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421 SW Sixth Avenue, Suite 1212, Portland, OR 97204-1613 tel 503/274-2675 fax 503/274-0313

BID AND PERMIT SET

SECTION 000002 – TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

PROVIDED IN INVITATION TO BID (ITB)SECTION 000002AAPPENDICES

DIVISION 01 – GENERAL REQUIREMENTS

ALLOWANCES
UNIT PRICES
ALTERNATES
SUBSTITUTION PROCEDURES
SUBSTITUTION REQUEST FORMS
CONTRACT MODIFICATION PROCEDURES
PAYMENT PROCEDURES
PROJECT MANAGEMENT AND COORDINATION
CONSTRUCTION PROGRESS DOCUMENTATION
SUBMITTAL PROCEDURES
QUALITY REQUIREMENTS
REFERENCES
TEMPORARY FACILITIES AND CONTROLS
TEMPORARY TREE AND PLANT PROTECTION
PRODUCT REQUIREMENTS
DELEGATED DESIGN REQUIREMENTS
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
CLOSEOUT PROCEDURES
OPERATION AND MAINTENANCE DATA
PROJECT RECORD DOCUMENTS
DEMONSTRATION AND TRAINING
GENERAL COMMISSIONING REQUIREMENTS
ASHRAE GUIDELINE 0-2005 THE COMMISSIONING PROCESS

DIVISION 02 – EXISTING CONDITIONS

SECTION 024116	STRUCTURE DEMOLITION
SECTION 024119	SELECTIVE DEMOLITION

DIVISION 03 – CONCRETE

SECTION 033000	CAST-IN-PLACE CONCRETE
SECTION 033543	POLISHED CONCRETE FINISHING
SECTION 034500	PRECAST ARCHITECTURAL CONCRETE
SECTION 035300	CONCRETE TOPPING

DIVISION 04 – MASONRY

BID AND PERMIT SET

SECTION 042200	CONCRETE UNIT MASONRY
SECTION 042613	MASONRY VENEER

DIVISION 05 – METALS

SECTION 051200	STRUCTURAL STEEL FRAMING
SECTION 051215	BUCKLING RESTRAINED BRACES
SECTION 052100	STEEL JOIST FRAMING
SECTION 053100	STEEL DECKING
SECTION 054000	COLD-FORMED METAL FRAMING
SECTION 055000	METAL FABRICATIONS
SECTION 055113	METAL PAN STAIRS
SECTION 055116	METAL FLOOR PLATE STAIRS
SECTION 057300	DECORATIVE METAL RAILINGS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

SECTION 061053	MISCELLANEOUS ROUGH CARPENTRY
SECTION 061600	SHEATHING
SECTION 062023	INTERIOR FINISH CARPENTRY
SECTION 064100	ARCHITECTURAL CASEWORK

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 071113	BITUMINOUS DAMPPROOFING
SECTION 071700	BENTONITE WATERPROOFING
SECTION 071900	WATER REPELLENTS
SECTION 072100	THERMAL INSULATION
SECTION 072119	FOAMED-IN-PLACE INSULATION
SECTION 072500	WEATHER BARRIERS
SECTION 072600	VAPOR RETARDERS
SECTION 074213	METAL WALL PANELS
SECTION 074113.23	METAL COMPOSITE MATERIAL WALL PANELS
SECTION 074213.33	METAL SOFFIT PANELS
SECTION 075423	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
SECTION 076200	SHEET METAL FLASHING AND TRIM
SECTION 077200	ROOF ACCESSORIES
SECTION 078413	PENETRATION FIRESTOPPING
SECTION 078443	JOINT FIRESTOPPING
SECTION 079200	JOINT SEALANTS
SECTION 079513	EXPANSION JOINT COVER ASSEMBLIES

DIVISION 08 – OPENINGS

SECTION 081113	HOLLOW METAL DOORS AND FRAMES
SECTION 081416	FLUSH WOOD DOORS
SECTION 083113	ACCESS DOORS AND FRAMES
SECTION 083313	COILING COUNTER DOORS

BID AND PERMIT SET

SECTION 083323	OVERHEAD COILING DOORS
SECTION 084113	ALUMINUM-FRAMED ENTRANCES AND
	STOREFRONTS
SECTION 084115	INTERIOR ALUMINUM-FRAMED ENTRANCES AND
	STOREFRONTS
SECTION 084523	FIBERGLASS-SANDWICH-PANEL ASSEMBLIES
SECTION 087100	DOOR HARDWARE
SECTION 087100A	DOOR HARDWARE SCHEDULE
SECTION 087100B	DOOR HARDWARE INDEX
SECTION 088000	GLAZING
SECTION 088813	FIRE-RESISTANT GLAZING
SECTION 089119	FIXED LOUVERS

DIVISION 09 – FINISHES

SECTION 092116.23	GYPSUM BOARD SHAFT WALL ASSEMBLIES
SECTION 092216	NON-STRUCTURAL METAL FRAMING
SECTION 092900	GYPSUM BOARD
SECTION 093000	TILING
SECTION 095113	ACOUSTICAL PANEL CEILINGS
SECTION 096466	ATHLETIC FLOORING
SECTION 096513	RESILIENT BASE AND ACCESSORIES
SECTION 096516	RESILIENT SHEET FLOORING
SECTION 096519	RESILIENT TILE FLOORING
SECTION 096813	TILE CARPETING
SECTION 097212	FIBERGLASS REINFORCED PLASTIC SHEET WALL COVERING
SECTION 097300	GRAPHIC WALL COVERINGS
SECTION 098433	SOUND ABSORBING WALL UNITS
SECTION 099113	EXTERIOR PAINTING
SECTION 099123	INTERIOR PAINTING

DIVISION 10 – SPECIALTIES

SECTION 101100	VISUAL DISPLAY UNITS
SECTION 101200	DISPLAY CASES
SECTION 101419	DIMENSIONAL LETTER SIGNAGE
SECTION 101423	SIGNAGE
SECTION 101960	CUBICLE CURTAINS AND TRACKS
SECTION 102113	PHENOLIC-CORE TOILET COMPARTMENTS
SECTION 102600	WALL AND DOOR PROTECTION
SECTION 102800	TOILET AND CUSTODIAL ACCESSORIES
SECTION 104413	FIRE PROTECTION CABINETS
SECTION 104416	FIRE EXTINGUISHERS
SECTION 105113	METAL LOCKERS
SECTION 107316	METAL CANOPIES
SECTION 107500	FLAGPOLES

BID AND PERMIT SET

DIVISION 11 – EQUIPMENT

SECTION 112425	FALL PROTECTION EQUIPMENT
SECTION 113110	APPLIANCES
SECTION 114000	FOOD SERVICE EQUIPMENT
SECTION 115123	LIBRARY STACK SYSTEMS
SECTION 115200	AUDIO VISUAL EQUIPMENT
SECTION 115313	LABORATORY FUME HOODS
SECTION 116143	STAGE CURTAINS

DIVISION 12 – FURNISHINGS

SECTION 122113	HORIZONTAL LOUVER BLINDS
SECTION 122413	ROLLER WINDOW SHADES
SECTION 123216	MANUFACTURED CASEWORK
SECTION 129300	SITE FURNISHINGS

DIVISION 13 – SPECIAL CONSTRUCTION

NOT USED

DIVISION 14 – CONVEYING EQUIPMENT

DIVISION 21 – FIRE SUPPRESSION

SECTION 210517	SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING
SECTION 210518	ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING
SECTION 210523	GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING
SECTION 210529	HANGERS AND SUPPORTS FOR FIRE SUPRESSION PIPING AND
	EQUIPMENT
SECTION 210548	VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION
	PIPING AND EQUIPMENT
SECTION 210553	IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND
	EQUIPMENT
SECTION 211313	WET-PIPE SPRINKLER SYSTEMS
SECTION 211316	DRY-PIPE SPRINKLER SYSTEMS

DIVISION 22 – PLUMBING

SECTION 220513	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
SECTION 220517	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
SECTION 220518	ESCUTCHEONS FOR PLUMBING PIPING
SECTION 220519	METERS AND GAGES FOR PLUMBING PIPING
SECTION 220523.12	BALL VALVES FOR PLUMBING PIPING
SECTION 220523.13	BUTTERFLY VALVES FOR PLUMBING PIPING
SECTION 220523.14	CHECK VALVES FOR PLUMBING PIPING
SECTION 220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND
	EQUIPMENT

BID AND PERMIT SET

SECTION 220548	VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING
	AND EQUIPMENT
SECTION 220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
SECTION 220719	PLUMBING PIPING INSULATION
SECTION 220800	PLUMBING COMMISSIONING REQUIREMENTS
SECTION 221116	DOMESTIC WATER PIPING
SECTION 221119	DOMESTIC WATER PIPING SPECIALTIES
SECTION 221123.21	INLINE, DOMESTIC-WATER PUMPS
SECTION 221316	SANITARY WASTE AND VENT PIPING
SECTION 221319	SANITARY WASTE PIPING SPECIALTIES
SECTION 221319.13	SANITARY DRAINS
SECTION 221323	SANITARY WASTE INTERCEPTORS
SECTION 221413	FACILITY STORM DRAINAGE PIPING
SECTION 221423	STORM DRAINAGE PIPING SPECIALTIES
SECTION 221429	SUMP PUMPS
SECTION 221513	GENERAL-SERVICE COMPRESSED-AIR PIPING
SECTION 221519	GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND
	RECEIVERS
SECTION 223400	FUEL-FIRED, DOMESTIC-WATER HEATERS
SECTION 224213.13	COMMERCIAL WATER CLOSETS
SECTION 224216.13	COMMERCIAL LAVATORIES
SECTION 224216.16	COMMERCIAL SINKS
SECTION 224500	EMERGENCY PLUMBING FIXTURES
GEOTION 22 (512	

SECTION 224713 DRINKING FOUNTAINS

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING

SECTION 230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
SECTION 230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
SECTION 230518	ESCUTCHEONS FOR HVAC PIPING
SECTION 230519	METERS AND GAGES FOR HVAC PIPING
SECTION 230523.12	BALL VALVES FOR HVAC PIPING
SECTION 230523.13	BUTTERFLY VALVES FOR HVAC PIPING
SECTION 230523.14	CHECK VALVES FOR HVAC PIPING
SECTION 230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
SECTION 230548	VIBRATION AND SEISMIC CONTROLS FOR HVAC
SECTION 230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
SECTION 230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC
SECTION 230713	DUCT INSULATION
SECTION 230716	HVAC EQUIPMENT INSULATION
SECTION 230719	HVAC PIPING INSULATION
SECTION 230800	HVAC COMMISSIONING REQUIREMENTS
SECTION 230923	DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC
SECTION 230923.11	CONTROL VALVES

BID AND PERMIT SET

SECTION 230923.12	CONTROL DAMPERS
SECTION 230923.13	ENERGY METERS
SECTION 230923.14	FLOW INSTRUMENTS
SECTION 230923.16	GAS INSTRUMENTS
SECTION 230923.23	PRESSURE INSTRUMENTS
SECTION 230923.27	TEMPERATURE INSTRUMENTS
SECTION 231123	FACILITY NATURAL-GAS PIPING
SECTION 232113	HYDRONIC PIPING
SECTION 232116	HYDRONIC PIPING SPECIALTIES
SECTION 232123	HYDRONIC PUMPS
SECTION 232300	REFRIGERANT PIPING
SECTION 232513	WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS
SECTION 232923	VARIABLE FREQUENCY MOTOR CONTROLLERS
SECTION 233113	METAL DUCTS
SECTION 233300	AIR DUCT ACCESSORIES
SECTION 233346	FLEXIBLE DUCTS
SECTION 233416	CENTRIFUGAL HVAC FANS
SECTION 233423	HVAC POWER VENTILATORS
SECTION 233439	HIGH-VOLUME, LOW-SPEED FANS
SECTION 233533	LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS
SECTION 233600	AIR TERMINAL UNITS
SECTION 233713.13	AIR DIFFUSERS
SECTION 233713.23	REGISTERS AND GRILLES
SECTION 235123	GAS VENTS
SECTION 235216	CONDENSING BOILERS
SECTION 237416.13	PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING
	UNITS
SECTION 237423.16	PACKAGED, INDIRECT-FIRED, OUTDOOR, HEATING-ONLY
	MAKEUP-AIR UNITS
SECTION 238126	SPLIT-SYSTEM AIR-CONDITIONERS
SECTION 238239.13	CABINET UNIT HEATERS
SECTION 238239.19	WALL AND CEILING UNIT HEATERS

DIVISION 26 – ELECTRICAL

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND
CABLES
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL
SYSTEMS
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS
AND CABLING

BID AND PERMIT SET

SECTION 260548.16	SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
SECTION 260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
SECTION 260800	LIGHTING SYSTEMS COMMISSIONING REQUIREMENTS
SECTION 260913	ELECTRICAL POWER MONITORING AND CONTROL
SECTION 260923	LIGHTING CONTROL DEVICES
SECTION 260943.23	RELAY-BASED LIGHTING CONTROLS
SECTION 262200	LOW-VOLTAGE TRANSFORMERS
SECTION 262413	SWITCHBOARDS
SECTION 262416	PANELBOARDS
SECTION 262726	WIRING DEVICES
SECTION 262813	FUSES
SECTION 262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
SECTION 263100	PHOTOVOLTAIC COLLECTORS
SECTION 263213	ENGINE GENERATORS
SECTION 263600	TRANSFER SWITCHES
SECTION 265100	INTERIOR LIGHTING
SECTION 265600	EXTERIOR LIGHTING

DIVISION 27 – COMMUNICATIONS

SECTION 270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
SECTION 270527	PATHWAYS FOR COMMUNICATIONS SYSTEMS
SECTION 270528	PATHWAYS FOR AUDIO VISUAL SYSTEMS
SECTION 270529	HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
SECTION 270536	CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
SECTION 270544	SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS
	PATHWAYS AND CABLING
SECTION 270553	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
SECTION 271100	COMMUNICATIONS EQUIPMENT ROOM FITTINGS
SECTION 271500	COMMUNICATIONS CABLING
SECTION 274116	AUDIO VISUAL SYSTEMS
SECTION 274143	CLASSROOM AUDIO VISUAL SYSTEM
SECTION 275113	PAGING SYSTEMS
SECTION 275313	CLOCK SYSTEMS
SECTION 275319	DISTRIBUTED ANTENNA SYSTEM (DAS)

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 280513	CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND
	SECURITY
SECTION 280526	GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND
	SECURITY
SECTION 280528	PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY
SECTION 280544	SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY AND
	SECURITY PATHWAYS AND CABLING
SECTION 281300	ACCESS CONTROL

BID AND PERMIT SET

SECTION 281600	INTRUSION DETECTION
SECTION 282300	VIDEO SURVEILLANCE
SECTION 283111	DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

DIVISION 31 – EARTHWORK

SECTION 311000	SITE CLEARING
SECTION 312000	EARTH MOVING
SECTION 312313	SUBGRADE STABILIZATION
SECTION 312317	TRENCHING
SECTION 312500	EROSION AND SEDIMENT CONTROL

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321216ASPHALT PAVINGSECTION 321313CONCRETE PAVINGSECTION 323113CHAIN LINK FENCES AND GATESSECTION 323119DECORATIVE METAL FENCES AND GATESECTION 328000IRRIGATIONSECTION 329000PLANTING	SECTION 321123	AGGREGATE BASE COURSES
SECTION 321313CONCRETE PAVINGSECTION 323113CHAIN LINK FENCES AND GATESSECTION 323119DECORATIVE METAL FENCES AND GATESECTION 328000IRRIGATIONSECTION 329000PLANTING	SECTION 321216	ASPHALT PAVING
SECTION 323113CHAIN LINK FENCES AND GATESSECTION 323119DECORATIVE METAL FENCES AND GATESECTION 328000IRRIGATIONSECTION 329000PLANTING	SECTION 321313	CONCRETE PAVING
SECTION 323119DECORATIVE METAL FENCES AND GATESECTION 328000IRRIGATIONSECTION 329000PLANTING	SECTION 323113	CHAIN LINK FENCES AND GATES
SECTION 328000IRRIGATIONSECTION 329000PLANTING	SECTION 323119	DECORATIVE METAL FENCES AND GATES
SECTION 329000 PLANTING	SECTION 328000	IRRIGATION
	SECTION 329000	PLANTING

DIVISION 33 – UTILITIES

SECTION 331100	WATER DISTRIBUTION PIPING
SECTION 331200	WATER DISTRIBUTION EQUIPMENT
SECTION 333100	SANITARY SEWER PIPING
SECTION 333900	SANITARY SEWER STRUCTURES
SECTION 334100	STORM DRAINAGE PIPING
SECTION 334400	STORM DRAINAGE INLETS
SECTION 334900	STORM DRAINAGE STRUCTURES

APPENDICES

APPENDIX A - HAZARDOUS MATERIALS SURVEY REPORT APPENDIX B - GEOTECHNICAL REPORT

END OF TABLE OF CONTENTS

DLR GROUP PROJECT NO. 74-18109-00

BID AND PERMIT SET

SECTION 000002A - APPENDICES

APPENDIX AHAZARDOUS MATERIALS SURVEY REPORTAPPENDIX BGEOTECHNICAL REPORT

END OF SECTION 000002A

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. Phased construction.
 - 4. Work by Owner.
 - 5. Work under separate contracts.
 - 6. Future work.
 - 7. Purchase contracts.
 - 8. Owner-furnished products.
 - 9. Contractor-furnished, Owner-installed products.
 - 10. Access to site.
 - 11. Coordination with occupants.
 - 12. Work restrictions.
 - 13. Specification and Drawing conventions.
 - 14. Miscellaneous provisions.
- 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:
 - 1. Arts & Communication Magnet Academy (ACMA).
 - 2. Project Location: 11375 SW Center St., Beaverton, OR 97005.
- B. Owner: Beaverton School District. Owner's Representative: Leslie Imes Construction Project Manager Facilities Development Department 16550 SW Merlo Road

Beaverton, OR 97003 (503) 356-4575

- C. Architect: DLR Group.
- D. Web-Based Project Software: Project software administered by Owner will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Beaverton School District standards for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Replacement of an existing school building, portables, and site buildings with a new approximately 75,000 square foot, two-story Arts school. which will house up to 725 students grades 6-12.
 - 2. Construction will include demolition of the old building(s) and associated site work, exterior improvements, construction of the new building, and associated new site work improvements.
 - 3. The Performing Arts Building and north west parking lot and drive will remain during construction.
 - 4. The new arts school shall be constructed of Type IIB fully-sprinklered construction and other Work indicated on the Contract Documents.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract (per AIA documents A101-2007 and A201-2007).
- C. Project Considerations:
 - 1. The school will be vacated by the end of June 2019 and the new school must be operational at the beginning of the 2021 school year. The Performing Arts Building will remain and must be protected and integrated into the new school construction.
 - 2. Hazardous material abatement will be done by the District (BSD) under separate contract. General Contractor shall coordinate scheduling, demolition, and building locations with abatement subcontractor, District Representative, and District Consultant. New construction shall not commence until completion of hazardous material abatement.
- D. Services to Provide:
 - 1. Once through the two-step solicitation process, the awarded Contractor is responsible for providing a complete project per the Construction Documents including materials, labor, equipment and coordination with the District and the design team.

BID AND PERMIT SET

- E. Specific Construction Services Description:
 - 1. Coordinate weekly construction meetings with the District and the design team.
 - 2. Prepare site and building logistics plans to encompass all proposed activities and impacts to the site, adjacent properties, and neighboring streets.
 - 3. Fully coordinate the work of subcontractors and suppliers. Provide regular and on-going quality inspection and assistance to the design team in ensuring that the Work meets the Specifications and applicable codes.
 - 4. Coordinate inspections with the authority have jurisdiction (AHJ) and third-party special inspections (provided by the District).
 - 5. Review and expedite Change Order requests and maintain logs.
 - 6. Coordinate with BSD FF&E efforts.
 - 7. Monitor compliance with payment of prevailing wages on all contracts and subcontracts, per ORS 279C.
 - 8. Maintain in a current condition Project Records including, but not necessarily limited to permits, Construction Documents, as-built records, meeting records, submittals, inspection reports, invoices, delivery receipts, daily activity logs, Requests for Information (RFI); RFI logs; Submittals; Submittal Logs; Inspection Reports; Change Order Proposals (COP); COP logs; Change Orders (CO); CO logs; Construction Change Directives (CCD); CCD logs; Architect's Supplemental Instructions (ASI); ASI logs; Permits; Project Allowance(s) Reconciliation; Project Contingency status reports; and Project Schedule updates.
 - 9. Transmit copies of MWESB Contact Logs, Career Learning Reports and Apprenticeship Program Logs monthly via eBuilder (as required).
 - 10. Intelligent and selective use of Building Information Modeling (BIM), where applicable.
 - 11. Use of the District's internet-based e-Builder Project Management System for coordination of efforts, approvals, and expedited communication is required.

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F. Solicitation and Selection Process Schedule;

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Process Milestones	Dates
ITB	
Advertise	March 16, 2019
Release ITB	March 18, 2019
Pre-Bid Conference	April 2, 2019 at 3:00 p.m. at ACMA
Deadline for Questions	April 5, 2019
Issue Addendum	April 9, 2019
Bids Due	April 18, 2019 by 2:00 p.m.
Notice of Intent to Award	April 19-26, 2019
School Board Approval	April 29, 2019

BID AND PERMIT SET

Award Contract

On or about April 30, 2019

G. Construction Schedule Milestones:

Milestones	Dates
Last Teacher day/Move out furnishings	June 17 – June 28, 2019
Mobilization on site	On or about July 1, 2019
Building Abatement start	On or about July 5, 2019
Demolition	On or about July 10, 2019
Construction Substantial Completion	June 1, 2021; Owner must be able to place FF&E
Final Completion	August 20, 2021

*The dates under ITB and Construction Schedule Milestones are for reference only. The District may modify as needed.

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
 - 1. As noted in Owner Furnished Material and Equipment Schedule in drawing set.

1.7 ACCESS TO SITE

A. General: Contractor shall have access to the Project site during the construction period according to AIA201 3.13.

BID AND PERMIT SET

1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- D. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- E. Employee Screening: Comply with Owner's requirements for screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.
 - 2. Badging to be provided by contractor.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

BID AND PERMIT SET

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

BID AND PERMIT SET

1.6 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

ALLOWANCE ONE	Decorative Wave Wall Steel/Wood	Lump Sum
	See details on Arch Sheet 8.4.	\$60,000
ALLOWANCE TWO	Recording Studio Audio/Visual Equipment, including cables, equipment and labor.	\$250,000
ALLOWANCE THREE	Custom Wall Graphics for printing and installation.	\$38,000

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

BID AND PERMIT SET

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

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 unit prices.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
 - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 **PROCEDURES**

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Subgrade Stabilization (Removal of unsatisfactory soils and replace with satisfactory fill material.
 - 1. Description: Work as indicated in Section 312313
 - 2. Unit of Measurement: As indicated in Section 312313

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.2 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.3 SCHEDULE OF ALTERNATES

- A. Alternate No. 1, South Ramp:
 - 1. Base Bid: Provide South ramp as shown on Drawings.
 - 2. Deductive Alternate: Remove South ramp. Drawings describing design without ramp are on Drawing A1.3, plus corresponding engineering and site drawings.
- B. Alternate No. 2, Wood Walls:
 - 1. Base Bid: Provide wood walls as shown on Drawings.
 - 2. Deductive Alternate: Replace WS-1 wood walls with accent paint color. Replace WS-1 ceilings with ACT-1, utilizing same lights as base bid. Work occurs in East West Hall (south of Restrooms), at Science Hall, and at the two Extended Learning areas on Level 2. Note: Wood wall in Commons (carpentry work) is not part of this Deductive Alternate.
- C. Alternate No. 3, Dance Balcony Storage Cabinets:
 - 1. Base Bid: Provide storage cabinets as shown on Drawings.
 - 2. Deductive Alternate: Remove storage cabinets on balcony side of dance rooms.
- D. Alternate No. 4, Vinyl Luxury Tile:
 - 1. Base Bid: Provide vinyl composition tile (VCT), 1/4-inch thick Luan board glued to acoustic underlayment as specified in Section 096519 "Resilient Tile Flooring".
 - 2. Additive Alternate: Provide vinyl luxury tile (VLT) and acoustic underlayment as specified in Section 096519 "Resilient Tile Flooring".

BID AND PERMIT SET

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012300

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.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to Contractor.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Refer to AIA Document A201 in the Supplementary Conditions for consideration of requests received after Contract award. Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 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.

BID AND PERMIT SET

- 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.
- 1. 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 14 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.

BID AND PERMIT SET

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 14 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

BID AND PERMIT SET SUBSTITUTION REQUEST

(After the Bidding Phase)

	(Arter the Diading I hase)
Project:	Substitution Request Number:
	From:
To:	Date:
	A/E Project Number:
Ke:	Contract For:
Specification Title:	Description:
Section:Page:	Article/Paragraph:
Proposed Substitution:	
Manufacturer Address:Phone:	
Trade Name:	Model No.:
Installer:Address:	Phone
History: \Box New product \Box 2-5 years old X \Box 5-10 years of	old
Differences between proposed substitution and specified product:	
Differences between proposed substitution and specified product.	
X Point-by-point comparative data attached	
Reason for not providing specified item:	
Similar Installation:	
Project: Archited	ət:
Address: Owner:	
Date Ins	stalled:
Proposed substitution affects other parts of Work:X 🗌 No 📋 Yes	;; explain
Savings to Owner for accepting substitution:	(\$).
Proposed substitution changes Contract Time:	Yes [Add] [Deduct]days.
Supporting Data Attached:	Samples Tests Reports
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DLR GROUP PROJECT NO. 74-18109-00

BID AND PERMIT SET SUBSTITUTION REQUEST (Continued)

The	Und	lersigned	certifies:
	~		

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by:					
Signed by:					
Firm:					
Address:					
Telephone:					
Attachments:					
A/E's REVIEW AND ACT Substitution approved - Substitution approved a Substitution rejected - U Substitution Request re	[ION Make submittals in a as noted - Make subm Use specified materia ceived too late - Use	accordance with Spec nittals in accordance v ils. specified materials.	cification Section with Specification	01330. Section 01330.	
Signed by:					Date:
Additional Comments:	Contractor	Subcontractor	Supplier	Manufacturer	A/E

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BID AND PERMIT SET

SUBSTITUTION REQUEST

(During the Bidding Phase)

Project:		Substitution Request Number:	
		From:	
То:		Date:	
		A/E Project Number:	
Re:		Contract For:	
Specification Title:		Description:	
Section:	Page:	Article/Paragraph:	
Proposed Substitution:			
Manufacturer:	Address:	Phone:	
Trade Name:		Model No.:	

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: Signed by: Firm: Address:	
Telephone:	

A/E's REVIEW AND ACTION

Substitution approved - Make submittals in accordance with Specification Section 01330. Substitution approved as noted - Make submittals in accordance with Specification Section 0 Substitution rejected - Use specified materials. Substitution Request received too late - Use specified materials.	1330.
Signed by:	Date:
Supporting Data Attached: Drawings X Product Data Samples Te	sts Reports
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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract (AIA 201), 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 handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 and eBuilder.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish

BID AND PERMIT SET

times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

- A. A Change Order is a written instrument prepared by the Architect, Owner or Contractor and signed by the Owner, Contractor and (at Owner's election) Architect stating their agreement upon all of the following:
 - 1. The change in the Work;
 - 2. The amount of the adjustment, if any, in the Contract Sum; and
 - 3. The extent of the adjustment, if any, in the Contract Time.
- B. Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.
- C. Agreement on any Amendment shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum, the construction schedule, and the Contract Time.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. A Construction Change Directive is a written order signed by the Owner (and at Owner's election, prepared and/or signed by Architect), directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work

BID AND PERMIT SET

within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

B. A Construction Change Directive shall be executed in accordance with the General Conditions of the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT 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 necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.

BID AND PERMIT SET

- c. Name of subcontractor.
- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest onehundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
- 4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
- 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
- 6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
- 7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

BID AND PERMIT SET

- 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- D. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect through Owner's web-based program (eBuilder).
- E. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of values.
 - 3. Contractor's construction schedule (preliminary if not final).
 - 4. Products list (preliminary if not final).
 - 5. Sustainable design action plans, including preliminary project materials cost data.
 - 6. Schedule of unit prices.
 - 7. Submittal schedule (preliminary if not final).
 - 8. List of Contractor's staff assignments.
 - 9. List of Contractor's principal consultants.
 - 10. Copies of building permits.
 - 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 12. Initial progress report.
 - 13. Report of preconstruction conference.
- F. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 - 3. Contractor shall provide all requirements of documents AIA 201 Section 9.10.2.
- G. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. All listed items in AIA Document A201 Section 9.10.2.

PART 2 - PRODUCTS (Not Used)
BID AND PERMIT SET

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

BID AND PERMIT SET

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. RFIs.
 - 4. Digital project management procedures.
 - 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.
 - 3. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. 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. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address 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.

BID AND PERMIT SET

B. Key Personnel Names: Submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site in accordance with the General Conditions of the Contract.

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.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated 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 Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative 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 sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components 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 (32 mm) in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other firealarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motorcontrol 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 in general 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 suitable modifications and resubmit.
- 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 - 2. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system.
 - 3. File Submittal Format: Submit or post coordination drawing files using PDF format.
 - 4. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - 5. 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 BIM.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
 - 6. Allow up to 14 working days for review by Owner and Architect.

BID AND PERMIT SET

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - 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: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in PDF format.
 - 2. RFIs will be submitted through owner provided web-based program (eBuilder).
- 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.

BID AND PERMIT SET

- 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 by Architect 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 software log that is part of web-based Project software. Software log with not less than 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.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- 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.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
 - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 - 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 - 3. Digital Drawing Software Program: Contract Drawings are available in BIM (Revit).

- 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
 - a. Sub-contractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
- B. Web-Based Project Software: Use Owner's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 - 1. 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.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: 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 a minimum of 10 working days prior to meeting.
 - 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 three days of the meeting.
- B. Preconstruction Conference: 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. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, 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.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.

- f. Lines of communications.
- g. Use of web-based Project software.
- h. Procedures for processing field decisions and Change Orders.
- i. Procedures for RFIs.
- j. Procedures for testing and inspecting.
- k. Procedures for processing Applications for Payment.
- 1. Distribution of the Contract Documents.
- m. Submittal procedures.
- n. Preparation of Record Documents.
- o. Use of the premises.
- p. Work restrictions.
- q. Working hours.
- r. Owner's occupancy requirements.
- s. Responsibility for temporary facilities and controls.
- t. Procedures for moisture and mold control.
- u. Procedures for disruptions and shutdowns.
- v. Construction waste management and recycling.
- w. Parking availability.
- x. Office, work, and storage areas.
- y. Equipment deliveries and priorities.
- z. First aid.
- aa. Security.
- 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity when required by other sections and when required for 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 and Owner's Commissioning Authority 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. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - 1. Time schedules.
 - m. Weather limitations.

- n. Manufacturer's written instructions.
- o. Warranty requirements.
- p. Compatibility of materials.
- q. Acceptability of substrates.
- r. Temporary facilities and controls.
- s. Space and access limitations.
- t. Regulations of authorities having jurisdiction.
- u. Testing and inspecting requirements.
- v. Installation procedures.
- w. Coordination with other work.
- x. Required performance results.
- y. Protection of adjacent work.
- z. 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: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 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, Owner's Commissioning Authority, 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. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Owner's partial occupancy requirements.
 - 1. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.

- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: 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 use.
 - 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.

BID AND PERMIT SET

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

BID AND PERMIT SET

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.
- B. AIA Document A201, Section 3.10

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. Unusual event reports.
 - 8. Construction Document Updates

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. 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.

BID AND PERMIT SET

C. Resource Loading: The allocation of manpower and equipment necessary for completing 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 file.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Material Location Reports: Submit at monthly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Unusual Event Reports: Submit at time of unusual event.
- I. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. 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 and interim milestones.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review submittal requirements and procedures.
 - 6. Review time required for review of submittals and resubmittals.
 - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.

- 8. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
- 9. Review and finalize list of construction activities to be included in schedule.
- 10. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the 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.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Use Scheduling component of Project website software specified in Section 013100 "Project Management and Coordination," or other approved software available to owner and architect for current Windows operating system.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final 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.
- C. Activities: Treat each floor 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 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.
 - 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. Commissioning Time: Include no fewer than 15 days for commissioning.
 - 6. 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.

- 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 2. 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.
 - 3. 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.
 - 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Use-of-premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. 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 the Contract Time.
- G. 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.

BID AND PERMIT SET

- H. 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.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice to Proceed.
- 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.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.
 - 1. 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.

1.10 REPORTS

- A. 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. Testing and inspection.

BID AND PERMIT SET

- 8. Accidents.
- 9. Meetings and significant decisions.
- 10. Unusual events.
- 11. Stoppages, delays, shortages, and losses.
- 12. Meter readings and similar recordings.
- 13. Emergency procedures.
- 14. Orders and requests of authorities having jurisdiction.
- 15. Change Orders received and implemented.
- 16. Construction Change Directives received and implemented.
- 17. Services connected and disconnected.
- 18. Equipment or system tests and startups.
- 19. Partial completions and occupancies.
- 20. Substantial Completions authorized.
- B. 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.
- C. Unusual Event Reports: 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, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
 - 1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

1.11 CONSTRUCTION DOCUMENT UPDATES

- A. Project documents shall be updated regularly electronically and available to the owner/architect/subcontractors.
- B. Updated documents are to be made available via construction management software, such as Procore or some similar document control platform.
- C. Document tracking to include Contract document updates:
 - 1. Issued via ASI, CCD, PR, or similar form.
 - 2. RFI's
 - 3. Submittals

BID AND PERMIT SET

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

BID AND PERMIT SET

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.
- B. AIA Document A201, Section 3.12

1.2 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 8. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

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

BID AND PERMIT SET

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: 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.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect.
 - 4. Name of Contractor.
 - 5. Name of firm or entity that prepared submittal.
 - 6. Names of subcontractor, manufacturer, and supplier.
 - 7. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 - 8. Category and type of submittal.
 - 9. Submittal purpose and description.
 - 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 - 11. Drawing number and detail references, as appropriate.

BID AND PERMIT SET

- 12. Location(s) where product is to be installed, as appropriate.
- 13. Other necessary identification.
- 14. Remarks.
- 15. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- E. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and, transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 - 2. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

BID AND PERMIT SET

- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 14 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 14 days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 14 days for initial review of each submittal.
 - 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.

- c. Standard color charts.
- d. Statement of compliance with specified referenced standards.
- e. Testing by recognized testing agency.
- f. Application of testing agency labels and seals.
- g. Notation of coordination requirements.
- h. Availability and delivery time information.
- 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - 3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

- 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 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. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

BID AND PERMIT SET

G. Certificates:

- 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
- 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
 - 6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.

BID AND PERMIT SET

- f. Test procedures and results.
- g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and 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.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in webbased Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - 2. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.

BID AND PERMIT SET

- 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. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Architect will return without review submittals received from sources other than Contractor.
- E. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

BID AND PERMIT SET

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other qualityassurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Integrated Exterior Mockup: Mockup of the exterior envelope constructed on-site as freestanding temporary built elements or, as part of permanent construction, consisting of multiple products, assemblies, and subassemblies that demonstrate construction of exterior envelop can meet project design intent. Integrated mockup shall include:
 - a. Exterior wall framing.
 - b. Exterior wall sheathing and weather barrier.
 - c. Brick veneer, masonry ties, cavity drainage material, and weeps.
 - d. Insulation.
 - e. Typical window or storefront opening with framing, glazing and flashings.
 - f. Typical building corner with proposed brick coursing.
 - g. Sample of "AMCA" logo sign in brick veneer.
 - h. Typical brick control joint and joint sealant.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

BID AND PERMIT SET

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups.
 - 1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

BID AND PERMIT SET

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

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

- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections will be conducted by Owner.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.

BID AND PERMIT SET

- 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
- 12. Name and signature of laboratory inspector.
- 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, telephone number, and email address of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products which are similar in material, design, and extent to those indicated for this Project.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

BID AND PERMIT SET

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
 - 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
- 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
- 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar qualitycontrol service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.

BID AND PERMIT SET

- 5. Delivery of samples to testing agencies.
- 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
- 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, that includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.

BID AND PERMIT SET

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

END OF SECTION 014000

BID AND PERMIT SET

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

BID AND PERMIT SET

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC Associated Air Balance Council; <u>www.aabc.com</u>.
 - 2. AAMA American Architectural Manufacturers Association; <u>www.aamanet.org</u>.
 - 3. AAPFCO Association of American Plant Food Control Officials; <u>www.aapfco.org</u>.
 - 4. AASHTO American Association of State Highway and Transportation Officials; <u>www.transportation.org</u>.
 - 5. AATCC American Association of Textile Chemists and Colorists; <u>www.aatcc.org</u>.
 - 6. ABMA American Bearing Manufacturers Association; <u>www.americanbearings.org</u>.
 - 7. ABMA American Boiler Manufacturers Association; <u>www.abma.com</u>.
 - 8. ACI American Concrete Institute; (Formerly: ACI International); <u>www.abma.com</u>.
 - 9. ACPA American Concrete Pipe Association; <u>www.concrete-pipe.org</u>.
 - 10. AEIC Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA American Forest & Paper Association; www.afandpa.org.
 - 12. AGA American Gas Association; <u>www.aga.org</u>.
 - 13. AHAM Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI Asphalt Institute; <u>www.asphaltinstitute.org</u>.
 - 16. AIA American Institute of Architects (The); www.aia.org.
 - 17. AISC American Institute of Steel Construction; www.aisc.org.
 - 18. AISI American Iron and Steel Institute; <u>www.steel.org</u>.
 - 19. AITC American Institute of Timber Construction; <u>www.aitc-glulam.org</u>.
 - 20. AMCA Air Movement and Control Association International, Inc.; www.amca.org.
 - 21. ANSI American National Standards Institute; www.ansi.org.
 - 22. AOSA Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 23. APA APA The Engineered Wood Association; www.apawood.org.
 - 24. APA Architectural Precast Association; www.archprecast.org.
 - 25. API American Petroleum Institute; <u>www.api.org</u>.
 - 26. ARI Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 27. ARI American Refrigeration Institute; (See AHRI).
 - 28. ARMA Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 - 29. ASCE American Society of Civil Engineers; www.asce.org.
 - 30. ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
 - 31. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
 - 32. ASME ASME International; (American Society of Mechanical Engineers); www.asme.org.
 - 33. ASSE American Society of Safety Engineers (The); www.asse.org.
 - 34. ASSE American Society of Sanitary Engineering; <u>www.asse-plumbing.org</u>.
 - 35. ASTM ASTM International; <u>www.astm.org</u>.

- 36. ATIS Alliance for Telecommunications Industry Solutions; <u>www.atis.org</u>.
- 37. AWEA American Wind Energy Association; <u>www.awea.org</u>.
- 38. AWI Architectural Woodwork Institute; <u>www.awinet.org</u>.
- 39. AWMAC Architectural Woodwork Manufacturers Association of Canada; <u>www.awmac.com</u>.
- 40. AWPA American Wood Protection Association; <u>www.awpa.com</u>.
- 41. AWS American Welding Society; <u>www.aws.org</u>.
- 42. AWWA American Water Works Association; www.awwa.org.
- 43. BHMA Builders Hardware Manufacturers Association; www.buildershardware.com.
- 44. BIA Brick Industry Association (The); www.gobrick.com.
- 45. BICSI BICSI, Inc.; <u>www.bicsi.org</u>.
- 46. BIFMA BIFMA International; (Business and Institutional Furniture Manufacturer's Association); <u>www.bifma.org</u>.
- 47. BISSC Baking Industry Sanitation Standards Committee; www.bissc.org.
- 48. BWF Badminton World Federation; (Formerly: International Badminton Federation); <u>www.bissc.org</u>.
- 49. CDA Copper Development Association; www.copper.org.
- 50. CEA Canadian Electricity Association; www.electricity.ca.
- 51. CEA Consumer Electronics Association; www.ce.org.
- 52. CFFA Chemical Fabrics and Film Association, Inc.; <u>www.chemicalfabricsandfilm.com</u>.
- 53. CFSEI Cold-Formed Steel Engineers Institute; <u>www.cfsei.org</u>.
- 54. CGA Compressed Gas Association; <u>www.cganet.com</u>.
- 55. CIMA Cellulose Insulation Manufacturers Association; www.cellulose.org.
- 56. CISCA Ceilings & Interior Systems Construction Association; <u>www.cisca.org</u>.
- 57. CISPI Cast Iron Soil Pipe Institute; www.cispi.org.
- 58. CLFMI Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
- 59. CPA Composite Panel Association; <u>www.pbmdf.com</u>.
- 60. CRI Carpet and Rug Institute (The); <u>www.carpet-rug.org</u>.
- 61. CRRC Cool Roof Rating Council; <u>www.coolroofs.org</u>.
- 62. CRSI Concrete Reinforcing Steel Institute; <u>www.crsi.org</u>.
- 63. CSA Canadian Standards Association; <u>www.csa.ca</u>.
- 64. CSA CSA International; (Formerly: IAS International Approval Services); <u>www.csa-international.org</u>.
- 65. CSI Construction Specifications Institute (The); <u>www.csinet.org</u>.
- 66. CSSB Cedar Shake & Shingle Bureau; <u>www.cedarbureau.org</u>.
- 67. CTI Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
- 68. CWC Composite Wood Council; (See CPA).
- 69. DASMA Door and Access Systems Manufacturers Association; www.dasma.com.
- 70. DHI Door and Hardware Institute; <u>www.dhi.org</u>.
- 71. ECA Electronic Components Association; (See ECIA).
- 72. ECAMA Electronic Components Assemblies & Materials Association; (See ECIA).
- 73. ECIA Electronic Components Industry Association; www.eciaonline.org.
- 74. EIA Electronic Industries Alliance; (See TIA).
- 75. EIMA EIFS Industry Members Association; www.eima.com.
- 76. EJMA Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
- 77. ESD ESD Association; (Electrostatic Discharge Association); www.esda.org.
- 78. ESTA Entertainment Services and Technology Association; (See PLASA).
- 79. EVO Efficiency Valuation Organization; www.evo-world.org.
- 80. FCI Fluid Controls Institute; www.fluidcontrolsinstitute.org.

- 81. FIBA Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
- 82. FIVB Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
- 83. FM Approvals FM Approvals LLC; www.fmglobal.com.
- 84. FM Global FM Global; (Formerly: FMG FM Global); www.fmglobal.com.
- 85. FRSA Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; <u>www.floridaroof.com</u>.
- 86. FSA Fluid Sealing Association; www.fluidsealing.com.
- 87. FSC Forest Stewardship Council U.S.; www.fscus.org.
- 88. GA Gypsum Association; <u>www.gypsum.org</u>.
- 89. GANA Glass Association of North America; www.glasswebsite.com.
- 90. GS Green Seal; <u>www.greenseal.org</u>.
- 91. HI Hydraulic Institute; <u>www.pumps.org</u>.
- 92. HI/GAMA Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
- 93. HMMA Hollow Metal Manufacturers Association; (See NAAMM).
- 94. HPVA Hardwood Plywood & Veneer Association; <u>www.hpva.org</u>.
- 95. HPW H. P. White Laboratory, Inc.; www.hpwhite.com.
- 96. IAPSC International Association of Professional Security Consultants; <u>www.iapsc.org</u>.
- 97. IAS International Accreditation Service; <u>www.iasonline.org</u>.
- 98. IAS International Approval Services; (See CSA).
- 99. ICBO International Conference of Building Officials; (See ICC).
- 100. ICC International Code Council; <u>www.iccsafe.org</u>.
- 101. ICEA Insulated Cable Engineers Association, Inc.; www.icea.net.
- 102. ICPA International Cast Polymer Alliance; www.icpa-hq.org.
- 103. ICRI International Concrete Repair Institute, Inc.; www.icri.org.
- 104. IEC International Electrotechnical Commission; http://www.iec.ch.
- 105. IEEE Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
- 106. IES Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
- 107. IESNA Illuminating Engineering Society of North America; (See IES).
- 108. IEST Institute of Environmental Sciences and Technology; www.iest.org.
- 109. IGMA Insulating Glass Manufacturers Alliance; www.igmaonline.org.
- 110. IGSHPA International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
- 111. ILI Indiana Limestone Institute of America, Inc.; www.iliai.com.
- 112. Intertek Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
- 113. ISA International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); <u>www.isa.org</u>.
- 114. ISAS Instrumentation, Systems, and Automation Society (The); (See ISA).
- 115. ISFA International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); <u>www.isfanow.org</u>.
- 116. ISO International Organization for Standardization; <u>www.iso.org</u>.
- 117. ISSFA International Solid Surface Fabricators Association; (See ISFA).
- 118. ITU International Telecommunication Union; www.itu.int/home.
- 119. KCMA Kitchen Cabinet Manufacturers Association; www.kcma.org.
- 120. LMA Laminating Materials Association; (See CPA).
- 121. LPI Lightning Protection Institute; <u>www.lightning.org</u>.
- 122. MBMA Metal Building Manufacturers Association; www.mbma.com.
- 123. MCA Metal Construction Association; www.metalconstruction.org.

- 124. MFMA Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
- 125. MFMA Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
- 126. MHIA Material Handling Industry of America; www.mhia.org.
- 127. MIA Marble Institute of America; <u>www.marble-institute.com</u>.
- 128. MMPA Moulding & Millwork Producers Association; <u>www.wmmpa.com</u>.
- 129. MPI Master Painters Institute; <u>www.paintinfo.com</u>.
- 130. MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; <u>www.mss-hq.org</u>.
- 131. NAAMM National Association of Architectural Metal Manufacturers; www.naamm.org.
- 132. NACE NACE International; (National Association of Corrosion Engineers International); www.nace.org.
- 133. NADCA National Air Duct Cleaners Association; www.nadca.com.
- 134. NAIMA North American Insulation Manufacturers Association; www.naima.org.
- 135. NBGQA National Building Granite Quarries Association, Inc.; www.nbgqa.com.
- 136. NBI New Buildings Institute; www.newbuildings.org.
- 137. NCAA National Collegiate Athletic Association (The); www.ncaa.org.
- 138. NCMA National Concrete Masonry Association; www.ncma.org.
- 139. NEBB National Environmental Balancing Bureau; www.nebb.org.
- 140. NECA National Electrical Contractors Association; www.necanet.org.
- 141. NeLMA Northeastern Lumber Manufacturers Association; www.nelma.org.
- 142. NEMA National Electrical Manufacturers Association; www.nema.org.
- 143. NETA InterNational Electrical Testing Association; www.netaworld.org.
- 144. NFHS National Federation of State High School Associations; www.nfhs.org.
- 145. NFPA National Fire Protection Association; www.nfpa.org.
- 146. NFPA NFPA International; (See NFPA).
- 147. NFRC National Fenestration Rating Council; www.nfrc.org.
- 148. NHLA National Hardwood Lumber Association; <u>www.nhla.com</u>.
- 149. NLGA National Lumber Grades Authority; www.nlga.org.
- 150. NOFMA National Oak Flooring Manufacturers Association; (See NWFA).
- 151. NOMMA National Ornamental & Miscellaneous Metals Association; www.nomma.org.
- 152. NRCA National Roofing Contractors Association; www.nrca.net.
- 153. NRMCA National Ready Mixed Concrete Association; www.nrmca.org.
- 154. NSF NSF International; <u>www.nsf.org</u>.
- 155. NSPE National Society of Professional Engineers; <u>www.nspe.org</u>.
- 156. NSSGA National Stone, Sand & Gravel Association; <u>www.nssga.org</u>.
- 157. NTMA National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
- 158. NWFA National Wood Flooring Association; www.nwfa.org.
- 159. PCI Precast/Prestressed Concrete Institute; www.pci.org.
- 160. PDI Plumbing & Drainage Institute; www.pdionline.org.
- 161. PLASA PLASA; (Formerly: ESTA Entertainment Services and Technology Association); www.plasa.org.
- 162. RCSC Research Council on Structural Connections; <u>www.boltcouncil.org</u>.
- 163. RFCI Resilient Floor Covering Institute; www.rfci.com.
- 164. RIS Redwood Inspection Service; <u>www.redwoodinspection.com</u>.
- 165. SAE SAE International; <u>www.sae.org</u>.
- 166. SCTE Society of Cable Telecommunications Engineers; <u>www.scte.org</u>.
- 167. SDI Steel Deck Institute; www.sdi.org.
- 168. SDI Steel Door Institute; <u>www.steeldoor.org</u>.
- 169. SEFA Scientific Equipment and Furniture Association (The); www.sefalabs.com.

- 170. SEI/ASCE Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
- 171. SIA Security Industry Association; www.siaonline.org.
- 172. SJI Steel Joist Institute; www.steeljoist.org.
- 173. SMA Screen Manufacturers Association; www.smainfo.org.
- 174. SMACNA Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
- 175. SMPTE Society of Motion Picture and Television Engineers; <u>www.smpte.org</u>.
- 176. SPFA Spray Polyurethane Foam Alliance; www.sprayfoam.org.
- 177. SPIB Southern Pine Inspection Bureau; www.spib.org.
- 178. SPRI Single Ply Roofing Industry; <u>www.spri.org</u>.
- 179. SRCC Solar Rating & Certification Corporation; <u>www.solar-rating.org</u>.
- 180. SSINA Specialty Steel Industry of North America; www.ssina.com.
- 181. SSPC SSPC: The Society for Protective Coatings; <u>www.sspc.org</u>.
- 182. STI Steel Tank Institute; www.steeltank.com.
- 183. SWI Steel Window Institute; <u>www.steelwindows.com</u>.
- 184. SWPA Submersible Wastewater Pump Association; www.swpa.org.
- 185. TCA Tilt-Up Concrete Association; www.tilt-up.org.
- 186. TCNA Tile Council of North America, Inc.; www.tileusa.com.
- 187. TEMA Tubular Exchanger Manufacturers Association, Inc.; <u>www.tema.org</u>.
- 188. TIA Telecommunications Industry Association (The); (Formerly: TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
- 189. TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
- 190. TMS The Masonry Society; www.masonrysociety.org.
- 191. TPI Truss Plate Institute; <u>www.tpinst.org</u>.
- 192. TPI Turfgrass Producers International; www.turfgrasssod.org.
- 193. TRI Tile Roofing Institute; www.tileroofing.org.
- 194. UL Underwriters Laboratories Inc.; www.ul.com.
- 195. UNI Uni-Bell PVC Pipe Association; www.uni-bell.org.
- 196. USAV USA Volleyball; www.usavolleyball.org.
- 197. USGBC U.S. Green Building Council; <u>www.usgbc.org</u>.
- 198. USITT United States Institute for Theatre Technology, Inc.; www.usitt.org.
- 199. WASTEC Waste Equipment Technology Association; www.wastec.org.
- 200. WCLIB West Coast Lumber Inspection Bureau; www.wclib.org.
- 201. WCMA Window Covering Manufacturers Association; www.wcmanet.org.
- 202. WDMA Window & Door Manufacturers Association; www.wdma.com.
- 203. WI Woodwork Institute; www.wicnet.org.
- 204. WSRCA Western States Roofing Contractors Association; www.wsrca.com.
- 205. WWPA Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 - 1. DIN Deutsches Institut fur Normung e.V.; <u>www.din.de</u>.
 - 2. IAPMO International Association of Plumbing and Mechanical Officials; <u>www.iapmo.org</u>.
 - 3. ICC International Code Council; <u>www.iccsafe.org</u>.

- 4. ICC-ES ICC Evaluation Service, LLC; <u>www.icc-es.org</u>.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
 - 1. COE Army Corps of Engineers; <u>www.usace.army.mil</u>.
 - 2. CPSC Consumer Product Safety Commission; <u>www.cpsc.gov</u>.
 - 3. DOC Department of Commerce; National Institute of Standards and Technology; <u>www.nist.gov</u>.
 - 4. DOD Department of Defense; <u>www.quicksearch.dla.mil</u>.
 - 5. DOE Department of Energy; <u>www.energy.gov</u>.
 - 6. EPA Environmental Protection Agency; <u>www.epa.gov</u>.
 - 7. FAA Federal Aviation Administration; <u>www.faa.gov</u>.
 - 8. FG Federal Government Publications; <u>www.gpo.gov/fdsys</u>.
 - 9. GSA General Services Administration; <u>www.gsa.gov</u>.
 - 10. HUD Department of Housing and Urban Development; <u>www.hud.gov</u>.
 - 11. LBL Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <u>www.eetd.lbl.gov</u>.
 - 12. OSHA Occupational Safety & Health Administration; www.osha.gov.
 - 13. SD Department of State; <u>www.state.gov</u>.
 - 14. TRB Transportation Research Board; National Cooperative Highway Research Program; The National Academies; <u>www.trb.org</u>.
 - 15. USDA Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; <u>www.ars.usda.gov</u>.
 - 16. USDA Department of Agriculture; Rural Utilities Service; www.usda.gov.
 - 17. USDOJ Department of Justice; Office of Justice Programs; National Institute of Justice; <u>www.ojp.usdoj.gov</u>.
 - 18. USP U.S. Pharmacopeial Convention; <u>www.usp.org</u>.
 - 19. USPS United States Postal Service; <u>www.usps.com</u>.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. CFR Code of Federal Regulations; Available from Government Printing Office; <u>www.gpo.gov/fdsys</u>.
 - 2. DOD Department of Defense; Military Specifications and Standards; Available from DLA Document Services; <u>www.quicksearch.dla.mil</u>.
 - 3. DSCC Defense Supply Center Columbus; (See FS).
 - 4. FED-STD Federal Standard; (See FS).
 - 5. FS Federal Specification; Available from DLA Document Services; <u>www.quicksearch.dla.mil</u>.
 - a. Available from Defense Standardization Program; <u>www.dsp.dla.mil</u>.
 - b. Available from General Services Administration; <u>www.gsa.gov</u>.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; <u>www.wbdg.org/ccb</u>.

BID AND PERMIT SET

- 6. MILSPEC Military Specification and Standards; (See DOD).
- 7. USAB United States Access Board; <u>www.access-board.gov</u>.
- 8. USATBCB U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

BID AND PERMIT SET

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- A. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- B. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- C. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

BID AND PERMIT SET

- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use at equipment occupied IDF and MDF rooms, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
 - 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.
- B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence.

BID AND PERMIT SET

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. Field Office, Owner: Prefabricated or mobile units of minimum size at least 12 feet by 60 feet. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Drinking water and private toilet.
 - 3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 - 4. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille

BID AND PERMIT SET

in system and remove at end of construction. and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction as needed.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use as available.

- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering owner equipment occupied IDF and MDF rooms.
 - 1. Upon installation of owner equipment, isolate the HVAC system in area where work is to be performed.
 - a. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until completion of construction.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dustproducing equipment. Isolate limited work within occupied areas using portable dustcontainment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filterequipped vacuum equipment.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service underground, unless overhead service must be used.
 - 2. Where power distribution wiring is required by circumstances to be overhead, arrange it to rise vertically where least exposed to damage.
 - 3. Connect temporary service to new electrical transformer as directed by electric company officials.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

- K. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail and internet access, in common-use facilities.
 - 1. The Contractor shall provide an e-mail account for the duration of the project, commencing from the time job site offices are established to post final completion. All communication to be via email or the Owner's eBuilder site. <u>Faxes will not be accepted</u>.
 - 2. Provide the following infrastructure for the computer to be used by the Owner, Architect/Engineers.
 - a. An RJ45 wall jack on the near location when the computer is to be set, connected to:
 - b. A network device that has the capability, such as a router, which has the capability to issue a DHCP address to the computer that we will be using at that site.
 - c. The network device (router) should also have the ability to connect the computer that we will be using at that site to the internet.
 - d. An RJ 45 cable to connect from the RJ45 wall jack to the computer that we will be using at that site.

3.4 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access. Contractor's temporary facility locations shall be sited to provide the least disturbance possible to neighboring properties Owner reserves the right to direct the location of temporary facilities like job-site trailers or temporary toilets.
 - 2. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
 - 4. Combustible structures should not be within 30 feet of trees or power poles.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

- 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31.
- 3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs for second level and roof access.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

BID AND PERMIT SET

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.

BID AND PERMIT SET

- 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
- 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
- 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

- 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
- 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsumbased products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

BID AND PERMIT SET

END OF SECTION 015000

BID AND PERMIT SET

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protection of existing trees from damage.

1.2 RELATED SECTIONS

- A. Section 328000 Irrigation.
- B. Section 329000 Planting.

1.3 REFERENCE STANDARDS

A. ANSI A300 - Tree Care Operations Standards

1.4 DEFINITIONS

- A. Designated Trees: Existing Trees to Remain as indicated on Drawings.
- B. Critical Root Zone (CRZ):
 - 1. CRZ for trees 4 inches in caliper of smaller shall be an area with a radius at least 5 feet from the trunk.
 - 2. CRZ for trees over 6 inches in caliper shall be the greater area of the below options:
 - a. An area 5 feet beyond the existing tree canopy.
- C. Tree Protection Zone: The CRZ and as indicated on Drawings.

1.5 POSTING

A. When directed, post Designated Trees with Notice sign provided by Owner's Representative. Attach sign to tree with twine or staples, no nails. Maintain and protect the Notice sign until completion of construction. Obtain approval of Owner's Representative prior to removal of sign.

BID AND PERMIT SET

1.6 NOTICE

A. Notify all workers, including subcontractors, of the requirements to protect Designated Trees using Notice provided.

1.7 PROTECTIVE FENCING

- A. Install protective fencing around Designated Trees, where shown on Drawings, prior to commencement of any work. Fencing to be a minimum 6 foot chain link, with fence posts securely anchored. Maintain during construction. Adjustments to fence locations are to be approved by the Owner's Representative prior to performing any work within the Zone of Protection.
- B. No construction activities are permitted within the protective fencing without prior approval of the Owner's Representative.

1.8 TRENCHING AND EXCAVATION

A. All trenching and excavation within the Tree Protection Zone is to be performed with the use of an air spade or by hand. Obtain Owner's Representative approval of trenching and excavation locations and methods prior to performing any work.

1.9 ROOT PRUNING

A. Prune roots encountered during construction with an approved root-pruning device. Make clean, vertical cuts. Do not leave split or frayed ends. Obtain Owner's Representative approval prior to cutting roots larger than 1 1/2 inches in diameter. Backfill exposed roots with specified Planting Soil as soon as practical.

1.10 TREE CANOPY PRUNING

A. Prune canopies of Designated Trees impacted by construction only upon approval of Owner's Representative. All canopy pruning must be performed by a certified arborist.

1.11 MULCH

A. Provide four (4) inch deep bark mulch within zone of protection as directed, see Section 329000 - Planting.

1.12 WATERING

A. Water trees if required by Owner's Representative. Watering will be required if it is judged that root removal is necessary for construction and threatens the survival of the tree. Use a slow drip or soaker hose to provide one-inch water per week until completion of construction.

BID AND PERMIT SET

1.13 PROHIBITED ACTIVITIES

- A. Cutting of roots larger than 1 1/2 inch diameter or larger without approval of Owner's Representative.
- B. Damaging tree bark or branches.
- C. Removal of protective fencing or notice posted on trees prior to approval of Owner's Representative.
- D. Activities prohibited within the Tree Protection Zone (without prior approval) are, but not limited to: construction, operation of machinery, storage of materials, paving, grading, cutting, filling, travel within, dumping, disposal of liquids, and parking of vehicles or equipment.

1.14 DAMAGE

A. Actual tree damage such as trunk scoring and broken limbs or damaged roots inside the Zone of Protection will be assessed according to the percentage of loss of tree value. Percentage of tree value will be determined by the Owner's Representative. Tree value will be determined from "Evaluation of Landscape Trees, Shrubs, and Other Landscape Plants" by International Society of Arboriculture.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 015639

BID AND PERMIT SET

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, inservice performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

BID AND PERMIT SET

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Architect's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.

BID AND PERMIT SET

- b. Model and serial number.
- c. Capacity.
- d. Speed.
- e. Ratings.
- 3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

- 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 - 1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."

- 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ..."
- 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ..."
- 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
- 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ..."
- 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
- 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

BID AND PERMIT SET

- C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 2. Evidence that proposed product provides specified warranty.
 - 3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 4. Samples, if requested.
- B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

BID AND PERMIT SET

SECTION 016116 - DELEGATED DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for delegated design indicated in the various Sections of these Specifications.
- B. Section Includes: Structural and other design requirements for delegated design components, otherwise known as fabricator-designed, Contractor-designed or Contractor design-build components.
- C. This Section applies to Technical Specification Sections, and supplements requirements indicated in the General and Supplementary Conditions.
- D. Delegated design items may require deferred submittals. Deferred submittals are required for delegated design items that require authority having jurisdiction (AHJ) permit review. Deferred submittals are required for:
 - 1. Section 052100 "Steel Joist Framing".
 - 2. Section 054000 "Cold-Formed Metal Framing", wall metal framing.
 - 3. Section 055113 "Metal Pan Stairs".
 - 4. Section 055116 "Metal Floor Plate Stairs".
 - 5. Section 077200 "Roof Accessories", attachment of rooftop mechanical units to supporting curbs.
 - 6. Section 078413 "Penetration Firestopping", special inspection required.
 - 7. Section 078443 "Joint Firestopping", special inspection required.
 - 8. Section 083313 "Coiling Counter Doors".
 - 9. Section 083323 "Overhead Coiling Doors".
 - 10. Section 095113 "Acoustical Panel Ceilings", acoustical ceiling suspension systems.
 - 11. Section 112425 "Fall Protection".
 - 12. Section 115313 "Laboratory Fume Hoods".
 - 13. Walk-in Cold Storage Rooms.
 - 14. Fire Protection.
 - 15. Fire sprinkler system.
 - 16. Fire Alarm Systems.
 - 17. Seismic bracing for permanently installed plumbing equipment.
 - 18. Product data and installation instructions for HVAC systems, components, and equipment.
 - 19. Kitchen Exhaust Hood, Type 1 Fire Suppression System.
 - 20. Hangers and Support for all equipment.
 - 21. Seismic bracing for permanently installed electrical equipment.
 - 22. Seismic bracing for telecommunications racks.
 - 23. Emergency Responder Radio System Testing.
 - 24. Emergency generator.

BID AND PERMIT SET

- E. Other Sections indicated for delegated design requirements, including, but not limited to the following:
 - 1. Section 034500 "Precast Architectural Concrete".
 - 2. Section 055000 "Metal Fabrications".
 - 3. Section 057300 "Decorative Metal Railings".
 - 4. Section 074213.23 "Metal Composite Material Wall Panels".
 - 5. Section 079513 "Expansion Joint Cover Assemblies".
 - 6. Section 084113 "Aluminum-Framed Entrances and Storefronts".
 - 7. Section 088000 "Glazing".
 - 8. Section 142400 "Hydraulic Elevators".

1.2 DEFINITIONS

- A. Contractor Design Requirements: Where occurs, same meaning as Delegated Design Requirements.
- B. Delegated Design Work: Design services and certifications provided by a Professional Engineer registered as such in the State where the Project is located related to systems, materials or equipment required for the Work to satisfy design and performance criteria established by the Contract Documents. Delegated Design does not include professional services the Contractor needs to fulfill their responsibilities under the Contract including but not limited to construction means, methods and sequence.
- C. Seal: Certification that builder design plans, computations and specifications were designed and prepared under the direct supervision of the Architect or Engineer whose name appears thereon.
- D. Approval Stamp: Certification obtained by the Contractor that the Building Official has reviewed a submittal, and finds it acceptable with respect to applicable regulatory requirements.
- E. Contractor-Design: Design services provided by an installer or manufacturer complying with quality assurance, performance requirements and design requirements indicated and established by the Contract Documents. Contractor-design does not include Professional Engineering unless indicated otherwise.

1.3 DELEGATED DESIGN SERVICES

- A. Where referenced in these specifications, Delegated Design components and their attachments to the structure shall comply with the currently adopted edition of applicable state and local ordinances, with parameters as specified in the individual Sections.
- B. Where referenced in these specifications, Contractor-Design components and installation shall comply with the currently adopted edition of all applicable state and local ordinates, with parameters specified in this and individual sections.
- C. Permitting Agency Requirements: Follow the requirements for permits current at the time of submission. The Contractor is responsible to coordinate and submit material required, so the permitting agency's review will not adversely affect the construction schedule. At or near time of

application, the Contractor shall meet with the permitting agency to identify Deferred Submittal components and how they are to be submitted and processed for permits.

- D. 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.

1.4 SUBMITTALS

- A. General: Submit complete Deferred Submittals to meet permitting agency requirements for permits. Include drawings and calculations for that portion of the Work signed and sealed by a State of Oregon registered engineer. Incomplete submittals or submittals not previously reviewed and so stamped by Contractor will not be accepted for review by the Architect or Engineer of Record.
- B. These submittal requirements are in addition to other submittal requirements stated elsewhere in the contract documents.

1.5 QUALITY ASSURANCE

- A. Where referenced in these specifications, Delegated Design components and their attachments to the structure shall comply with the currently adopted edition of applicable state and local ordinances, with parameters as specified in this Section.
- B. Permitting Agency Requirements: Follow the requirements for permits current at the time of submission. The General Contractor is responsible to coordinate and submit all material required, so the permitting agency's review will not adversely affect the construction schedule. At or near time of application, the Contractor shall meet with the permitting agency to identify Deferred submittal components and how they are to be submitted and processed for permits.

1.6 INSURANCES

A. Refer to General Conditions for Insurance and Bonds.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 WORK INCLUDED

A. General: Certain of the components of the Work under this project are Delegated Design. It is the General Contractor's responsibility to coordinate and assume or assign to subcontractors the

complete responsibility for the design, calculations, submittals, fabrication, transportation and installation of the Delegated Design portions or components as required in this Section.

- B. The General Contractor is responsible to submit all documents required by the permitting agency for the separate approval and permit for each Delegated Design item. Delegated Design components of this Work are defined as complete, operational systems, provided for their intended use.
- C. All permit plan review and permit fees for Delegated Design items are the responsibility of the submitting General Contractor.

3.2 DOCUMENTS REQUIRED

- A. General: Delegated Design documents and related permits issuance must be completed prior to fabrication. The General Contractor must complete and submit a Contractor Design Summary Sheet listing Delegated Design Subcontractors and their registered engineer's names and phone numbers prior to submission of the Delegated Design documents for review.
- B. Scope of Documents: Delegated Design components are shown in the Contract Documents for design intent. The purpose is to have the General Contractor responsible to provide, coordinate and install each Delegated Design component.
 - 1. Delegated Design components attached to the structural frame or supplemental to the structural frame shall be designed for the anticipated loads as outlined in the Contract Documents. These Delegated Design components are all to be coordinated with appropriate subcontractors.
 - 2. Load reactions at the interface between the Delegated Design components and the structural frame shall be clearly defined to allow for a review by the Architect and Engineer of Record.
- C. Component Certification: Certify that mechanical and electrical components comply with the structural provisions of all applicable codes.
 - 1. Shop Drawings: Submit shop drawings for all attachments to the structure for all elements requiring structural design per these specifications. These attachments include, but are not limited to, structural bracing for equipment, conveyances, and architectural components; seismic restraints of vibration isolation systems; and details of lateral bracing and attachment systems designed to accommodate differential movement between building levels.
 - 2. Shop Drawings shall be sealed by the structural engineer responsible for their design.
- D. Quality Assurance Plan: Submit a quality assurance plan for the designated structural system of all elements requiring structural design per these specifications. Quality assurance plan shall comply with Owner's requirements and all applicable codes.

END OF SECTION 016116

BID AND PERMIT SET

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 the following:
 - 1. Recycling nonhazardous demolition and construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.
- B. Reports: Submit monthly documentation to Owner with each Application for Payment prior to Substantial Completion substantiating that Waste Management Plan was maintained and that goals were achieved.
 - 1. Trash: Quantity by weight deposited in landfills. Include associated fees, transportation costs, container rentals, and taxes for total cost of disposal.
 - 2. Salvaged Material: Quantity by weight or quantity with destination for each type of material salvaged for resale, recycling, or adaptive reuse. Include associated fees,
transportation costs, container rentals, and taxes for total cost of disposal. Also, include reimbursements due to salvage resale.

3. Total Cost: Indicate total cost or savings for implementation of Waste Management Plan. This does not imply reimbursement by Owner.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 WASTE MANAGEMENT PLAN

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

BID AND PERMIT SET

- B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING

- A. Use Source Separation Method or Co-Mingling Method suitable to sorting and processing method of selected recycling center. Dispose non-recyclable trash separately into landfill.
 - 1. Source Separation Method: Recyclable materials separated from trash and sorted into bins or containers prior to transportation to recycling center.
 - 2. Co-Mingling Method: Recyclable materials separated from trash and placed in unsorted bins or container for sorting at recycling center.
- B. Materials suggested for recycling include:
 - 1. Packing materials including paper, cardboard, foam plastic, and sheeting.
 - 2. Recyclable plastics.
 - 3. Organic plant debris.
 - 4. Earth materials.
 - 5. Native stone and granular fill.
 - 6. Asphalt and paving.
 - 7. Wood.
 - 8. Glass.
 - 9. Metals.
 - 10. Gypsum products.
 - 11. Acoustical ceiling tile.
 - 12. Carpet.
 - 13. Equipment oil.

3.3 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Contractor will be responsible for disposing of any equipment in the existing buildings not scheduled to be salvaged to the owner.
 - 2. Contractor will be responsible for disposing of remaining school portable units if present.
 - 3. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 4. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

BID AND PERMIT SET

- B. Burning: Do not burn waste materials.
- C. Burying: Do not bury waste materials.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

BID AND PERMIT SET

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 additional operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

BID AND PERMIT SET

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Request re-inspection 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. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

BID AND PERMIT SET

- 7. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
- 8. 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.
- 9. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- 10. Submit pest-control final inspection report.
- 11. Submit final completion photographic documentation.
- B. Procedures Prior to Final 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 utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements.
 - 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Request re-inspection 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.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

BID AND PERMIT SET

- 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 electronic file. Architect will return annotated file.
 - b. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into an individual electronic PDF files corresponding to specification section numbers.
 - 1. Submit by uploading to web-based project software site.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

BID AND PERMIT SET

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, 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 not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. 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.
 - 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.

- 1. Wipe surfaces of mechanical and electrical equipment, elevator 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.
- p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with Owner waste disposal.

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 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

BID AND PERMIT SET

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operations Maintenance Manual:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Submit a closeout submittal log listing all required closeout submittals, listed by Specifications section numbers.
 - 2. Architect, BSD, and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.

- 3. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Initial Electronic Submittal Review: Submit by uploading to web-based project software site, eBuilder process called "CLOP." Enable reviewer comments on draft submittals.
 - 2. BSD will not accept any hardcopy documents until initial electronic review has been completed.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 10 days before commencing demonstration and training. Architect, BSD and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion Prior to final completion.
 - 1. Correct or revise each manual to comply with Architect's, BSD's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's, BSD's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic keyword searchable PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. For each specification section, provide 1 PDF containing all Product Data and 1 PDF containing the Warranty. Place PDFs into files named according to CSI format
 - 3. Submit all documents by uploading to web-based project software site.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

- b. Submit 1 copy of the Operation and Maintenance Manual and 1 copy of the Warranty Binder.
- 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
- 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
- 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
- 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manual: Unless otherwise indicated, organize single manual. The manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
 - a. Contact list.
 - b. Certificate of Substantial Completion (AIA G704-2000).
 - c. Contractor's Statement of Warranty.
 - d. Lead & Asbestos Free Certification Letter.
 - e. Certificate of Occupancy.
 - f. Final Permit Inspection Approvals.
 - g. Operation & Maintenance Data (including shop drawings, where applicable) and Warranties organized by specification sections chronological order and named according to CSI Format.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.

BID AND PERMIT SET

- 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
- 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Arrange contents by specification sections chronological order. If possible, assemble instructions for subsystems, equipment, and components of one system into a single file.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.

BID AND PERMIT SET

- 8. Engineering data and tests.
- 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed and, identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, sub-system, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, sub-system, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component

BID AND PERMIT SET

incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
- 3. Identification and nomenclature of parts and components.
- 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of maintenance manuals.

BID AND PERMIT SET

1.9 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

BID AND PERMIT SET

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 PRELIMINARY CLOSEOUT SUBMITTALS

- A. Submit to the Owner the following for review:
 - 1. Revit model detailed to LOD 300.
 - 2. CAD files & X-refs (i.e. Landscape dwgs).
 - 3. Draft Operations and Maintenance Manual.

1.4 CLOSEOUT SUBMITTALS

- A. Upload to owner web-based program: O&M Manual; Specs; Revit model; DWG files; pdfs of Record Drawings, Redline Drawings (scanned if necessary) and Permit Drawings (scanned) also submit by uploading to web-based project software site.
- B. Permit Drawing Set (original stamp, signature, & date).
- C. One (1) hard copy of Record Drawings.

BID AND PERMIT SET

- D. One (1) copy O&M Manual 3-Ring Binders including:
 - 1. Table of Contents.
 - 2. Contact list.
 - 3. Certificate of Substantial Completion (AIA G704-2000).
 - 4. Lead & Asbestos Free Certification Letter.
 - 5. Certificate of Occupancy.
 - 6. Final Permit Inspection Approvals.
 - 7. Operation & Maintenance Data (including shop drawings, where applicable) and Warranties organized logically by CSI division.
 - 8. Warranties.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous recordkeeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.5 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - 1. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.

DLR GROUP PROJECT NO. 74-18109-00

ACMA BEAVERTON SCHOOL DISTRICT BEAVERTON, OREGON

BID AND PERMIT SET

- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Annotated PDF electronic file with comment function enabled Via USB Drive.
 - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 3. Refer instances of uncertainty to Architect for resolution.
 - 4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled via USB Drive.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.6 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

- 2. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file via USB drive and upload to web-based project software site.

1.7 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as annotated PDF electronic file via USB Drive.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.8 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file via USB Drive.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.9 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

BID AND PERMIT SET

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

BID AND PERMIT SET

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Upload to web-based software website or on USB within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.

BID AND PERMIT SET

- f. Date of video recording.
- 2. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.
- D. In addition to general building training the subcontractors to provide trade specific training for Mechanical and Electrical systems. This training shall be conducted during commissioning of the building, 3 months after building competition and prior to 1 year warranty expiration.
 - 1. Each training sessions to last a maximum of 8 hours.

BID AND PERMIT SET

2. Controls specific training to be four to five days training for multiple Owner's operation team members.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operation and Maintenance Manual.
 - c. Project Record Documents.
 - d. Identification systems.
 - e. Warranties and bonds.
 - f. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.

BID AND PERMIT SET

- e. Control sequences.
- f. Safety procedures.
- g. Instructions on stopping.
- h. Normal shutdown instructions.
- i. Operating procedures for emergencies.
- j. Operating procedures for system, subsystem, or equipment failure.
- k. Seasonal and weekend operating instructions.
- 1. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

BID AND PERMIT SET

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 2. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

BID AND PERMIT SET

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning: Commissioning is a systematic process of ensuring and documenting that all building systems perform interactively according to the design intent and the owner's operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.
- B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
 - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper performance of equipment and systems.
 - 3. Verify that O&M documentation left on site is complete.
 - 4. Verify that the Owner's operating personnel are adequately trained.
- C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.2 COORDINATION

- A. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority (CxA), the owner's designated Project Manager (PM), the General Contractor (GC or Contractor), the architect and design engineers, the Plumbing Contractor (PC), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.
- B. Management: The CxA is hired by the Owner directly. The CxA directs and coordinates the commissioning activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CxA's responsibilities are the same regardless of who hired the CxA.
- C. Scheduling: The CxA will work with the GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the PM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling on an ongoing basis and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.3 COMMISSIONING PROCESS

- A. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 - 1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 - 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 - 3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
 - 4. The CxA works with the Subs to develop startup plans and startup documentation formats, which may include providing the Subs with prefunctional checklists to be completed during the startup process.
 - 5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.
 - 6. The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CxA documents that the checklists and startup were completed according to approved plans, and may witness startup of selected systems and equipment.
 - 7. The CxA develops specific equipment and system functional testing procedures. The Subs review the procedures.
 - 8. The procedures are executed/witnessed and documented by the CxA, with the assistance of the Subs as necessary.
 - 9. Items of non-compliance in material, installation, programming, calibration, start-up or setup are corrected at the Sub's expense and the system retested.
 - 10. The CxA reviews O&M's for all commissioned systems for completeness.
 - 11. The CxA reviews and approves training plans/agenda for training provided by the Subs (for commissioned equipment), and verifies that training was completed as per the contract documents.
 - 12. The CxA issues a report of the commissioning process and results.
 - 13. The CxA performs a Near-Warranty End or Post Occupancy Review approximately 10 months into the 12-month warranty period.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.
 - 1. Section 011000 "Summary" for Commissioning Authority responsibilities.
 - 2. Section 013300 "Submittal Procedures" for submittal procedure requirements for commissioning process.
 - 3. Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
 - 4. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.
 - 5. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.

BID AND PERMIT SET

- 6. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
- 7. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.5 RESPONSIBILITIES

- A. The responsibilities of various parties in the commissioning process are provided in this section. It is noted that the services for the Commissioning Authority, Project Manager, Construction Manager, Architect, and HVAC mechanical and electrical designers/engineers are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.
- B. All Parties
 - 1. Follow the Commissioning Plan and Cx Specification requirements.
 - 2. Attend commissioning scoping meeting and additional meetings, as necessary.
- C. Architect (of the A/E)
 - 1. Attend the commissioning scoping meeting and selected commissioning team meetings.
 - 2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
 - 3. Provide any design narrative documentation requested by the CxA.
 - 4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 - 5. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
- D. Mechanical and Electrical Designers/Engineers (of the A/E)
 - 1. Perform normal submittal review, construction observation, O&M review, etc., as contracted.
 - 2. Review and respond to CxA review comments of construction documents and O&M manuals.
 - 3. Coordinate with CxA for review of contractor submittals. Review and respond to CxA review comments. Incorporate CxA comments into response to contractors as appropriate.
 - 4. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 - 5. Review draft functional/performance test procedures: respond with any comments.
 - 6. Respond to issues in the Cx Log identified as awaiting action by Engineer.
 - 7. Attend commissioning scoping meetings and other selected commissioning team meetings.
 - 8. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.

BID AND PERMIT SET

E. Commissioning Authority (CxA)

- 1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving, non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxA.
- 2. Coordinate the commissioning work and, with the GC and PM, ensure that commissioning activities are being scheduled into the master schedule.
- 3. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
- 4. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
- 5. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
- 6. Review and comment on Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
- 7. Prepare and distribute pre-functional checklists and startup forms.
- 8. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
- 9. Approve systems startup by reviewing start-up reports and by selected site observation.
- 10. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
- 11. Review and comment on TAB report for commissioning related issues.
- 12. With necessary assistance and review from installing contractors, write the functional testing procedures for equipment and systems. This may include energy management control system trending, stand-alone data logger monitoring or manual functional testing. Submit to PM for review, and for approval if required.
- 13. Analyze any functional performance trend logs and monitoring data to verify performance.
- 14. Witness selected startup/performance tests performed by installing contractors. Review and comment on test reports.
- 15. Perform or witness functional test procedures on the commissioned equipment.
- 16. Maintain a master deficiency and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions.
- 17. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
- 18. Review Contractor's training plan for facility operating staff and building occupants. Verify Contractor's execution of plan.
- 19. Review and comment on preliminary O&M manuals for commissioned systems.
- 20. Provide a final commissioning report (as described in this section).
- 21. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
- 22. Return to the site at 10 months into the 12-month warranty period and do a brief review with facility staff the current building operation and the condition of outstanding issues

BID AND PERMIT SET

related to the original and seasonal commissioning. Identify problems or concerns staff have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract.

- F. Owner's Project Manager (PM)
 - 1. Manage the contract of the A/E and of the GC.
 - 2. Provide final approval for the completion of the commissioning work.
 - 3. Provide construction documents for CxA review.
 - 4. Review draft functional/performance test procedures; respond with any comments.
 - 5. Respond to issues in the Cx Log identified as awaiting action by Owner.
 - 6. Attend commissioning meetings.
 - 7. Forward to CxA any start-up forms produced by vendors hired by owner.
 - 8. Arrange for O&M staff to attend contractor training sessions; coordinate with GC and/or Subs to schedule.
 - 9. Forward O&M manuals for any commissioned equipment provided by owner to CxA for review.
 - 10. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
- G. General Contractor (GC)
 - 1. Designate one of their staff to be the General Contractor's Cx Coordinator, with whom the CxA coordinates all contractor Cx responsibilities.
 - 2. Facilitate the coordination of the commissioning work by the CxA, and with the CxA ensure that commissioning activities are being scheduled into the master schedule.
 - 3. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
 - 4. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
 - 5. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
 - 6. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
 - 7. Schedule subcontractors to attend commissioning meetings when requested by CxA.
 - 8. Deliver Pre-Functional checklists to subcontractors, collect completed forms and forward to CxA.
 - 9. Forward completed contractor and vendor Start-up Forms for commissioned equipment to the CxA.
 - 10. Submit RFI's generated by the CxA to the A/E.
 - 11. Notify CxA when all Pre-Functional Checklists and Start-up Forms have been completed and systems are ready for Functional/performance testing.
 - 12. Respond to all issues in the Cx Log identified as awaiting action by the GC.
 - 13. Coordinate the training of owner personnel. Forward training plans and records to CxA for review.
 - 14. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions and make available to the CxA, concurrent with the A/E review.
 - 15. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

BID AND PERMIT SET

H. Equipment Suppliers

- 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
- 2. Assist in equipment testing per agreements with Subs.
- 3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxA.
- 4. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
- 5. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
- 6. Review test procedures for equipment installed by factory representatives.
- I. Subcontractors
 - 1. Refer to division specific commissioning specification sections listed under 019113 part 1.4, "Related Work" for responsibilities specific to each subcontractor.

1.6 SYSTEMS TO BE COMMISSIONED

- A. The following equipment and associated systems will be commissioned in this project:
 - 1. Division 22: Plumbing Systems
 - a. Domestic Hot and Cold water systems
 - b. Hot water recirculation system
 - 2. Division 23: HVAC Systems
 - a. Air handling units
 - b. Exhaust fans
 - c. Terminal units
 - d. Heating water system
 - e. Airflow measuring stations
 - f. Control system for commissioned equipment
 - 3. Division 26: Electrical Systems
 - a. Lighting controls
 - 4. Division 28: Fire Detection and Alarm
 - a. Interface with life safety systems, fire protection systems, HVAC systems and elevators.

B. General references to equipment will refer to the above systems and their components.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by the TAB contractor in their commissioning responsibilities.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone data-logging equipment that may be used by the CxA.
- C. Data-logging equipment and software required to test equipment will be provided by the CxA for use by the CxA only, and shall not become the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications*. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of $\pm 0.5^{\circ}$ F and a resolution of $\pm 0.2^{\circ}$ F. Pressure sensors shall have an accuracy of + or -2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Scoping Meeting: Within 60 days of commencement of construction, the CxA will schedule, plan and conduct a commissioning kickoff meeting with the entire commissioning team in attendance. Information gathered from this meeting will be used by the CxA to revise the Draft Commissioning Plan to its "final" version.
- B. Miscellaneous Meetings: CxA may attend regular construction meetings to keep informed of project progress & coordinate the commissioning activities. Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CxA will plan these meetings and will minimize unnecessary time being spent by Subs.

BID AND PERMIT SET

3.2 REPORTING

- A. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- B. A final summary report (about four to six pages, not including backup documentation) by the CxA will be provided to the PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.3 SUBMITTALS

- A. The CxA will provide appropriate contractors with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation requested by the CxA will be included by the Subs in their O&M manual contributions.
- B. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- C. The Commissioning authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications, which is the A/E's responsibility. The Commissioning authority will notify the GC, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which requires resubmission.
- D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.06, Systems to be Commissioned.

DLR GROUP PROJECT NO. 74-18109-00

ACMA BEAVERTON SCHOOL DISTRICT BEAVERTON, OREGON

BID AND PERMIT SET

- B. General: Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional testing of equipment or subsystems of the given system.
- C. Start-up and Initial Checkout Plan: The CxA shall assist the contractor in developing prefunctional checklists and a detailed start-up plan for all commissioned equipment. The primary role of the CxA in this process is ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.
 - 1. The subcontractor responsible for the purchase of the equipment develops the full start-up plan. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 - 2. The full start-up plan could consist of something as simple as:
 - a. The CxA's, contractor's or manufacturer's prefunctional checklists.
 - b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - c. The manufacturer's normally used field checkout sheets.
 - 3. The subcontractor submits the full startup plan to the CxA for review and approval.
 - 4. The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
 - 5. The full start-up procedures and the approval form may be provided to the PM for review and approval, depending on management protocol.
- D. Execution of Prefunctional Checklists and Startup.
 - 1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the PM, GC and CxA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
 - 2. The CxA shall verify compliance on at least 20% of equipment requiring formal start-up procedures.
 - 3. The Subs and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
- E. Only individuals that have <u>direct</u> knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms unless they have personally witnessed or verified each item.

BID AND PERMIT SET

- F. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
 - 1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.
 - 2. The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CxA will work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the PM, GC and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report.
 - 3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back-charges to the responsible party. Refer to Part 3.6 herein for details.

3.5 FUNCTIONAL TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. Objectives and Scope: The objective of functional testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cooldown, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required.
- C. Development of Test Procedures: Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor shall provide limited assistance to the CxA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA may submit the tests to the A/E for review, if requested.
- D. Test Methods
 - 1. Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data-loggers.
 - 2. Simulated Conditions: Simulating conditions (not by an overwritten value) is allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 - 3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, is allowed, but will be used with caution and avoided when possible. Such
BID AND PERMIT SET

testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair dryer rather than overwriting the value or by altering the appropriate set point to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

- 4. Altering Set Points: Rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout set point to be 2F above the current outside air temperature.
- 5. Indirect Indicators: Relying on indirect indicators for responses or performance is allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
- 6. Setup: Each function and test will be performed under conditions that simulate actual conditions as close as is practically possible. At completion of the test, the CxA will return all affected building equipment and systems, due to temporary modifications, to their pretest condition.
- 7. Sampling
 - a. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy as approved by the owner representative. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.
 - b. A common sampling strategy is the "xx% Sampling—yy% Failure Rule", defined by the following example.
 - 1) xx = the percent of the group of identical equipment to be included in each sample.
 - 2) yy = the percent of the sample that if failing, will require another sample to be tested.
 - 3) The example below describes a 20% Sampling—10% Failure Rule.
 - a) Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
 - b) If 10% (yy) of the units in the first sample fail the functional testing, test another 20% of the group (the second sample).
 - c) If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - d) If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

BID AND PERMIT SET

- E. Coordination and Scheduling.
 - 1. The Subs shall provide sufficient notice to the CxA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The Controls Contractor will provide written notification that they have completed all required prefunctional checklists, point-to-point verification, sensor calibration verification, programming verification checks, and that their system(s) are complete and ready for functional testing before testing will proceed. The CxA will schedule functional tests through the PM, GC and affected Subs. The CxA will develop, execute and document the functional testing of all equipment and systems.
 - 2. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is complete and pre-functionally tested before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
- F. Test Equipment: Refer to Section 019113, Part 2 for test equipment requirements.
- G. Problem Solving: The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The CxA will document the results of all functional tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM for review and approval and to the Subs for review.
- B. Non-Conformance
 - 1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the PM on the CxA's standard issues tracking form.
 - 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
 - 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work, loosening acceptance criteria, or combining CxA functional testing with the contractor QA checkout procedures to satisfy scheduling or cost.
 - 4. A complete round of tests will be performed, with results and deficiencies reported to the Subs and the PM. The responsible Subs will then have an opportunity to correct the deficiencies and schedule re-testing. Re-testing of up to 10% of the total number of

executed tests will be provided by the CxA at no additional charge. Costs of additional retesting will be as described in the next section.

- a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CxA documents the deficiency and the Sub's response with intentions and they go on to another test or sequence. The Sub corrects the deficiency and notifies the CxA that the system is ready to be retested.
 - 2) The CxA reschedules the test and the test is repeated.
- b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the PM and to the Sub representative assumed to be responsible.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
 - 3) The CxA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
- 5. Cost of Retesting.
 - a. The time for the CxA to execute any re-testing required because a specific *prefunctional* checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, may be back-charged to the GC, who may choose to recover costs from the party responsible for executing the faulty prefunctional check.
 - b. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA and PM will direct the retesting of up to 10% of the total executed tests once at no "charge" to the GC for their time. However, the CxA's time for a second test will be charged to the GC, who may choose to recover costs from the responsible Sub.
 - c. Refer to the sampling section of Section 019100 for requirements for testing and retesting identical equipment.
- 6. The Contractor shall respond in writing to the CxA and PM the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
- 7. Any required re-testing shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.
- C. Approval: The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the CM, if necessary. The CxA recommends acceptance of each test to the CM using a standard form.

3.7 OPERATION AND MAINTENANCE MANUALS AND FINAL REPORT

- A. Standard O&M Manuals.
 - 1. The specific content and format requirements for the standard O&M manuals are detailed in Division 01, with specific section requirements in Divisions 22, 23 & 26 for commissioned equipment.
 - 2. CxA Review and Approval: Prior to substantial completion, the CxA will review the O&M manuals, documentation and redline as-builds *for systems that were commissioned* to verify compliance with the *Specifications*. The CxA will communicate deficiencies in the manuals to the PM or A/E, as requested. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.
- B. Final Commissioning Report
 - 1. The final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding noncompliance items will be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. will also be listed. Each non-compliance issue will be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment will include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.
 - 2. Other documentation will be retained by the CxA.

3.8 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed. NWESI's scope does not include any training review.

3.9 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted as soon as possible. Services of necessary parties will be negotiated.

BID AND PERMIT SET

3.10 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them.

B. In summary, the written products are:

Item no.	Product	Developed by
01 9100-1	Equipment documentation submittals	Subs
01 9100-2	Sequence clarifications	Subs and A/E as needed
01 9100-3	Pre-functional checklists	CxA
01 9100-4	Start-up and initial checkout plan	Subs w/ assistance from CxA
01 9100-5	Pre-functional checklists filled out	Subs
01 9100-6	Start-up and initial checkout forms filled out	Subs
01 9100-7	Final TAB report	TAB
01 9100-8	Issues log (deficiencies)	CxA
01 9100-9	Functional test forms	CxA
01 9100-10	Filled out functional tests	CxA
01 9100-11	Training plans and records	Subs
01 9100-12	O&M manuals	Subs
01 9100-13	Final Commissioning Report	CxA

END OF SECTION 019113

The Commissioning Process

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CONTENTS

ASHRAE Guideline 0-2005 The Commissioning Process

SECTION PAGE

NOTE

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FOREWORD

The Commissioning Process is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.

The Commissioning Process assumes that owners, programmers, designers, contractors, and operations and maintenance entities are fully accountable for the quality of their work. The Commissioning Team uses methods and tools to verify that the project is achieving the Owner's Project Requirements throughout the delivery of the project. For example, the contractor is responsible for fully constructing, testing, and ensuring that its employees' work has provided the level of quality expected. The Commissioning Authority then randomly samples the contractor's work to verify that it is achieving the Owner's Project Requirements. If systemic issues are identified, then the contractor is expected to recheck all of his/her work and correct any deficiencies. This qualityoriented process is different than when the Commissioning Authority does 100% checking or non-quality-based sampling. Guideline 0 has been developed to present an approach based on these assumptions.

The Commissioning Process begins at project inception (during the Pre-Design Phase) and continues for the life of the facility (through the Occupancy and Operations Phase). Because this Guideline details a process, it can be applied to both new and renovation projects. The Commissioning Process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meet the Owner's Project Requirements. This Guideline describes the overall Commissioning Process in order to provide a uniform, integrated, and consistent approach for delivering and operating facilities that meet an owner's ongoing requirements.

The Commissioning Process is a quality-based method that is adopted by an Owner to achieve successful construction projects. It is not an additional layer of construction or project management. In fact, its purpose is to reduce the cost of delivering construction projects and increase value to owners, occupants, and users. This Guideline has been developed to assist those who are adopting or plan to adopt a better quality-based and cost-effective process.

Development of guidelines for the Commissioning Process began formally in 1982 when the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) formed a committee to document best practices to achieve facilities that performed according to the owner's project requirements. ASHRAE published its original commissioning guideline in 1989 and an updated version in 1996. The Commissioning Process detailed in these guidelines is the result of experience on projects requiring that systems and assemblies worked from the first day the project was turned over to the owner. This Commissioning Process is further based upon experience with projects that met the requirements of owners, occupants, users of processes, and facility operating-maintenance-service organizations at a high level of satisfaction and that reduced the cost to deliver the project.

Guideline 0 is an integral part of the National Institute of Building Sciences (NIBS) total building commissioning guideline series. The relationship of this guideline to other technical commissioning guidelines is shown below.

Guideline 0 presents details on the Commissioning Process without focusing upon specific systems or assemblies. Supplementary technical guidelines are being developed to provide specific and detailed information on how to implement the Commissioning Process for each major building/facility system or assembly. For example, this Guideline details what is required for a high-quality and effective Systems Manual and how and when it is developed, whereas a technical guideline details what specific information for a given system or assembly must be included in the Systems Manual.

The use of a common content organization and the focus upon specific information achieve a closely coordinated set of documents that can be used together or in any combination to accommodate varying owner requirements. This Commissioning Process guideline allows the technical commissioning guidelines to avoid repeating information on the commissioning process, making them more concise and focused relative to their technical requirements.



The fundamental objectives of the Commissioning Process are to:

- (a) Clearly document Owner's Project Requirements;
- (b) *Provide documentation and tools to improve the quality of deliverables;*
- (c) Verify and document that systems and assemblies perform according to the Owner's Project Requirements;
- (d) Verify that adequate and accurate system and assembly documentation is provided to the owner;
- (e) Verify that operation and maintenance personnel and occupants are properly trained;
- (f) Provide a uniform and effective process for delivery of construction projects;
- (g) Deliver buildings and construction projects that meet the owner's needs, at the time of completion;
- (h) Utilize quality-based sampling techniques to detect systemic problems, as such sampling provides high value, efficient verification, accurate results, and reduced project costs; and
- (i) Verify proper coordination among systems and assemblies, and among all contractors, subcontractors, vendors, and manufacturers of furnished equipment and assemblies.

Due to the integration and interdependency of facility systems, a performance deficiency in one system can result in less than optimal performance by other systems. Implementing the Commissioning Process is intended to reduce the project capital cost through the first year of operation and also reduce the life-cycle cost of the facility. Using this integrated process results in a fully functional, fine-tuned facility, with complete documentation of its systems and assemblies and trained operating and maintenance personnel.

Emphasis is placed on documentation of the Owner's Project Requirements at the inception of the project and the proper transfer of this information from one party to the next. Owners adopt the Commissioning Process to achieve their stated objectives and criteria—starting with the inception of a project instead of after a facility is occupied.

While circumstances may require owners to adopt the Commissioning Process during the Design or Construction Phase of a project, such later implementation must capture the information that would have been developed had the Commissioning Process begun at project inception. Beginning the Commissioning Process at project inception will achieve the maximum benefits.

Annexes to this document have been included to assist in further understanding the Commissioning Process and to aid in the development of the technical guidelines. The Annexes are based on specific project experience, with details on what is current best practice. Annexes illustrate varying applications of the Commissioning Process for all projects. Therefore, Annexes should be viewed as examples of how to develop documents and to define Owner's Project Requirements, Basis of Design, Commissioning Plan, benefits and roles in the Commissioning Process, verification, testing requirements, documentation, and training. The Commissioning Process has been structured to coincide with the phases of a generic project with Pre-Design, Design, Construction, and Occupancy and Operations phases.

This guideline describes the Commissioning Process; the responsibilities of Commissioning Team participants; the role of the Commissioning Authority; and a model framework for developing a Commissioning Plan, specifications, and reports. This guideline also describes the general requirements for a training program for continued successful system and assembly performance. Documentation necessary to meet the guideline requirements is also described.

1. PURPOSE

1.1 The purpose of this guideline is to describe the Commissioning Process capable of verifying that a facility and its systems meet the Owner's Project Requirements.

2. SCOPE

2.1 The procedures, methods, and documentation requirements in this guideline describe each phase of the project delivery and the associated Commissioning Processes from pre-design through occupancy and operation, without regard to specific elements, assemblies, or systems, and provide the following:

- (a) overview of Commissioning Process activities,
- (b) description of each phase's processes,
- (c) requirements for acceptance of each phase,
- (d) requirements for documentation of each phase, and
- (e) requirements for training of operation and maintenance personnel.

2.2 These *Commissioning Process* guideline procedures include the Total Building Commissioning Process (TBCxP) as defined by National Institute of Building Sciences (NIBS) in its *Commissioning Process Guideline 0*.

3. UTILIZATION

3.1 The application of this guideline will depend upon the Owner's Project Requirements and how the project will be designed, built, and operated. The process described in this guideline is written for a generic project and must be adapted to each project.

3.2 This guideline describes the Commissioning Process, and is supplemented by companion technical guidelines. A technical guideline describes the specific details to properly implement the Commissioning Process relative to a specific facility system or assembly. Annex A in this guideline provides the required format for developing technical guidelines for the Commissioning Process.

4. DEFINITIONS

Acceptance: A formal action, taken by a person with appropriate authority (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.

Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Checklists: Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements.

Commissioning: See Commissioning Process.

Commissioning Authority: An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process.

Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Commissioning Process Activities: Components of the Commissioning Process.

Commissioning Process Progress Report: A written document that details activities completed as part of the Commissioning Process and significant findings from those activities, which is continuously updated during the course of a project. Usually incorporated into the Commissioning Plan as an ongoing appendix.

Commissioning Process Report: A document that records the activities and results of the Commissioning Process. Usually developed from the final Commissioning Plan with all of its attached appendices.

Commissioning Team: The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

Construction Checklist: A form used by the contractor to verify that appropriate components are onsite, ready for installation, correctly installed, and functional. Also see *Checklists*.

Construction Documents: These include a wide range of documents that will vary from project to project and with the Owner's needs and with regulations, laws, and countries. Construction documents usually include the project manual (specifications), plans (drawings), and general terms and conditions of the contract.

Continuous Commissioning Process: A continuation of the Commissioning Process well into the Occupancy and Operations Phase to verify that a project continues to meet current and evolving Owner's Project Requirements. Continuous Commissioning Process activities are ongoing for the life of the facility. Also see *Ongoing Commissioning Process*.

Contract Documents: These include a wide range of documents that will vary from project to project and with the Owner's needs and with regulations, laws, and countries. Contract Documents frequently include price agreements, construction management process, subcontractor agreements or requirements, requirements and procedures for submittals, changes, and other construction requirements, timeline for completion, and the Construction Documents.

Coordination Drawings: Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

Nominal Group Technique: A formal, structured brainstorming process used to obtain the maximum possible ranked input from a variety of viewpoints in a short period of time. The typical approach is a workshop session where a question is presented, the attendees record their responses individually on a piece of paper, the individual responses are recorded on a flip chart without discussion in a round robin fashion, all of the responses are discussed, and then the participants rank their top five responses.

Ongoing Commissioning Process: A continuation of the Commissioning Process well into the Occupancy and Operations Phase to verify that a project continues to meet current and evolving Owner's Project Requirements. Ongoing Commissioning Process activities occur throughout the life of the facility; some of these will be close to continuous in implementation, and others will be either scheduled or unscheduled (as needed). Also see *Continuous Commissioning Process*.

Owner's Project Requirements: A written document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term *Project Intent* is used by some owners for their Commissioning Process Owner's Project Requirements.)

Quality Based Sampling: A process for evaluating a subset (sample) of the total population. The sample is based upon a known or estimated probability distribution of expected values; an assumed statistical distribution based upon data from a similar product, assembly, or system; or a random sampling that has scientific statistical basis.^{1, 2, 3}

Re-Commissioning: An application of the Commissioning Process requirements to a project that has been delivered using the Commissioning Process. This may be a scheduled re-commissioning developed as part of an *Ongoing Commissioning Process*, or it may be triggered by use change, operations problems, or other needs.

Retro-Commissioning: The Commissioning Process applied to an existing facility that was not previously commissioned. This guideline does not specifically address retro-commissioning. However, the same basic process needs to be followed from Pre-Design through Occupancy and Operations to optimize the benefits of implementing the Commissioning Process philosophy and practice.

Systems Manual: A system-focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the Occupancy and Operations Phase.

Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Training Plan: A written document that details the expectations, schedule, budget, and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.

Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

5. PRE-DESIGN PHASE

5.1 Introduction

5.1.1 Pre-Design is a preparatory phase of the project delivery process in which the Owner's Project Requirements are developed and defined. Information about the project is gathered, including program requirements, community context, codes and regulations, site and climate, facility context and function, facility technology, sustainability, cost, schedule, and the client's (including owner, occupants, operators, and maintenance personnel) needs and capabilities.

5.1.2 This phase is critical to the Commissioning Process because the documented Owner's Project Requirements form the foundation for the design, construction, and occupancy and operation of the facility and are the basis for the Commissioning Plan and schedule. Starting the Commissioning Process during the Pre-Design Phase facilitates project communication by monitoring the Owner's Project Requirements from Pre-Design through Design, Construction, and Occupancy and Operations and by verifying decisions in these phases with the written documents called the Owner's Project Requirements and the Basis of Design.

5.1.3 Pre-Design Phase Commissioning Process objectives include the following:

- (a) Developing the Owner's Project Requirements.
- (b) Identifying a scope and budget for the Commissioning Process.
- (c) Developing the initial Commissioning Plan.
- (d) Acceptance of Pre-Design Phase Commissioning Process activities.
- (e) Review and use of lessons-learned information from previous projects.

5.2 Pre-Design Phase Commissioning Process Activities

5.2.1 Pre-Design Phase Commissioning Process Responsibilities

5.2.1.1 During the Pre-Design Phase, a Commissioning Team is formed to oversee, implement, and accomplish the Commissioning Process activities detailed in this guideline. Responsibility for leadership of the Commissioning Team should be defined and assigned at the beginning of the Pre-Design Phase. The term used for the person with overall responsibility for the Commissioning Process is "Commissioning Authority." The Commissioning Team members must be available for meetings, have the qualifications to contribute to the development of the Owner's Project Requirements, and have the authority to make decisions binding on the firms/ constituencies they represent. Lines of authority and lines of communication in determining Commissioning Team members' responsibilities shall be documented. The Commissioning Team composition must be based upon the scope of the Commissioning Process services established for the project.

5.2.1.2 The Owner must assign (or contract for) appropriate representatives to participate on the Commissioning Team – both from within and external to their organization. Commissioning Team responsibilities should be consistent with the agreements between parties involved in the project – and such agreements must clearly address Commissioning Process responsibilities.

5.2.1.3 Essential team members during the Pre-Design Phase include Owner's representatives, the Commissioning Authority, pre-design and programming professionals, design professionals, and (if known) the construction/program/ project managers. The Commissioning Authority can assist the Owner in identifying and selecting these initial Commissioning Team members. Owner's representatives will include the project manager, occupants or users, facility manager, and operation and maintenance personnel. Including operation and maintenance personnel on the Commissioning Team will help ensure that important operation and maintenance issues are included in the Owner's Project Requirements. The Owner will generally need to reconcile conflicting project requirements and provide feedback on decisions to the Commissioning Team. The design team members and Commissioning Authority can assist the Owner in reconciling conflicting technical requirements.

5.2.1.4 The Commissioning Team will evolve as a project progresses. During successive phases, the active membership of the Commissioning Team may shift to meet the unique requirements of each phase. Contractors and vendors, for example, may join the Commissioning Team after they are under contract or after the start of construction.

5.2.1.5 Pre-Design Phase Commissioning Process activities described in this section to be performed by the design team must be included in the scope of services described in the "Owner - Design Professional Service Agreement." These Commissioning Process activities may be more than are normally required in their scope of services. The scope of services in the "Owner - Design Professional Service Agreement" should also include the requirement to cooperate with the

Commissioning Authority during Pre-Design, Design, and Construction phases of the project. This may include testing soils, surveying, or other requirements during Pre-Design.

5.2.1.6 Responsibilities of the Commissioning Team during the Pre-Design Phase include the following:

- (a) Assist Owner in preparing requests for project services that outline the roles and responsibilities developed in the Commissioning Plan.
- (b) Facilitate development and documentation of the Owner's Project Requirements.
- (c) Develop scope and format for project Systems Manual and select/designate entity responsible for developing this manual. Add this entity to the Commissioning Team where appropriate.
- (d) Develop scope and budget for project-specific Commissioning Process activities.
- (e) Verify that Commissioning Process activities are clearly stated in all project scopes of work.
- (f) Integrate the Commissioning Process activities into the project schedule.
- (g) Build and maintain cohesiveness and cooperation among the project team.
- (h) Coordinate Owner's representative's participation as defined in Section 5.2.1.2.
- (i) Conduct and document Commissioning Team meetings.
- (j) Identify who will accomplish the Commissioning Process activities.
- (k) Review Pre-Design Phase documents for compliance with the Owner's Project Requirements.
- (l) Write the initial Commissioning Plan.
- (m) Develop the initial format to be used for Issues Logs throughout, and for each phase of, the Commissioning Process.
- (n) Track and document issues and deviations relating to the Owner's Project Requirements and document resolutions in the Issues Log.
- (o) Write and review Commissioning Process Progress Reports.

5.2.2 Develop Owner's Project Requirements

5.2.2.1 The Owner's Project Requirements form the basis from which all design, construction, acceptance, and operational decisions are made. An effective Commissioning Process depends upon a clear, concise, and comprehensive Owner's Project Requirements document. It includes information to help the project team to properly plan, design, construct, operate, and maintain systems and assemblies.

5.2.2.2 The Commissioning Authority facilitates the development of the Owner's Project Requirements. Input will be gathered from all team members.

5.2.2.3 Each item of the Owner's Project Requirements shall have defined performance and acceptance criteria. Those that can be benchmarked should have the benchmark

defined in specific terms and the means of measurement defined.

5.2.2.4 The Owner's Project Requirements should include the following:

- (a) Project schedule and budget.
- (b) Commissioning Process scope and budget.
- (c) Project documentation requirements, including format for submittals, training materials, reports, and the Systems Manual. Consideration should be given to use of electronic format documents and records where appropriate.
- (d) Owner directives.
- (e) Restrictions and limitations.
- (f) User requirements.
- (g) Occupancy requirements and schedules.
- (h) Training requirements for Owner's personnel.
- (i) Warranty requirements.
- (j) Benchmarking requirements.
- (k) Operation and maintenance criteria for the facility that reflect the Owner's expectations and capabilities and the realities of the facility type.
- (l) Equipment and system maintainability expectations, including limitations of operating and maintenance personnel.
- (m) Quality requirements for materials and construction.
- (n) Allowable tolerance in facility system operations.
- (o) Energy efficiency goals.
- (p) Environmental and sustainability goals.
- (q) Community requirements.
- (r) Adaptability for future facility changes and expansion.
- (s) Systems integration requirements, especially across disciplines.
- (t) Health, hygiene, and indoor environment requirements.
- (u) Acoustical requirements.
- (v) Vibration requirements.
- (w) Seismic requirements.
- (x) Accessibility requirements.
- (y) Security requirements.
- (z) Aesthetics requirements.
- (aa) Constructability requirements.
- (ab) Communication requirements.
- (ac) Applicable codes and standards.

(See Table J-1 in Annex J for an example matrix that can assist in the development of Owner's Project Requirements.)

5.2.2.5 Obtaining the information and criteria for the Owner's Project Requirements document requires input from all key facility users and operators. The method used to obtain the information should allow the different user groups and operators to interact. Nominal Group Technique workshops, interviews, and surveys can be used to obtain this input, with decreasing levels of interaction attained, respectively, for each type. See Annex I for additional guidance.

5.2.2.6 The Owner's Project Requirements become part of the Systems Manual documentation.

5.2.2.7 The Owner's Project Requirements is a document that evolves through each project phase. As decisions are made during the Design, Construction, and Occupancy and Operations Phases, this document will be updated to reflect the current project requirements of the Owner. It is the primary tool for benchmarking success and quality at all phases of the project delivery and throughout the life of the facility.

5.2.2.8 Make reference to the Owner's Project Requirements in the bidding documents as "information available to bidders." It must be noted in the contract documents that the Owner's Project Requirements are issued for information only and that this document shall not define, nor shall it be used to interpret, the requirements of the contract.

5.2.2.9 Use quality-based sampling for verification of each activity or task to determine how well it meets or relates to the Owner's Project Requirements in the Pre-Design Phase. This includes programming documents, defined scope-of-design services, special reports and workshop outcomes, and other activities in the Pre-Design Phase.

5.2.3 Identify the scope and budget for the Commissioning Process

5.2.3.1 The scope of the Commissioning Process will vary from one project to another. The Commissioning Team develops the scope for the Commissioning Process. The experiences of the programming team, users, designers, Commissioning Authority, and the Owner with similar and previous facilities and projects can aid in establishing a scope for the Commissioning Process. Additional insight regarding the scope of the Commissioning Process can be obtained from code officials, regulations, published information on similar facilities, and information in the Technical Commissioning Process Guidelines.

5.2.3.2 A well-defined scope permits the establishment of an appropriate budget allocation for the Commissioning Process. The Commissioning Process budget should be realistic, distributed by phase, activity, and entity (Owner, Commissioning Authority, design professional, and contractors), and not subject to reduction without an express change in the Commissioning Plan. Lack of a properly defined and maintained Commissioning Process budget will adversely affect the Commissioning Process and the success of the facility in meeting the Owner's Project Requirements.

5.2.3.3 Typically the Owner will focus the Commissioning Process efforts on selected systems or assemblies based upon the budget, systems or assemblies where the Owner has experienced previous problems, upon complex systems and assemblies, or upon the criticality of the system or assembly in providing for the Owner's Project Requirements. The Commissioning Process can focus upon:

- (a) Substructure: includes basement and foundations.
- (b) Shell: includes superstructure, roof, walls, fenestration, and exterior doors.
- (c) Interiors: includes interior construction, wall, floor, and ceiling finishes, partitions, interior doors, stairways,

hardware, and fitting specialties.

- (d) Services: includes controls, HVAC&R systems, electrical systems, fire and life safety systems and assemblies, security systems, communication systems, plumbing systems, conveying systems, and specialty or technology systems.
- (e) Equipment and furnishings.
- (f) Sitework.
- (g) Landscaping.

5.2.4 Develop the Commissioning Plan

5.2.4.1 The Commissioning Plan identifies processes and procedures necessary for a successful Commissioning Process. The Commissioning Plan addresses the Owner's Project Requirements and reflects the defined scope and budget for the Commissioning Process.

5.2.4.2 The Commissioning Plan includes a schedule of Commissioning Process activities, individual responsibilities, documentation requirements, communication and reporting protocols, and evaluation procedures. Evaluation procedures include the review and verification to the Owner's Project Requirements of the design documents, contract documents, construction and test procedures.

5.2.4.3 The Commissioning Plan is continually updated during the life of a project to reflect changes in planning, design, construction, and occupancy and operations. During the Pre-Design Phase, the Commissioning Plan focuses upon the scope of the Commissioning Process during the Design Phase. The Construction Phase and Occupancy and Operations Phases are included, but details are usually added during the Design Phase for the Construction and Occupancy and Operations Phases—see Sections 6.2.3 and 7.2.5.

5.2.4.4 The Commissioning Plan contains the following information:

- (a) Overview of the Commissioning Process developed specifically for the project.
- (b) Roles and responsibilities for the Commissioning Team throughout the project and specifically during the Pre-Design and Design Phases. The roles shall differentiate the areas with which each of the members is involved, and the responsibilities shall detail the specific tasks that are to be completed by the individual members.
- (c) Documentation of general communication channels to be used throughout the project. Design Phase procedures should be clearly documented during the Pre-Design Phase.
- (d) Detailed description of Commissioning Process activities and a schedule of activities during the Pre-Design and Design Phases. The milestones should include the Commissioning Team meetings, Owner's Project Requirements development, design review periods, and the completion of the Basis of Design and the commissioning specifications.
- (e) General description of Commissioning Process activities that will occur during the Construction and Occupancy and Operations Phases.
- (f) Guidelines and format that will be used to develop the

Commissioning Process documentation that facilitates communication among the Commissioning Team and all other parties involved in the project.

- (g) Commissioning Process forms that will be used during the Pre-Design and Design Phases to communicate and track critical Commissioning Process information.
- (h) Project design document verification procedures.
- (i) The framework for procedures to follow whenever Commissioning Process verification does not meet the Owner's Project Requirements.
- Quality-based sampling procedures for verification of achieving the Owner's Project Requirements during all project phases.

5.2.4.5 If properly developed, the Commissioning Plan forms the core of the Final Commissioning Process Report.

5.2.5 Establish Issues Log Procedures

5.2.5.1 An Issues Log contains detailed descriptions of design, installation, or performance issues that are at variance with the Owner's Project Requirements. Issues are identified and tracked as they are encountered during the design, construction, and operation of a facility. It is recommended that an Issues Log be maintained with the status of all current and resolved issues. The information outlined in 5.2.5.2 and 5.2.5.3 should be documented in the Issues Log as a minimum.

5.2.5.2 Information to be documented at the time an issue is identified includes:

- (a) Unique numeric or alphanumeric identifier by which the issue may be tracked.
- (b) Short, descriptive title of the issue.
- (c) Date and time of the identification of the issue.
- (d) Test number of the test being performed at the time of the observation, if applicable, for cross-reference.
- (e) Identification of system, equipment, or assembly to which the issue applies.
- (f) Location of the issue.
- (g) Description of the observed design, installation, or performance issue, including any information that may be helpful in diagnosing or evaluating the issue.
- (h) Recommended corrective action, if apparent.
- (i) Identification of the Commissioning Team member responsible for resolution of the issue, if apparent.
- (j) Expected date of correction.
- (k) Name of the person documenting the issue.

5.2.5.3 Information to be documented when an issue is resolved:

- (a) Date of completion of resolution.
- (b) Description of corrective action taken. Include description of diagnostic steps taken to determine the root cause of the issue and the value of resolving the Commissioning Process issue for the owner, design team, contractor, or occupant.
- (c) Identification of changes to the Owner's Project Requirements or Basis of Design that require action (if any).

- (d) Statement that the correction was completed and the system or assembly is ready for retest, if applicable.
- (e) Name of the person who resolved the issue.
- (f) Name of person documenting the issue resolution.

5.2.6 Prepare Issues Report

5.2.6.1 On a periodic basis, at least for each Commissioning Team meeting, a report shall be generated for review of outstanding issues. The following information should be included:

- (a) Issue number.
- (b) Short, descriptive title of the issue.
- (c) Date of the identification of the issue.
- (d) Name of the Commissioning Team member assigned responsibility for resolution.
- (e) Expected date of correction.

5.2.7 Prepare Commissioning Process Progress Reports

5.2.7.1 Commissioning Process Progress Reports are periodic reports of the status of Commissioning Process activities throughout the project and become part of the Commissioning Process Report. Commissioning Process Progress Reports should cover the following information:

- (a) Commissioning Process activities completed since the last report, including the current status of Pre-Design project activities.
- (b) Description of changes to the Commissioning Process schedule (e.g., early completion of or delays in work and early or late delivery of items that impact the Commissioning Process activities), Commissioning Plan, and design, along with their effect on the Owner's Project Requirements and Basis of Design.
- (c) Include new and outstanding issues and list those that have been resolved since the last Progress Report, including a brief description of actions taken to resolve the issues. Also include planned activities to resolve outstanding issues expeditiously.
- (d) Commissioning Process activities anticipated during the period before the next Progress Report.

5.2.7.2 The frequency of Commissioning Process Progress Reports depends upon the amount of work being accomplished and could vary from every two weeks to every six months. A general guide to follow is one progress report for every four Commissioning Team meetings.

5.3 Pre-Design Phase Acceptance Requirements

5.3.1 During the Pre-Design Phase the Commissioning Process should include the formal acceptance by the Owner of the Owner's Project Requirements and the Commissioning Plan.

5.4 Pre-Design Phase Documentation

5.4.1 The Commissioning Process scope and budget, Owner's Project Requirements, the Commissioning Plan, Issues Log and reports, and Commissioning Process Progress Reports are the primary documentation requirements for the Pre-Design Phase Commissioning Process. **5.4.2** The information in the Owner's Project Requirements and the Commissioning Plan is used throughout subsequent project phases (including Occupancy and Operations).

5.5 Pre-Design Phase Training Identification Requirements

5.5.1 Training requirements for facility, system, and assembly operation and maintenance are addressed in the Owner's Project Requirements.

6. DESIGN PHASE

6.1 Introduction

6.1.1 During the Design Phase of the project delivery process, the Owner's Project Requirements are translated into construction documents. A document called the Basis of Design is created that clearly conveys the assumptions made in developing a design solution that fulfills the intent and criteria in the Owner's Project Requirements document. Narrative descriptions of facility systems and assemblies are developed and included in the Basis of Design, and the Commissioning Plan is expanded to include the details of Construction and Occupancy and Operations Phase activities.

6.1.2 Design Phase Commissioning Process objectives include the following:

- (a) Verifying the Basis of Design document with the Owner's Project Requirements document.
- (b) Updating the Commissioning Plan to include Construction and Occupancy and Operations Phase Commissioning Process activities.
- (c) Developing Commissioning Process requirements for inclusion in the Construction Documents.
- (d) Developing draft Construction Checklists.
- (e) Updating the scope and format of the project Systems Manual.
- (f) Defining training requirements.
- (g) Performing commissioning-focused design review.
- (h) Acceptance of Design Phase Commissioning Process activities.

6.1.3 Design Phase Commissioning Process activities described in this section that are to be performed by the design team and special consultants must be included in the scope of services described in the "Owner - Design Professional Service Agreement." These Commissioning Process activities may be more than are normally required in their scope of services. The scope of services in the "Owner - Design Professional Service Agreement" should also include the requirement to cooperate with the Commissioning Authority during Pre-Design, Design, and Construction phases of the project. This may include testing soils, evaluating or checking existing conditions, surveying, or other requirements during Design.

6.1.4 Use quality-based sampling for verification of each activity or task determined to be related to the Owner's Project Requirements in the Design Phase.

6.1.5 If the Commissioning Process on a particular project starts at the Design Phase, then the Commissioning Process

activities described for the Pre-Design Phase must be completed before the following Design Phase activities are begun.

6.2 Design-Phase Commissioning Process Activities

6.2.1 Design-Phase Commissioning Process Responsibilities

6.2.1.1 During the Design Phase, the Commissioning Team works to verify that the Construction Documents meet and properly convey the Owner's Project Requirements.

6.2.1.2 Essential team members during the Design Phase include the Owner's representatives, the Commissioning Authority, design professionals, and construction/program/project managers (if known).

6.2.1.3 Responsibilities of the Commissioning Team during the Design Phase include the following:

- (a) Build and maintain cohesiveness and cooperation among the project team.
- (b) Assist Owner in preparing requests for project services that outline the Commissioning Process roles and responsibilities developed in the Commissioning Plan.
- (c) Verify that Commissioning Process activities are clearly stated in all project scopes of work.
- (d) Develop the scope and budget for project-specific Commissioning Process activities.
- (e) Identify specialists who will be responsible for accomplishing the Commissioning Process activities for specific systems and assemblies.
- (f) Conduct and document Commissioning Team meetings.
- (g) Inform all Commissioning Team members of decisions that result in modifications to the Owner's Project Requirements.
- (h) Integrate the Commissioning Process activities into the project schedule.
- Track and document issues and deviations relating to the Owner's Project Requirements and document resolutions in the Issues Log.
- (j) Verify documentation and updating of the Basis of Design.
- (k) Develop Construction Checklists.
- (1) Develop Construction and Occupancy and Operations Phase test requirements.
- (m) Develop training program requirements.
- (n) Document Commissioning Process requirements and integrate them into the contract documents.
- (o) Update the Commissioning Plan.
- (p) Review Design Phase documents for compliance with the Owner's Project Requirements.
- (q) Update the Owner's Project Requirements.
- (r) Write and review Commissioning Process Progress Reports.

6.2.2 Basis of Design Documentation

6.2.2.1 The Basis of Design, developed and updated throughout the Design Phase, is required with each design submission and should include the following:

(a) System and assembly options.

- (b) System and assembly selection reasoning.
- (c) Facility, system, and assembly performance assumptions:
 - (i) Assumptions for calculations/sizing.
 - (ii) Analytical procedures and tools.
 - (iii) Environmental conditions.
 - (iv) Limiting conditions.
 - (v) Reference make and model.
 - (vi) Operational assumptions.
- (d) Narrative system and assembly descriptions.
- (e) Codes, standards, guidelines, regulations, and other references.
- (f) Owner guidelines and directives.
- (g) Specific descriptions of systems and assemblies.
- (h) Consultant, engineering, and architectural guidelines for design developed by the design team or others.

6.2.2.2 The Basis of Design documents how each criterion in the Owner's Project Requirements is implemented in the design. For any criterion that could not be met, documentation detailing what was done, its impact on the Owner's Project Requirements, and how the Owner's Project Requirements was modified shall be included.

6.2.3 Update Commissioning Plan

6.2.3.1 The Commissioning Plan must be updated to reflect changes in the Owner's Project Requirements and include additional information developed during the Design Phase.

6.2.3.2 During the Design Phase, the following is added to or updated in the Commissioning Plan:

- (a) Systems and assemblies to be verified and tested.
- (b) Schedule of Construction Phase and Occupancy and Operations Phase Commissioning Process activities.
- (c) Roles and responsibilities of new Commissioning Team members.
- (d) Construction Phase and Occupancy and Operations Phase documentation and reporting requirements, including procedures and formats.
- (e) Construction Phase and Occupancy and Operations Phase communication protocols.
- (f) Construction Phase and Occupancy and Operations Phase Commissioning Process procedures.

6.2.3.3 The milestones to be incorporated in the schedule should include the pre-bid meeting, pre-construction meeting, Commissioning Team meetings, training sessions, shop drawing submittals, Systems Manual submittal, special tests or code official inspection and acceptance, tests, test periods, substantial completion, occupancy, seasonal testing, initial Commissioning Process Report submittal, warranty review two months prior to end of warranty period, lessons-learned meeting, and final Commissioning Process Report.

6.2.3.4 The Construction Phase and Occupancy and Operations Phase roles and responsibilities of the individual members of the Commissioning Team, including any new members, should be clearly defined based upon the unique experience and knowledge of the team members. Professional

and services agreements must be modified to reflect the scope of work.

6.2.3.5 The Commissioning Plan must define the documentation that will be required as part of the Commissioning Process during the Construction Phase and Occupancy and Operations Phase. This includes the specific formats to be used (electronic/paper, software program and version), the information to be included, the frequency of submittal, and the distribution.

6.2.3.6 The communication protocols to be used during the Construction Phase and Occupancy and Operations Phase shall be clearly defined in the Commissioning Plan. This includes how the flow of information among the team members will be coordinated and distributed.

6.2.3.7 The Commissioning Process procedures to be implemented during the Construction Phase and Occupancy and Operations Phase must be clearly documented in the Commissioning Plan. These include:

- (a) Review of submittals.
- (b) Scheduling and holding of meetings.
- (c) Site visit procedures.
- (d) Issues identification, documentation, tracking, and resolution.
- (e) Construction Phase test preparation, implementation, and follow-up.
- (f) The responsibilities of each member of the Commissioning Team.
- (g) Who is responsible for costs related to verification and testing—including re-testing or verification activities.
- (h) Systems Manual development and review.
- (i) Training program.
- (j) Occupancy and Operations Phase test preparation, implementation, and follow-up.

6.2.3.8 The test procedure requirements developed during the Design Phase are general in nature, structure, and complexity but must clearly convey the level and amount of testing (see Section 7.2.9) required by manufacturers and contractors.

6.2.4 Commissioning Process Requirements in the Construction Documents

6.2.4.1 The Commissioning Process requires that certain quality-assurance and quality-control procedures, envisioned in the Commissioning Plan, be performed as part of the construction contract.

6.2.4.2 The Owner's Project Requirements should be included in the Contract Documents and labeled as for "Informational Purposes Only" to differentiate it from the contractor's contractual obligations. In addition, as much Basis of Design information should be included in the Contract Documents as possible. This information is included in the Contract Documents to aid the contractors in understanding the design, material requirements, sustainability and energy goals, and the desired use and intent of the facility. Such information aids in the successful implementation of the Commissioning Process but does not relate directly to the contract requirements.

6.2.4.3 Specific Commissioning Process requirements are included in the contract specifications. For this guideline, specification division numbers and section titles consistent with the Construction Specifications Institute MasterFormat® are used. This is done to simplify a lengthy list of specification requirements. Commissioning Process activities that address systems and assemblies need to be included in Division 1 sections and those that address equipment and components need to be included in Divisions 2 through 16.

- (a) The obligations to perform Commissioning Process activities must be documented in the contract between the Owner and Contractor.
- (b) Detailed scope and responsibilities of the Contractor shall be included in the "Summary of Work" section in Division 1.
- (c) The Commissioning Process requirements for documentation, training, and testing facility systems and assemblies are integrated into commissioning sections in Division 1.
- (d) Specific equipment and component performance documentation requirements and use of Construction Checklists should be integrated into specification sections in Divisions 2 through 16, with appropriate cross-references.

6.2.4.4 The Commissioning Process activities to be integrated include:

- (a) Performance, installation, and operations information requirements as part of shop drawing submittals in Divisions 2 through 16 sections.
- (b) Completion of Construction Checklists in Division 1 and references to Division 1 in Divisions 2 through 16 sections.
- (c) Contractor involvement in the Commissioning Team in Division 1.
- (d) Test requirements in Division 1.
- (e) Training program development and implementation requirements in Division 1.
- (f) Systems Manual requirements in Division 1.

6.2.4.5 A guide specification section template for general Commissioning Process requirements in Division 1 is included in Annex L.

6.2.5 Construction Checklists

6.2.5.1 Construction Checklists aid the installers by providing specific information on the Owner's Project Requirements for equipment and assemblies for long-term operation. Checklists typically include:

- (a) Equipment/assembly verification.
- (b) Pre-installation checks.
- (c) Installation checks.
- (d) Any negative responses.

6.2.5.2 The first section of the Checklist is equipment/ assembly verification. This section should include vital information on the equipment or materials being supplied (specific listings of vital information are included in the technical guidelines developed for various facility systems). This section contains information on what equipment/material was specified/submitted and space to document/verify what was actually delivered to the site.

6.2.5.3 The pre-installation section of the Checklist is utilized to verify the condition of the equipment/material at the site immediately prior to its installation.

6.2.5.4 The installation section of the Checklist is utilized to verify proper installation. This section focuses on the ability of the installation to meet the Construction Documents and the Owner's Project Requirements. For equipment, this section focuses on the physical installation and its start-up when applicable. For assemblies, the focus is typically on installation and performance.

6.2.5.5 The negative responses section is a space provided to document the reason for any negative responses and whether any action has been taken to correct the problem or problems that led to the negative responses.

6.2.5.6 Whenever a test data form is required for a specific system or assembly, there should be an item in the associated Construction Checklist for the test data form to be submitted to the Commissioning Authority.

6.2.5.7 Construction Checklists should be kept as short as possible and the questions should be worded clearly so that the correct answer is typically yes.

6.2.5.8 Construction Checklists are used by the Commissioning Team to verify that the installation meets the Owner's Project Requirements. They can also be used by the contractors to track progress of construction against the schedule of values.

6.2.5.9 Annex M contains sample formats for Construction Checklists.

6.2.6 Systems Manual

6.2.6.1 The Systems Manual should provide the information needed to understand, operate, and maintain the systems and assemblies and to inform those not involved in the design and construction process about the systems and assemblies. The Systems Manual should be the repository of information on updates and corrections to systems and assemblies as they occur during the Occupancy and Operations Phase.

6.2.6.2 The Systems Manual expands the scope of the traditional operating and maintenance documentation to include the additional information gathered during the Commissioning Process and to provide a systems-based organization of information.

6.2.6.3 Contractor documentation requirements for the Systems Manual shall be clearly stated in the Construction Documents.

6.2.6.4 The following should be included in the Systems Manual (see Annex O for an example format):

- (a) Index of Systems Manual with notation as to content storage location if not in actual manual.
- (b) Executive Summary.
- (c) Owner's Project Requirements.
- (d) Basis of Design documents.
- (e) Construction Record Documents, specifications, and approved submittals.
- (f) A list of recommended operational record-keeping pro-

cedures, including sample forms, logs, or other means, and a rationale for each.

- (g) Ongoing optimization guidance.
- (h) Operations and maintenance manuals (includes operating procedures for all normal, abnormal, and emergency modes of operation; maintenance procedures; parts and recommended spare parts list; troubleshooting guide; and systems schematics (one-line diagrams).
- (i) Training materials.
- (j) Commissioning Process Report.

6.2.7 Training Requirements

6.2.7.1 During the Design Phase, the training requirements of the operations and maintenance personnel and occupants are identified relative to the systems and assemblies to be installed in the facility. It is critical that the operations and maintenance personnel have the knowledge and skills required to operate the facility to meet the Owner's Project Requirements. The occupants need to understand their impact on the use of the facility and its ability to meet the Owner's Project Requirements.

6.2.7.2 These training requirements can be obtained using a Nominal Group Technique workshop, interviews, or surveys. The requirements are obtained after the systems and assemblies have been decided upon, and prior to issuance of the Construction Documents, to ensure that the requirements for training are clearly conveyed in the Construction Documents. The results of the workshop, interviews, or surveys should address the following:

- (a) The systems, subsystems, equipment, and assemblies for which training will be required.
- (b) The capabilities and knowledge of the occupants and operations and maintenance personnel.
- (c) The number and type of training sessions. The training program should be organized into a series of instructional modules, each covering a portion of the facility's systems, equipment, and assemblies.
- (d) Measurable learning objectives and teaching outlines should be developed to clearly describe the specific skills and knowledge that the participant is expected to master.

6.2.7.3 The first training session should be general in nature for the operations and maintenance personnel and the occupants, and it should review the Owner's Project Requirements and the Basis of Design. This provides the background on why the facility is being constructed and its limitations.

6.2.7.4 The majority of training should be planned to be accomplished during the Construction Phase and prior to substantial completion.

6.2.7.5 Training during the Occupancy and Operations Phase may be required for certain systems and assemblies to achieve or maintain the Owner's Project Requirements.

6.2.7.6 The Systems Manual has a close functional relationship with personnel training. A meaningful and useful training program typically includes using the operation and maintenance components of the Systems Manual as the basis of development.

6.2.7.7 Review of documentation during training consists of reviewing the content of emergency, operation, and maintenance information in the Systems Manual, project Record Documents, system and equipment identification systems, warranties, and maintenance service agreements contained in the Systems Manual. Training should specifically address:

- (a) Emergency instructions and procedures: those required for operating the facility during various emergencies, including step-by-step instructions for each type of emergency.
- (b) Operation instructions and procedures: the procedures required for normal operation of the facility, including step-by-step instructions for day-to-day operation.
- (c) Adjustment instructions: information for maintaining operational parameters.
- (d) Troubleshooting procedures: instructions for diagnosing operating problems and procedures for testing and inspecting.
- (e) Maintenance and inspection procedures.
- (f) Repair procedures: instructions for diagnosing problems and for disassembly, component removal, replacement, and reassembly.
- (g) Upkeep of the Systems Manual and associated maintenance documentation and logs.

6.2.7.8 In the specifications, as a minimum, define the time requirements for each type of system/assembly that requires demonstration and training or include an allowance for demonstration and training capabilities. Also include the expected experience and knowledge of trainer, the number of unique training sessions, the need for repeating the training for multiple shifts, and submittal of Training Plan, handouts, record of the training, and electronic recording of on-site training.

6.2.7.9 Training materials should include or utilize the following items:

- (a) Copy of the Training Plan including schedule, syllabus, and agenda.
- (b) Systems Manual.
- (c) Manufacturers' training manuals.
- (d) Electronic media or videotapes of manufacturers' or vendors' training and service materials.

6.2.8 Review of Design Professional Submittals

6.2.8.1 Complete targeted design reviews at strategic times during the Design Phase. All design issues should be resolved prior to continuing with design.

6.2.8.2 A targeted design review is composed of four tasks:

- (a) General quality review of the documents, including legibility, consistency, and level of completeness.
- (b) Coordination between disciplines.
- (c) Discipline-specific review for achieving the Owner's Project Requirements.
- (d) Specification applicability and consistency with Owner's Project Requirements and Basis of Design.

6.2.8.3 The general quality of the documents is evaluated by checking for consistent layout and legibility of the Design Professional Submittal and Construction Documents. Compliance with the Owner's Project Requirements along with ease of use and clarity are the major issues to check when looking at the complete package. This review looks for completeness of the drawings and for items of concern identified during previous reviews.

6.2.8.4 Sample areas of the facility, 10-20% of the total area, are reviewed in detail to evaluate the coordination accomplished within and among disciplines. This includes reviewing for constructability and interfaces among disciplines. The intent of this review is to determine if there are systematic errors, not to fully check the drawings. The responsibility for complete checking of the drawings for coordination and accuracy remains with the Design Team.

6.2.8.5 A discipline-specific review involves a review of the Construction Documents along with the Basis of Design, design calculation assumptions, and methods for compliance with the Owner's Project Requirements. A sampling strategy of focusing upon 10-20% of the drawings provides for an in-depth analysis and evaluation of the ability of the documents to meet the Owner's Project Requirements.

6.2.8.6 A review of the specifications is performed to determine completeness and applicability to the project. A review of 10-20% of the specification is performed in detail for verification of compliance with the Owner's Project Requirements. Items checked include applicability of the section to the project, Commissioning Process requirements, submittal requirements, applicability of equipment, training requirements, and coordination with other sections.

6.2.8.7 See Annex N for additional guidance on how to accomplish quality-based design reviews.

6.3 Design Phase Acceptance Requirements

6.3.1 The Commissioning Process should include the formal acceptance by the Owner of the Basis of Design and the updated Owner's Project Requirements during the Design Phase, following review and comment by the Commissioning Authority.

6.4 Design Phase Documentation Requirements

6.4.1 Construction Document commissioning requirements, updated Owner's Project Requirements, updated Commissioning Plan, the updated Issues Log, and the Commissioning Process Progress Reports are the primary documentation requirements for the Design Phase Commissioning Process.

6.4.2 The information in these deliverables is used throughout subsequent project phases (including Occupancy and Operations).

6.5 Design Phase Training Identification Requirements

6.5.1 Training requirements for facility, system, and assembly operation and maintenance are addressed during the Design Phase by the completion of a training requirements identification workshop, development of the Construction Phase and Occupancy and Operations Phase training pro-

gram, and inclusion of the training program requirements in the Commissioning Plan and Construction Documents.

7. CONSTRUCTION PHASE

7.1 Introduction

7.1.1 During the Construction Phase of the project delivery process, systems and assemblies are installed, inspected, tested, and placed into service to meet the Owner's Project Requirements. This phase may also include bidding, negotiation, and contracting activities. The Systems Manual is delivered during this phase and training is provided.

7.1.2 Construction Phase Commissioning Process objectives include the following:

- (a) Updating the Owner's Project Requirements.
- (b) Updating the Commissioning Plan.
- (c) Verifying that submittals meet the Owner's Project Requirements.
- (d) Developing detailed test procedures and data forms.
- (e) Verifying that systems and assemblies comply with the Owner's Project Requirements.
- (f) Delivering the Systems Manual.
- (g) Verifying training of the Owner's operation and maintenance personnel and occupants.
- (h) Acceptance of Construction Phase Commissioning Process activities.

7.1.3 Construction Phase Commissioning Process activities described in this section that are to be performed by the design team and special consultants must be included in the scope of services described in the "Owner – Design Professional Service Agreement." These Commissioning Process activities may be more than are normally required in their scope of services. The scope of services in the "Owner – Design Professional Service Agreement" should also include the requirement to cooperate with the Commissioning Authority during Pre-Design, Design, and Construction phases of the project. This may include material testing, TAB, performance tests, records, photography, outside training, Owner's furnished equipment vendors, and other requirements during the Construction Phase.

7.1.4 If the Commissioning Process on a particular project starts at the Construction Phase, Commissioning Process activities described for the Pre-Design and Design Phases must be completed before the following Construction Phase activities are begun.

7.2 Construction Phase Commissioning Process Activities

7.2.1 Construction Phase Commissioning Process Responsibilities

7.2.1.1 During the Construction Phase, the Commissioning Team works to verify that systems and assemblies are installed in a manner that will achieve the Owner's Project Requirements.

7.2.1.2 Use quality-based sampling for verification of each task and test determined to be related to the Owner's Project Requirements during the Construction Phase.

7.2.1.3 Conduct and document regularly scheduled Commissioning Team meetings to facilitate coordination and cooperation in delivering a facility that meets the Owner's Project Requirements.

7.2.1.4 Essential team members during the Construction Phase include Owner's representatives, the Commissioning Authority, design professionals, contractors, suppliers/vendors, and construction/program/project managers.

7.2.1.5 Responsibilities of the Commissioning Team during the Construction Phase include the following:

- (a) Participate in the pre-bid conference.
- (b) Coordinate participation of Owner's representatives.
- (c) Identify specialists who will be responsible for accomplishing the Commissioning Process activities for specific systems and assemblies.
- (d) Update the Owner's Project Requirements to reflect decisions made during bidding and construction.
- (e) Update the Commissioning Plan.
- (f) Conduct a pre-construction Commissioning Process meeting.
- (g) Review the following submittals for compliance with the Owner's Project Requirements: coordination drawings, shop drawings, product data, preliminary Systems Manual, and training program.
- (h) Schedule the Commissioning Process activities and integrate them into the project construction schedule.
- (i) Address schedule changes.
- (j) Develop and document test procedures and data forms.
- (k) Conduct and document ongoing Commissioning Team meetings.
- (1) Monitor compliance with the Owner's Project Requirements through periodic site visits.
- (m) Verify completion of items indicated in the Construction Checklists.
- (n) Witness tests.
- (o) Verify tests.
- (p) Verify test data reports.
- (q) Verify training of operation and maintenance personnel and occupants according to the Owner's Project Requirements.
- (r) Identify, diagnose, and track issues and deviations relating to the Owner's Project Requirements and document resolution of same.
- (s) Write and review Commissioning Process Progress Reports.
- (t) Review construction progress reports.
- (u) Verify incorporation of new equipment and systems into the maintenance management program.
- (v) Verify updates to the Basis of Design documentation.
- (w) Verify updates to the Systems Manual.
- (x) All Commissioning Team members are responsible for keeping the Commissioning Team informed of decisions that result in modifications to the Owner's Project Requirements.

(y) Review contract modifications for compliance with Owner's Project Requirements.

7.2.2 Pre-bid Conference

7.2.2.1 Time should be allotted during the pre-bid conference for the Commissioning Team to alert bidders to Commissioning Process requirements with which they may not be familiar.

7.2.3 Coordinate Owner's Representatives Participation

7.2.3.1 Coordinate and schedule participation of Owner's representatives in Commissioning Process activities. Owner representatives may vary from one activity to another, both in number and in the specific individuals. It is important for Owner's representatives to participate in Commissioning Team meetings, review of commissioning process reports, discussions of changes to the Owner's Project Requirements, and staff and occupant training. Other Commissioning Process activities in which Owner's representatives typically participate include reviewing submittals and witnessing testing.

7.2.4 Update Owner's Project Requirements

7.2.4.1 Changes to the Owner's Project Requirements during bidding and the Construction Phase may be initiated as the result of Owner-directed changes to the Owner's Project Requirements or design/construction process-initiated changes to the Construction Documents.

7.2.4.2 When the Owner initiates a change to the Owner's Project Requirements, the design shall be modified and reviewed as necessary to meet the change in the Owner's Project Requirements.

7.2.4.3 When the Owner considers changes initiated through the design/construction process, the Commissioning Team should review the proposed changes to determine if they compromise the Owner's Project Requirements, paying special attention to the functional impacts of value management proposals. If the Owner chooses to initiate a change after reviewing the Commissioning Team's comments, the Owner's Project Requirements must be updated as necessary to match the change.

7.2.5 Update the Commissioning Plan

7.2.5.1 Update the Commissioning Plan to include new or revised descriptions of Commissioning Process activities during the Construction Phase. Incorporate the following:

- (a) Test procedures and data forms developed during the Construction Phase.
- (b) Refinement and integration of Commissioning Process activities in the construction schedule.
- (c) Roles and responsibilities of the Commissioning Team during the Construction Phase, including the identification of new team members.
- (d) Identification of specialists responsible for accomplishing Commissioning Process activities for specific systems and assemblies.
- (e) Changes to the communication channels and procedures to be used during the Construction Phase.

7.2.6 Conduct Pre-Construction Commissioning Process Meeting

7.2.6.1 Early in the Construction Phase, the Commissioning Authority shall conduct a pre-construction Commissioning Process meeting with the Commissioning Team.

7.2.6.2 During the pre-construction meeting, the Owner's Project Requirements, Basis of Design, and unique contract document requirements are reviewed. In addition, the specific roles and responsibilities of the contractors relative to the Commissioning Process activities are reviewed.

7.2.7 Verify Submittals

7.2.7.1 It is recommended that a sampling strategy of randomly selecting 5% to 10% of the submittal be used to focus upon the quality and ability of the submittal to achieve the Owner's Project Requirements. If deviations are substantial, then review an additional 5% to 10%. If substantial deviations still exist, then reject the submittal and return it with comments.

7.2.7.2 Concurrent with Design Team and Owner review, a designated Commissioning Team member reviews coordination drawings, shop drawings, and project submittals for compliance with the Owner's Project Requirements. Special attention must be paid to substitutions and proposed deviations from the Contract Documents and the Basis of Design that could adversely impact the Owner's Project Requirements.

7.2.7.3 Upon receipt, designated members of the Commissioning Team shall review the Systems Manual for compliance with the Contract Documents and the Owner's Project Requirements.

7.2.7.4 Review training program, materials, and schedule, and monitor delivery of training to verify that it meets the Owner's Project Requirements for the preparation of operations and maintenance personnel.

7.2.7.5 Training records are reviewed by designated members of the Commissioning Team for proper documentation of attendees, material covered, and associated details.

7.2.8 Schedule Commissioning Process Activities

7.2.8.1 The objective of scheduling Commissioning Process activities is to integrate and coordinate them with other Construction Phase activities and to allow all Commissioning Team members to plan their work to achieve the Owner's Project Requirements. Commissioning Process activities should be integrated into the construction schedule. Detailed integration of commissioning work with the construction schedule is critical to maintaining project schedule milestones.

7.2.8.2 The project schedule needs to include the start date, duration, description, and entity responsible for completion.

7.2.8.3 As a minimum, the following should be included in the project schedule:

- (a) Commissioning Team meetings.
- (b) Start and completion of each construction phase.
- (c) Key system and assembly completion and tests.
- (d) Training sessions.
- (e) Substantial completion.
- (f) Warranty start date.

- (g) Occupant move-in.
- (h) Warranty review two months prior to end of warranty period.
- (i) Lessons-learned meeting.

7.2.9 Develop Test Procedures

7.2.9.1 Test Procedures define the means and methods to carry out the tests that are accomplished during the Construction Phase. Test Procedures provide the following:

- (a) Participants required for the test, which may include the primary contractor, secondary contractors, design professionals, the Commissioning Authority, operators, the local authority having jurisdiction, and manufacturers associated with the equipment, system, or assembly.
- (b) Prerequisites for the test performance in terms of completion of systems and assemblies and acceptable completion of other activities.
- (c) Step-by-step instructions to exercise the specific systems and assemblies under test. Instructions include how to configure the system or assembly to start the test and how to restore the system to normal operation at the conclusion of the test.
- (d) List of instrumentation, tools, and supplies required for the test. The list should indicate which of the participants is responsible for each of the items listed. The list should be specific as to make, model, range, capacity, accuracy, calibration, and other pertinent performance requirements.
- (e) An indication, for each step of the procedure, of what observations or measurements must be recorded and the range of acceptable results.

7.2.9.2 The Commissioning Team will develop a range of test verification procedures. These procedures include:

- (a) Component test procedures: Component test procedures verify the performance of components under a full range of actions, responses to inputs, and loads.
- (b) System/assembly test procedures: System/assembly test procedures verify the performance of subsystems, systems, and assemblies under a full range of operating conditions (both normal and emergency), responses to inputs, and loads.
- (c) Intersystem test procedures: Intersystem test procedures verify the interactions between systems and assemblies.
- (d) Owner's Project Requirements test procedures: Owner's Project Requirements test procedures verify that the various systems and assemblies that comprise the facility deliver the intended Owner's Project Requirements at the point of use.
- (e) Use quality-based sampling for verification of each test determined to be related to the Owner's Project Requirements.

7.2.9.3 In developing the Test Procedures, special attention must be paid to issues of personnel safety, equipment/ assembly protection, and manufacturer's recommendations to protect the validity of the warranty.

7.2.10 Develop Test Data Records

7.2.10.1 Test Data Records capture test data, observations, and measurements. Data may be recorded on photographs, forms, or other means appropriate for the application. The following minimum information should be recorded:

- (a) Test number.
- (b) Date and time of the test.
- (c) Indication of whether the record is for a first test or retest following correction of a problem or issue.
- (d) Identification of the system, equipment, or assembly under test. List the location and the construction document designation.
- (e) Conditions under which the test was conducted. For example, when testing, fully describe the ambient conditions, setpoints, overrides, and the status and operating condition of devices, systems, and equipment that impact the results of the test.
- (f) Expected performance of the systems and assemblies at each step of the test.
- (g) Observed performance of the system, equipment, or assembly at each step of the test. When data forms are used, check boxes generally do not adequately describe the system performance and therefore should be avoided in most cases. A blank space in which the observed or measured performance may be described provides more information for diagnostics and a future baseline for performance.
- (h) Notation to indicate whether the observed performance at each step meets the expected results.
- (i) Other observations about system performance or test procedure.
- (j) Issue number, if any, generated as a result of the test.
- (k) Dated signatures of the person performing the test and of the witness, if applicable.

7.2.11 Commissioning Team Meetings

7.2.11.1 Consistent, periodic Commissioning Team meetings are essential to maintaining the progress of the project.

7.2.11.2 The schedule of meetings should be documented as early as possible during the Construction Phase and updated as required due to schedule changes. The meeting dates and times should be known a minimum of two weeks in advance and should be coordinated with other meetings to minimize travel time and costs for various attendees.

7.2.11.3 Team members represented at the meeting must be authorized to make commitments and decisions for their respective organizations to facilitate an effective Commissioning Team meeting.

7.2.11.4 Prior to a meeting (usually a minimum of three days) an agenda should be distributed to all invited attendees. The agenda should include:

- (a) Meeting location.
- (b) Start time.
- (c) List of invited attendees.
- (d) List of items to cover (previous action items, outstand-

ing issues, schedule review, new issues, and other business) along with defined time allotments for each item.

- (e) End time.
- (f) Attachments, if applicable.

7.2.11.5 The meeting time and duration should be strictly adhered to. This will set the tone for other Commissioning Process activities.

7.2.11.6 Within a reasonable and established period (frequently, three days) after the meeting, distribute meeting notes or minutes. This should include:

- (a) Date, time, and location of the meeting.
- (b) List of attendees.
- (c) Resolved action items and issues.
- (d) Outstanding action items and issues, including clear identification of the responsible party and due dates.
- (e) Date, time, and location of the next meeting.

7.2.12 Accomplish Periodic Site Visits to Verify Compliance with the Owner's Project Requirements

7.2.12.1 Site visits are the primary method used during the Construction Phase to verify that the installed systems and assemblies comply with the Owner's Project Requirements.

7.2.12.2 A clear, concise, and consistent procedure must be followed for each site visit to properly identify Construction Phase process problems and issues.

7.2.12.3 The site visit procedure uses statistical sampling techniques for verification of the Construction Checklists and Record Documents. This provides assurance that the verification process is not biased and has reliable consistency. The recommended procedure has the following general steps:

- (a) Identify the current state of construction to define the scope of systems and assemblies that can be verified.
- (b) Randomly select between 2% and 10% of the systems and assemblies for verification. This can be accomplished by randomly selecting a starting point and selecting every tenth item from a list or by automatically generating a random sample from a computerized database.
- (c) Identify Commissioning Team members for the site visit.
- (d) Review Owner's Project Requirements.
- (e) Accomplish verification. This task is completed by going to the selected system or assembly and comparing the installation to the completed (full or partial) Construction Checklists. Any negative responses should be reviewed in detail.
- (f) Any consistent problems with the installation identified (typically more than 10% of the sample has the same issue), including Record Documents, are documented in general terms and provided to the contractor for resolution. The contractor is then responsible for 100% checking of all affected systems or assemblies and making corrections as required.
- (g) Any inconsistent problems (one or two occurrences) are sent to the contractor, detailing the specific component, system, or assembly for resolution.

- (h) Meet with contractors to discuss any issues identified and the general progress of the project.
- (i) Meet with the Owner's representative to review the findings, project schedule, and outstanding issues.
- (j) Develop a site visit report and distribute to the Commissioning Team members and other interested parties.

(k) Update the Issues Log.

7.2.13 Test Execution

7.2.13.1 During test execution there can be witnessing of tests, verification of tests, or verification of test data reports. Typically, only one of these is performed by the Commissioning Authority for a specific test or series of tests. However, depending upon the type and complexity of the test, it is possible in some cases to witness a portion of the test, verify the test through a random sampling of components, and verify the test data report through random sampling of the reported results.

7.2.13.2 Completion of tests should comply with the following:

- (a) Tests shall be performed according to approved written procedures. Results of test performance shall be recorded on the test data forms and witnessed.
- (b) Deviations from the approved procedures, if permitted, should be documented in writing.
- (c) Test data should be recorded under steady-state and stable conditions.
- (d) If an issue is observed during a test, the test should be terminated, within the scope of the contract. An issue report is created at the time of observation. If the issue cannot be resolved within a reasonable time period, it may be required to run the test immediately, with the understood options to run the test later, after all issues are resolved.
- (e) If an issue is discovered during review of the data, the issues shall be resolved or the test repeated in its entirety.
- (f) Upon completion of the test, the technician performing the test and the witnesses sign the test data record, attesting to the verity of the recorded observations.

7.2.13.3 Generally, the sequence of testing will be executed in the order of activities listed:

- (a) The verification of the Construction Checklists begins with equipment or assembly delivery and continues through start-up and testing.
- (b) Tests verifying system and intersystem performance according to the Owner's Project Requirements cannot begin until the Construction Checklists have been verified and accepted by the Commissioning Team.
- (c) Other sequencing requirements, depending upon the specific system, may be required to ensure the proper conditions are present or can be created.
- (d) A specified test is run according to Contract Documents or to manufacturer's requirements.

7.2.14 Verify Training

7.2.14.1 Within a reasonable period (such as three weeks) of each training program, between 5% and 10% of the

trainees shall be randomly selected and tested or informally evaluated on the material covered in the specific program. The intent of this testing is to verify that the trainees were provided with the pertinent information to operate and maintain the facility according to the Owner's Project Requirements.

7.2.14.2 It is not typically expected that the trainees will have memorized everything from the training session but that they know where the information is, can find it, and understand sufficiently to walk through the key steps to trouble-shoot a problem and resolve it.

7.2.14.3 Attendee sign-in sheets should be used to verify that training was delivered to the intended people.

7.2.15 Construction Phase Commissioning Process Report

7.2.15.1 The Construction Phase Commissioning Process Report is the documentation of the commissioning work and results accomplished during the Construction Phase. The Construction Phase Commissioning Process Report contains the following:

- (a) Identification of any systems or assemblies that do not perform in accordance with the Owner's Project Requirements. For various reasons, the Owner may choose to accept performance that is at variance with the Owner's Project Requirements, either permanently or until schedule and budget constraints allow for correction. The Owner's acceptance of these conditions should be documented along with the environmental, health, safety, comfort, energy, and operating and maintenance cost impacts. The Owner's Project Requirements must be updated to match the revised expectations.
- (b) Evaluations of the operating condition of the systems at the time of test completion.
- (c) Construction Checklist completion and verification summary.
- (d) Results from the Issues Log, including the descriptions of issues and the measures taken to correct them. The description should assess the importance of the issues and estimate the value of their correction in terms of environmental impact, improved health, safety, comfort, energy consumption, operating and maintenance costs, and the ability of the facility to support its mission.
- (e) Test procedures and data. This section should incorporate the original test procedures and signed data forms, including additional data such as photos, computerized documentation, and other records of the tests. Data should include the final accepted test, as well as earlier tests that failed to meet the specified criteria. This section should also include a set of blank data forms for future use in the Continuous Commissioning Process and Re-commissioning.
- (f) Commissioning Process Progress Reports. Copies of progress reports generated throughout the Commissioning Process.
- (g) Deferred Tests. Execution of some tests may be deferred until appropriate natural loads, such as occupancy or design weather conditions, are available. For these deferred tests, the prerequisite conditions and an estimated schedule for their completion should be included.

(h) Lessons Learned. Evaluation of the Commissioning Process used and changes that will improve the delivered project and form the basis for the Final Commissioning Process Report developed during the Occupancy and Operations Phase. This is essential to ensure that issues, benefits, and recommendations are captured in a written document while all team members are available and information is fresh.

7.2.15.2 A draft Construction Phase Commissioning Process Report should be submitted for Owner review. Submittal of the draft Commissioning Process Report to other Commissioning Team members may also be appropriate.

7.2.15.3 The final Construction Phase Commissioning Process Report should incorporate review comments from the Owner and, optionally, from other Commissioning Team members.

7.2.16 Verify Systems Manual Update

7.2.16.1 Verify that the Systems Manual is updated to incorporate materials generated during the Construction Phase. Materials that should be added are:

(a) Test procedures and test data records.

- (b) Training plans.
- (c) Training records.
- (d) Record Drawings.
- (e) Submittal review reports.
- (f) Updated Owner's Project Requirements.
- (g) Updated Basis of Design.
- (h) Updated Commissioning Plan.
- (i) Updated Issues Log.
- (j) Commissioning Process Progress Reports.

7.2.17 Verify Update of the Basis of Design

7.2.17.1 Verify that the Basis of Design is updated to reflect any changes to the design during the Construction Phase. Verify that design changes comply with the Owner's Project Requirements. If necessary, update the Owner's Project Requirements.

7.3 Construction Phase Acceptance Requirements

7.3.1 The Commissioning Process should include the formal acceptance by the Owner of the Systems Manual, verified test reports, and training reports, consistent with the recommendations of the Commissioning Authority and appropriate other Commissioning Team members.

7.4 Construction Phase Documentation Requirements

7.4.1 The primary Commissioning Process requirements for documentation during the Construction Phase include the Construction Phase Commissioning Process Report and commissioning elements of the Systems Manual.

7.4.2 The information in these deliverables is used throughout the Occupancy and Operations Phase.

7.5 Construction Phase Training Requirements

7.5.1 The Commissioning Process training requirements for the Construction Phase are discussed in Section 7.2.14.

8. OCCUPANCY AND OPERATIONS PHASE

8.1 Introduction

8.1.1 The Occupancy and Operations Phase of the Commissioning Process begins at substantial completion. As a minimum, the Commissioning Process activities begun at this point should continue through the end of the contractual warranty/correction period and ideally continue throughout the life of the facility. During the Occupancy and Operations Phase, the ongoing operation, maintenance, and modification of the facility systems and assemblies, and their associated documentation, are verified against the updated Owner's Project Requirements.

8.1.2 The active involvement of the Commissioning Authority and Commissioning Team during the initial portion of the Occupancy and Operations Phase of a project is an integral aspect of the Commissioning Process.

8.1.3 Occupancy and Operations Phase Commissioning Process objectives include the following:

- (a) Using the Commissioning Authority's project knowledge and experience to minimize contractor callbacks.
- (b) Providing ongoing guidance on operations and maintenance to achieve the Owner's Project Requirements.
- (c) Completing seasonal testing of facility systems and assemblies.
- (d) Documenting lessons learned from applying the Commissioning Process for application to the next project.
- (e) Acceptance of Occupancy and Operations Phase Commissioning Process activities.

8.1.4 Occupancy and Operations Phase Commissioning Process activities described in this section that are to be performed by the design team and special consultants that must be included in the scope of services described in the "Owner – Design Professional Service Agreement." These Commissioning Process activities may be more than are normally required in their scope of services. The scope of services in the "Owner - Design Professional Service Agreement" should also include the requirement to cooperate with the Commissioning Authority during Pre-Design, Design, and Construction Phases of the project. This may include training, seasonal tests, problem resolution, design evaluation, site visits, updating drawings and specifications, or other requirements performed during the occupancy and initial operations period defined for the project.

8.1.5 If the Owner adopts the Commissioning Process on a project at the Occupancy and Operations Phase, then this process is termed "Retro-Commissioning" and, while it accomplishes some Commissioning Process Activities described herein, it is sufficiently different from the Commissioning Process that it is not within the scope of this guideline.

8.1.6 It is often desirable for the Owner to maintain the benefits of the Commissioning Process well into the life of the facility.

8.2 Occupancy and Operations Phase Commissioning Process Activities

8.2.1 Occupancy and Operations Phase Commissioning Process Responsibilities **8.2.1.1** During the Occupancy and Operations Phase, the Commissioning Team works to verify the ongoing compliance with the Owner's Project Requirements.

8.2.1.2 Essential team members during the Occupancy and Operations Phase include Owner's representatives, the Commissioning Authority, design professionals, contractors, and construction/program/project managers.

8.2.1.3 Responsibilities of the Commissioning Team during the Occupancy and Operations Phase include the following:

- (a) Coordinate contractor callbacks.
- (b) Verify seasonal testing of facility systems and assemblies.
- (c) Verify continuing operation and maintenance personnel training.
- (d) Verify system and assembly operations meet updated Owner's Project Requirements.
- (e) Verify continual updating of the Systems Manual.
- (f) Conduct and verify periodic performance evaluations of facility systems and assemblies.
- (g) Convene lessons-learned workshop.
- (h) Complete the final Commissioning Process Report for the project.

8.2.2 The Commissioning Authority should aid in the coordination of the callback of contractors during the Occupancy and Operations Phase. Since the Commissioning Authority has been involved since the Pre-Design Phase, he/ she has the ability to identify which contractors should be contacted to resolve an issue.

8.2.3 Verification of the performance of all systems and assemblies being commissioned should be completed during the Construction Phase. However, certain weather conditions, load conditions, or occupant interactions are required to complete some verification activities. Such deferred performance verification shall be conducted at an appropriate time, and under appropriate conditions, as early as possible after occupancy.

8.2.4 Training of the Owner's operation and maintenance personnel on the fundamentals of facility and system/assembly operations and the occupants on facility usage will ideally occur primarily during the Construction Phase of a project. Some training, however, is likely to be best deferred until the Owner has assumed responsibility for his/her facility. Such training will be defined in the Commissioning Plan and Contract Documents.

8.2.4.1 Ongoing training is an integral part of a Continuous Commissioning Process. The Owner's operation and maintenance personnel and the occupants will be critical members of the Commissioning Team responsible for these periodic efforts.

8.2.5 The final project Commissioning Process Report will be completed during this phase. The requirements for a successful Commissioning Process Report are described in Section 7. Content not available or incomplete at the end of the Construction Phase will be added during this phase.

8.2.5.1 Should the Owner choose to implement the Continuous Commissioning Process for his/her facility, periodic Commissioning Process Reports will be created throughout the Occupancy and Operations Phase to reflect the Commissioning Process activities undertaken.

8.2.6 The final project Systems Manual will be completed during this phase. The requirements for a successful Systems Manual are described in Section 7. Content not available or incomplete at the end of the Construction Phase will be added during this phase.

8.2.6.1 The Systems Manual needs to be updated as changes are made to the facility throughout the entire Occupancy and Operations Phase. This includes updating the Owner's Project Requirements to reflect current conditions and needs and updating the Basis of Design to reflect changes to systems and assemblies.

8.2.7 Dynamic systems and equipment, as well as static systems, assemblies, and components, will tend to migrate from their as-installed conditions over time. In addition, the needs and demands of facility users and processes typically change as a facility is used. To attain optimal performance of facility systems, periodic verification of system, assembly, and component condition and operation is essential. The Systems Manual provides the tools and documented benchmarks for evaluation of ongoing performance. Such periodic verification is often best done in the context of a Continuous Commissioning Process.

8.2.8 The Continuous Commissioning Process has the following key activities:

- (a) Maintaining the Owner's Project Requirements to reflect changes in use and operation of the facility.
- (b) Maintaining the Basis of Design to reflect changes in systems and assemblies due to renovations or in response to changes in the Owner's Project Requirements.
- (c) Periodic evaluation of achieving the current Owner's Project Requirements and against previous benchmarks by appropriate tests.
- (d) Maintaining the Systems Manual to reflect changes in Owner's Project Requirements, Basis of Design, and systems/assemblies.
- (e) Ongoing training of operations and maintenance personnel and occupants on current Owner's Project Requirements and Basis of Design and changes in systems and assemblies.

8.3 Occupancy and Operations Phase Acceptance Requirements

8.3.1 The Commissioning Process should include the formal acceptance by the Commissioning Authority and the Owner of any deferred training, the final project Systems Manual, and the Final Commissioning Process Report during the Occupancy and Operations Phase.

8.4 Occupancy and Operations Phase Documentation Requirements

8.4.1 The final project Commissioning Process Report and final project Systems Manual are the primary documen-

tation requirements for the Occupancy and Operations Phase Commissioning Process. The information in these deliverables is used throughout the life of the facility.

8.4.2 If periodic performance verification is conducted for the Owner, a Continuous Commissioning Process Report and updates (as necessary) to training and the Systems Manual should be provided as deliverables.

8.5 Occupancy and Operations Phase Training Requirements

8.5.1 The Commissioning Process training requirements for the Occupancy and Operations Phase are discussed in Section 8.2.4.

9. REFERENCES

- DeVor, R., T. Chang, and J. Sutherland. 1992. *Statistical Quality Control: Contemporary Concepts and Methods*, Macmillan Publishing Company, New York, Chapter 7.
- 2. Gitlow, H. and S. Gitlow. 1987. *The Deming Guide to Quality and Competitive Position*, Prentice-Hall, Englewood Cliffs, NJ, Chapter 3.
- 3. Juran, J.M. (Ed.). 1995. A History of Managing for Quality: The Evolution, Trends, and Future Directions of Managing for Quality, ASQC Quality Press, Milwaukee, WI.

(This is a normative annex and is part of this guideline.)

NORMATIVE ANNEX A GUIDE FOR DEVELOPING SUPPLEMENTARY TECHNICAL GUIDELINES FOR THE COMMISSIONING PROCESS

The purpose of this annex is to provide the recommended format and content for Total Building Commissioning Process supporting technical guidelines. The objective is to use the same format for all Commissioning Process guidelines. The National Institute of Building Sciences is facilitating the development of a number of technical topic guidelines to support the effective implementation of the Total Building Commissioning Process. These guidelines will be developed by various professional, technical, and trade organizations. For example, the technical guideline for heating, ventilating, air-conditioning, and refrigeration (HVAC&R) will be developed by ASHRAE. The technical guidelines are developed to assist the Commissioning Team in successfully using the Commissioning Process for various systems and assemblies. The goal is to use the process as defined and provided in Guideline 0, "The Commissioning Process." Further, it is desired that each different system or assembly involved in the construction, addition to, or rehab of buildings, structures, campuses, or utilities use the Commissioning Process from Guideline 0-2005 and not redefine it within the respective (topic) technical guideline.

The objective of both Guideline 0-2005 and the technical guidelines is to provide information on implementing the Commissioning Process. The technical guidelines are not intended to be a detailed user's guide or provide guide speci-

fications, full commissioning plans, development of owner's project requirements, construction checklists, statistical or other quality tools, or other detailed requirements for implementing the Commissioning Process.

The format of the technical guidelines should follow the same format used in Guideline 0-2005. The following is the general organization to be used in the development of the technical guidelines.

FOREWORD

The Foreword should provide key information on what has led to success on previous projects, the role of the specific technology in a successful building or construction project, and closely related supplementary technical guidelines or topics.

SECTION 1, PURPOSE

The following should be used as the general purpose for each technical guideline:

"The purpose of this guideline is to describe the technical requirements for the application of the Commissioning Process described in ASHRAE Guideline 0-2005 that will verify that the [*insert topic, for example, fire systems or envelope assembly*] achieves the Owner's Project Requirements."

SECTION 2, SCOPE

The following text should be used as the general scope for each technical guideline:

"The procedures, methods, and documentation requirements in this guideline describe the application of the Commissioning Process for each project delivery phase from Pre-design through Owner Occupancy and Operation for [*insert topic*] to support the Commissioning Process activities described in ASHRAE *Guideline 0-2005, The Commissioning Process* (also published by NIBS as Guideline 0, *The Total Building Commissioning Process*). This includes requirements for:

- (a) [*insert topic*] to fully support the Total Building Commissioning Process activities,
- (b) verification during each phase of the Commissioning Process,
- (c) acceptance at each phase,
- (d) documentation during each phase,
- (e) Systems Manual, and
- (f) training for operations and maintenance personnel and occupants."

SECTION 3, UTILIZATION

The following paragraphs should be included as the Utilization section:

3.1 The application of this guideline will depend upon the Owner's Project Requirements and how the project will be designed, built, and operated. This guideline is supplemental to the Commissioning Process detailed in ASHRAE Guideline 0-2005.

3.2 This guideline describes specific details required to properly implement the Commissioning Process relative to

[*insert topic*]. This includes documentation, test procedures, and checklists.

SECTION 4, DEFINITIONS

Include definitions that are unique to the technical guideline. Do not redefine or repeat those in ASHRAE Guideline 0; instead, include a statement referring to the definitions in Section 4 of Guideline 0.

SECTION 5, PRE-DESIGN PHASE

The following needs to be included in the Pre-Design Phase section for [*insert topic*]:

- 1. List of Commissioning Team members.
- 2. List and description of criteria and items to be included in the Owner's Project Requirements document.
- 3. List of milestones.
- 4. List of specialists required for implementing the Commissioning Process.
- 5. List of items to focus upon during the design reviews.
- 6. List of items to be included in the Commissioning Plan.
- 7. List of items to be included as part of the Issues Log.
- 8. List of items required for acceptance of Pre-Design Phase commissioning.
- 9. Develop needs for tests and list tests that need to be performed.
- 10. Develop training requirements.
- 11. Develop requirements for the Systems Manual, such as parts lists, troubleshooting needs, operations and maintenance requirements, system description, level at which each set of material needs to be written for clear understanding.

SECTION 6, DESIGN PHASE

The following needs to be included in the Design Phase section for (*topic*). This will be the basis for Construction Phase documents for contractors, vendors, and equipment/ assembly manufacturers:

- 1. List of items required for the Basis of Design.
- 2. Revision review procedure for Commissioning Team members and Owner's Project Requirements.
- 3. List of coordination requirements and items provided by others.
- 4. Key milestones that need to be reviewed.
- 5. Update lists of specialists required to implement the Commissioning Process based upon the actual design and interrelationship with other systems and assemblies.
- 6. List of items to be included in the construction documents.
- 7. Develop lists of priority items and relate whenever possible to safety, health, energy, environmental impact, aesthetics, operations and maintenance, in addition to Owner's Project Requirements.
- 8. List of Construction Checklists to be used by the contractor.

- Samples of Construction Checklists. Examples of construction checklists are included in Annex M to this guideline and in other annexes in other supplementary technical guidelines (such as ASHRAE Guideline 1-200x, HVAC&R Technical Requirements for the Commissioning Process).
- 10. List of items to be included in the Systems Manual, such as parts lists, troubleshooting needs, operations and maintenance requirements, system description, level at which each set of material needs to be written for clear understanding.
- 11. List of training requirements, timing, learning outcomes.
- 12. Develop needs for tests and tests that need to be performed.
- 13. List of items required for acceptance of Design Phase commissioning.

SECTION 7, CONSTRUCTION PHASE

The following needs to be included in the Construction Phase section for [*insert topic*]:

- 1. List of test procedures and data forms to verify achievement of Owner's Project Requirements and Basis of Design.
- Samples of test procedures and data forms. Examples of these are included in Annex U to other supplementary technical guidelines (such as ASHRAE Guideline 1-200X, HVAC&R Technical Requirements for the Commissioning Process).
- 3. List of coordination requirements and items provided by others.
- 4. List of specific items for the site visit procedures.
- 5. Tests needs and schedule.
- 6. Commissioning Team meetings.
- 7. Issues Logs.
- 8. Input into the final Commissioning Process Report.
- 9. Lessons-learned workshop schedule during Occupancy and Operations Phase.
- 10. List of items required for acceptance of Construction Phase commissioning.

SECTION 8, OCCUPANCY AND OPERATIONS PHASE

The following needs to be included in the Occupancy and Operations Phase section for [*insert topic*]:

- 1. List of training items to be accomplished during the first year of operation.
- 2. List of warranty items to be checked during the first year of operation.
- 3. List test requirements during occupancy, including periodic re-testing for a successful continuous operation of the facility.
- 4. List who should attend the lessons-learned workshop.
- 5. List of criteria to be included in the final Commissioning Process Report.
- 6. List of items required for acceptance of Occupancy and Operations Phase commissioning.

SECTION 9, REFERENCES

Include industry-specific references that support recommendations for benchmarking, testing, and other supporting guidance in the development of the Owner's Project Requirements, Basis of Design, tests, and other Commissioning Process documents.

ANNEXES

Annexes are to be used to provide additional information, examples of documentation, examples of specifications, acceptance procedure details, and other items that are not required to achieve compliance with the technical guideline but will assist in implementing the Commissioning Process for the specific technical system or assembly. This is the place to illustrate best practices and to provide information on how to achieve best practice and economy in design. Annex Q, References, should provide current articles, guides, and other information on implementing the Commissioning Process for the specific supporting technical requirements guidelines.

The desired goal is to have all Commissioning Process guidelines use the same annex designation. They should use the same annex letters as Guideline 0-2005. If an annex is not required, it should specifically be so noted in each technical guideline—suggested wording: "This annex is intentionally left blank" or "There is no supplemental information required for [*insert assembly or system*] technology." Annex A will be empty in all supplemental guidelines. Annex B is specific to Guideline 0 and should not be changed in supplemental guidelines. Annexes C through E may require no modification for most supplemental guidelines.

NOTE: The list and numbering of annexes, to be in compliance with Guideline 0-2005, must be as follows:

- Annex A Guide for Developing Supplementary Technical Guidelines for the Commissioning Process (used only in Guideline 0)
- Annex B Commissioning Process Flowchart (used only in Guideline 0)
- Annex C Cost and Benefits of the Commissioning Process (typically only in Guideline 0)
- Annex D Commissioning Process Documentation Matrix (typically only in Guideline 0)
- Annex E Commissioning Process Request for Qualifications (typically only in Guideline 0)
- Annex F Roles and Responsibilities
- Annex G Commissioning Plan
- Annex H Acceptance Plan
- Annex I Owner's Project Requirements Workshop Guidance
- Annex J Owner's Project Requirements
- Annex K Basis of Design
- Annex L Specifications
- Annex M Construction Checklists
- Annex N Quality-Based Sampling Examples
- Annex O Systems Manual
- Annex P Training Manual and Training Needs
- Annexes Q through X In addition to the annexes (above) that are included in Guideline 0-2005, *The*

Commissioning Process, all supplemental technical guidelines should include the following annexes with specific technical topic guidance or requirements, as appropriate. It is the intent to have all technical guidelines use the same reference letter for each topic. That is, all examples of Checklists would always be included in Annex M. The technical Commissioning Process guidelines should include annexes that provide examples and guidance on the following topics or should include notes such as "Not used," or "This annex is intentionally left blank," or "There is no supplemental information required."

- Annex Q Publications, Articles, References, Codes, Regulations, and Standards
- Annex R Integration Requirements
- Annex S Interference and Coordination with Other Systems and Assemblies
- Annex T Communications: What, When, and Who
- Annex U Test Procedures and Data Forms
- Annex V Pre-Design Phase Commissioning Process Specific Needs
- Annex W Design Phase Commissioning Process Specific Needs
- Annex X Construction Phase Commissioning Process
 Specific Needs
- Annex Y Occupancy and Operations Phase Commissioning Process Specific Needs
- Annex Z (and, if needed, Annex AA and beyond) can be used as required for other topics that are determined to be useful for a specific assembly or system.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX B COMMISSIONING PROCESS FLOW CHART

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

The flow chart shown in Figure B.1 depicts an example for an owner who has adopted the Commissioning Process from project inception. If the owner adopts the Commissioning Process after project inception, then the tasks shown are still accomplished in whatever phase the Commissioning Process commences. The Continuous Commissioning Process is shown in the flow chart as ongoing tasks during the Occupancy and Operations Phase after the last acceptance block.



Figure B.1 Commissioning process flow chart.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX C COST AND BENEFITS OF THE COMMISSIONING PROCESS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

OVERVIEW

The Commissioning Process focuses on producing a quality-based system that achieves the Owner's Project Requirements.

This annex discusses the potential benefits and where they accrue and quantifies these benefits by providing evidence of potential costs and savings.

DISCUSSION OF NEW COST ITEMS

Ultimately, the owner of the facility will determine the extent of the Commissioning Process activities and who will be responsible for each phase of work. The intent here is to outline the scope of work that represents new cost items rather than to assign responsibilities for each task. The cost of the Commissioning Process should be considered as a part of the project budget.

Design Professional

In addition to the design professional's typical scope of work, including the preparation of design drawings and specifications, the Commissioning Process often requires that the design professional work with the Commissioning Authority to integrate the Commissioning Process activities into the project specifications. These activities typically include:

- 1. Test requirements and documentation.
- 2. Operational, maintenance, and troubleshooting documentation requirements.
- 3. Construction Checklists.
- 4. Systems Manual.
- 5. Comprehensive training program for operation and maintenance personnel and users.

The design professional may also be responsible for reviewing the Commissioning Plan at the various phases of the process and for delivering the Basis of Design in a format specific for the owner.

Commissioning Authority

The activities accomplished by the Commissioning Authority as defined in this guideline require that additional funds be allocated during the Pre-Design, Design, and Construction Phases. These funds are allocated from the savings obtained through fewer change orders and requests for information and through reduced problems during start-up of the systems and occupancy of the facility.

Contractors

The completion of some detailed tests is unique to the Commissioning Process. The contractor will have additional work and costs associated with completing these tests.

DISCUSSION OF BENEFITS

For convenience and clarity, benefits will be discussed as they relate to major participants in the Commissioning Process: the Design Professional, the Contractor, and the Owner.

Benefits to the Design Professional

Potential benefits include:

- Facility will achieve the of Owner's Project Requirements.
- Reduced risk exposure.
- Improved knowledge base for use in future designs and installation.
- Benefit of other participants' input, leading to the most cost-effective design and operation.
- Reduced number of interference drawings during construction due to improved communication and coordination throughout the project.

Benefits to the Contractor

Potential benefits include:

- Improved planning and coordination through the implementation of the Commissioning Plan.
- Improved coordination between different trades and reduced likelihood of site interference drawings required of contractors throughout the project. Reduced number of deficiencies at substantial completion. Reduced number of callbacks.
- Reduced number of calls for operational guidance due to participation in training programs for operations and maintenance personnel.

Benefits to the Owner

Potential benefits include:

- Improved operator knowledge of how to optimize the facility operation and maintenance due to the early inclusion of operators in the Commissioning Process.
- Reduced training requirements due to continuously updated documentation of how systems should operate and be maintained; personnel will only need to be trained with regard to changes.
- Facility performance is in accordance with the Owner's Project Requirements.
- Systems Manual provides an easy reference document for system and assembly operation and maintenance.
- Reduced downtime due to better diagnosis of failures.
- Improved ability to provide accurate information to occupants on facility operation and maintenance.
- Lower operating costs due to improved operational techniques.
- Benefits to building occupants, including greater worker productivity, reduced complaints, and reduced incidence of absenteeism.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX D COMMISSIONING PROCESS DOCUMENTATION MATRIX

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

The following table summarizes the documents that are produced during the implementation of the Commissioning Process on a project.

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Pre-Design	Owner's Project Requirements	O&M, Users, Capi- tal Projects, Design Team (?)	CA or Designer	Owner	CA, Design Team	Design Team may not be hired yet.
	Commissioning Plan	Owner, Design Team (?), CA	CA	Owner	CA, Owner, Design Team	Design Team may not be hired yet.
	Systems Manual Outline	O&M, CA	Owner or CA	Owner	Design Team	May be included in OPR
	Training Requirements Outline	O&M, Users, CA, Design Team	Owner or CA	Owner	Design Team	May be included in OPR
	Issues Log	CA	СА	N/A	CA, Design Team	May be only format at this phase
	Issues Report	CA	СА	Owner	Design Team, Owner	
	Pre-Design Phase Commissioning Process Report	СА	СА	Owner	Owner	Close of Phase report
Design	Owner's Project Requirements Update	O&M, Users, Capi- tal Projects, Design Team	CA or Designer	Owner	CA, Design Team	
	Basis Of Design	Design Team	Design Team	Owner, CA	Design Team, CA	
	Construction Specifications for Commissioning	Design Team, CA, Owner	Design Team or CA	Owner	Contractors, CA, Design Team	May also be provided by Project Manager/ Owner's Rep.
	Systems Manual Outline-Expanded	Design Team, CA, O&M, Contractor (?)	Design Team or CA	Owner, CA	Design Team, Contractor	Contractor may not be hired yet.
	Training Requirements In Specifications	O&M, Users, CA, Design Team	Owner or CA	Owner	Design Team	Contractor may not be hired yet
	Design Review Comments	CA	CA	Owner	Design Team	
	Issues Log	CA	CA	N/A	CA, Design Team	
	Issues Report	CA	CA	Owner	Design Team, Owner	
	Design Phase Commissioning Process Report	СА	СА	Owner	Owner	Close of Phase report
Construction	Owner's Project Requirements Update	O&M, Users, Capi- tal Projects, Design Team	CA or Designer	Owner	CA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CA, Owner	Design Team, CA	
	Commissioning Plan Update	Design Team, CA, Owner, Contractor	CA	CA, Owner, Design Team, Contractor	CA, Owner, Design Team, Contractors	
	Submittal Review Comments	CA	Design Team	Design Team	Contractor	

TABLE D-1 **Documentation Matrix**

Notes:

1. The term "contractor" is understood to refer to any of several entities that provide construction services. Depending upon the project, this could include, among others, the owner's representative, construction manager, contractors, and subcontractors. 2. Abbreviations: CA: Commissioning Authority; O&M: operations and maintenance personnel; OPR: Owner's Project Requirements.

Phase	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
	System Coordination Plans	Contractor, Design Team	Contractor	CA, Design Team	Contractor, CA	
	Inspection Checklists	CA, Contractor, Design Team	CA	CA, Design Team	Contractor	
	Inspection Reports	Contractor	CA	CA, Owner	Contractor	
	Test Procedures	CA, Contractor, Design Team	CA	CA, Design Team	Contractor	
	Test Data Reports	Contractor	CA	CA, Owner	Contractor	
	Commissioning Meeting Agendas and Minutes	CA	CA	All	All	
	Training Plans	Design Team, CA, O&M, Contractor	Contractor or CA	Owner, CA	O&M, Users, Con- tractor	
	Systems Manual	Design Team, CA, O&M, Contractor	Contractor	Owner, CA	O&M, Users	
	Issues Log	CA	CA	N/A	CA, Design Team, Contractor	
	Issues Report	CA	CA	Owner, Design Team	Design Team, Owner, Contractor	
	Preliminary Construction Commissioning Process Report	CA	CA	Owner	Owner	Prior to Occupancy
	Final Construction Phase Commissioning Process Report	СА	СА	Owner	Owner	Close of Phase report
Occupancy and Operations	Owner's Project Requirements Update	O&M, Users, Design Team	CA or Designer	Owner	CA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CA, Owner	Design Team, CA	
	Maintenance Program	O&M, Contractor, CA	Owner or CA	Owner, CA	O&M, Users	
	Test Procedures	Contractor, CA, O&M, Design Team	CA	Design Team, CA	Contractor	
	Test Data Reports	Contractor	CA	CA, Owner	Contractor, O&M	
	Issues Log	CA	СА	N/A	CA, Design Team, Owner, Contrac- tors	
	Issues Report	СА	CA	Owner	Design Team, Owner, Contrac- tors	
	Commissioning Process Report	CA	СА	Owner	Owner	Final report
	Re-Commissioning Plan	O&M, Users, CA	CA or Owner	Owner	Owner	

TABLE D-1 (Continued) Documentation Matrix

Notes:
1. The term "contractor" is understood to refer to any of several entities that provide construction services. Depending upon the project, this could include, among others, the owner's representative, construction manager, contractors, and subcontractors.
2. Abbreviations: CA: Commissioning Authority; O&M: operations and maintenance personnel; OPR: Owner's Project Requirements.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX E COMMISSIONING PROCESS REQUEST FOR QUALIFICATIONS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

BACKGROUND

		(Owner) is seek	ting
the services of a qual	ified Commis	sioning Authority	for
	The pro	ject is a	
gross ft ² , story, Clas	ss [type]	buildin	g in
[city & state]	,	, with a pro	ject
budget of \$ mil	lion. The fac	ility is expected to) be
composed of% [s	pace type],	% [space type],	and
% [space type].			
The project is curre	ntly in the early	v pre-design phase '	The

The project is currently in the early pre-design phase. The expected schedule is to start design by ______, start construction by ______, and occupy by

The management structure is traditional design/bid/build with full design documents and specifications being developed by an architectural/engineering firm. The construction documents will be let out to bid and a general contractor will be hired to complete the construction. The Owner's primary construction representative on site will be provided by the separately contracted services of a construction manager. The Commissioning Authority will be hired by and report directly to the Owner.

SCOPE OF WORK

The Owner has adopted the Commissioning Process as his/her quality process to plan, design, construct, and operate this facility. As with any quality process, the Commissioning Process provides tools to enable everyone involved in the construction of the facility to verify that the final facility meets the Owner's Project Requirements.

The following is a summary of the Commissioning Process that the Owner intends to implement on this project. The proposer is free to suggest changes and improvements to this process. However, for this proposal the following process will be assumed.

Commissioning Process During the Pre-Design Phase

The Commissioning Process activities completed by the Commissioning Authority during the Pre-Design Phase include:

- Developing and documenting the Owner's Project Requirements.
- Identifying a scope and budget for the Commissioning Process.

- Developing the initial Commissioning Plan.
- Acceptance of Pre-Design Phase Commissioning Process activities.

Commissioning Process During the Design Phase

The Commissioning Process activities completed by the Commissioning Authority during the Design Phase include:

- Works with the Commissioning Team to document the Owner's Project Requirements for the facility.
- Works with the design professionals in documenting the Basis of Design.
- Verifies the Basis of Design with regard to the Owner's Project Requirements.
- Develops a Commissioning Plan encompassing the Design, Construction, Occupancy and Operations Phases.
- Determines the commissioning requirements and activities to include in the Construction Documents, with review by the design team, for integration into the project's construction specifications.
- Reviews the in-depth design documentation developed by the design professionals.
- Performs statistically based quality design review at 35%, 50%, 95%, and 100% completion of the drawings and specifications.

Commissioning Process During the Construction Phase

The Commissioning Process activities accomplished by the Commissioning Authority during the Construction Phase include:

- Organizes the Commissioning Process components and conducts a pre-bid and pre-construction meeting where the Commissioning Process requirements are reviewed with the Commissioning Team.
- Organizes and conducts periodic Commissioning Team meetings necessary to plan, develop the scope of, coordinate, and schedule activities and resolve problems.
- Reviews submittals concurrent with the design professional's review.
- Works with Contractors in completing Construction Checklists and tracking of Checklist completion.
- Statistically samples completion of Construction Checklists on a periodic basis to verify that Contractor's quality process is achieving the Owner's Project Requirements.
- Develops specific test procedures. The Contractors review the procedures.
- Directs the execution of the tests by the Contractors.
- Documents the results of the tests.
- Documents the correction and retesting of noncompliance items by the Contractor.
- Reviews the Systems Manual for achieving the Owner's Project Requirements.
- Reviews, pre-approves, and verifies the training provided by the Contractors.
- Verifies delivery of the Systems Manual.

Commissioning Process During the Occupancy and Operations Phase

The Commissioning Process activities accomplished by the Commissioning Authority during the Occupancy and Operations Phase include:

- Schedules and verifies deferred and seasonal testing by the Contractor.
- Verifies continuing training.
- Accomplishes a review of warranties with the operations and maintenance staff two months prior to expiration of warranty.
- Schedules, organizes, and attends a lessons-learned workshop. The workshop is facilitated by an independent member of the Commissioning Authority's firm.
- Completes the Final Commissioning Process Report.

LIMIT OF RESPONSIBILITIES

The Commissioning Authority is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The Commissioning Authority may assist with problem-solving or resolving nonconformance or deficiencies, but ultimately that responsibility resides with the general contractor and design professionals.

FOCUS OF THE COMMISSIONING PROCESS

The following systems and assemblies are the focus of the Commissioning Process:

• [Insert list of systems and assemblies]

DESIRED QUALIFICATIONS

It is desired that the person designated as the Commissioning Authority satisfy as many of the following requirements as possible:

- 1. Has acted as the principal Commissioning Authority for at least three projects during the past year. [Note that the size of the project should be accounted for. Whereas one proposer may have done ten projects all small in size, another proposer that accomplished one large and complex project may have equal credentials].
- 2. Experienced in quality processes.
- 3. Knowledgeable in building operation and maintenance training.
- 4. Excellent verbal and written communication skills. Highly organized and able to work with both management and trade contractors.
- 5. A bachelor's degree in [*insert discipline*] is strongly preferred and [*insert type*] certification or professional license is desired.
- 6. The Commissioning Authority's firm will demonstrate depth of experienced personnel and capability to sustain loss of assigned personnel without compromising quality and timeliness of performance.

- 7. The Commissioning Authority will be an independent contractor and not an employee or subcontractor of the General Contractor or any other subcontractor on this project, including the design professionals.
- 8. [Insert any qualifications or special requirements for a *specific system or assembly*].

INSTRUCTIONS TO PROPOSERS

A proposer must propose to execute all phases of the Commissioning Process in a single proposal. The proposal must be signed by an officer of your firm with the authority to commit the firm.

- 1. List the key individual who will be the Commissioning Authority for this contract and describe his or her relevant qualifications and experience. This information is required in addition to any detailed resumes the proposer submits. The contract will require that this individual be committed to the project for its duration.
- 2. Provide project and professional references and experience for three to five commissioning projects for which the proposer was the principal Commissioning Authority in the last three years. Include a description of the projects, identify when the proposer came into the projects, and describe the involvement of each individual on the proposer's team in the projects. For each project, attach a sheet that includes the name and telephone number of the Owner's project manager, construction manager, facility administrator of the building, the design professionals, and the contractors.
- 3. Describe any experience of the proposer's team in the following areas. List each party's involvement.
 - (a) Quality process experience.
 - (b) Operation and maintenance experience.
 - (c) Design experience.
 - (d) Life-cycle costing.
 - (e) [Insert other system or assembly specific experience requirements].
- 4. Describe your proposed approach to managing the project expertly and efficiently, including your team participation. Describe what approach you will take to integrate the Commissioning Process into the normal design and construction process in order to make it "business as usual."
- 5. Describe what you will do to foster teamwork and cooperation from contractors and designers and what you will do to minimize adversarial relationships.
- 6. Describe how your work will facilitate the use of your product as a prototype that may be subsequently used by the Owner in future projects, including access to the electronic versions of all documents and forms.
- 7. As an attachment, provide the following work products that members of the proposer's team wrote.
 - (a) Commissioning Plan that was executed.
 - (b) Integrated commissioning specifications.
 - (c) Electronic Issues Log.
 - (d) Construction Checklists.
 - (e) Test procedure that was executed.
- 8. [Insert any other desired instructions].

SELECTION CRITERIA

The submitted proposals will be reviewed and ranked according to the following (items from the above numbered list):

1.	Key individual experience	20 points
2.	Staff experience	15 points
3.	Similar project experience	20 points
4.	Team experience in related skill areas	15 points
5.	Management approach	20 points
6.	Work examples	10 points
		100 points

Reference checks will not be scored individually but may be used to supplement all categories. The Owner reserves the right to eliminate or change the weight of extremely high or extremely low fee proposals.

SUBMISSION AND SELECTION

Consultants will submit [quantity]] copies of
the written proposal, to be received in	the Owner's office at
[address]	by [<i>date and</i>
time]. Late proposals will
not be accepted.	

Review and selection process..... Requirement of personal interview for finalists.....

LIMITATIONS AND PROVISIONS

[Insert wording on right to reject, to seek clarifications, to negotiate a final contract; cost of proposal preparation not reimbursable; primary contact for questions; other necessary legal language, etc.]

MINIMUM REQUIREMENTS FOR CONTRACT EXECUTION

General Conditions

Miscellaneous as required.....

Insurance

The Commissioning Authority's firm shall obtain, at the firm's expense, and keep in effect during the term of the project, *\$[list required insurance]*.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX F ROLES AND RESPONSIBILITIES

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects. Understanding and defining the role of each participant is vital to the success of the Commissioning Process. This annex provides an example of the responsibilities of each participant in a comprehensive Commissioning Process. These responsibilities shall be documented in the contracts between the owner and the contractor(s) and the owner and the design professionals. The responsibilities of each participant should be included in the contract documents.

The responsibilities of the owner, Commissioning Authority, design professionals, construction manager, contractors, and manufacturers are detailed below.

OWNER

- 1. Include a statement regarding design professional commissioning responsibilities and scope in the request for design services.
- 2. Develop and commit to the Owner's Project Requirements for the facility and its use.
- 3. Assign operations and maintenance personnel and schedule them to participate in the various meetings, training sessions, and observations/inspections as follows:
 - (a) Design Phase coordination meetings.
 - (b) Construction Phase coordination meetings.
 - (c) Initial owner-training session at initial placement of major equipment.
 - (d) Maintenance orientation and inspection.
 - (e) System testing verification meetings.
 - (f) Procedures meeting for testing systems.
 - (g) Owner's training session.
 - (h) Verification demonstrations.
 - (i) Systems and assemblies tests.
 - (j) Final review at acceptance meeting.
- 4. Review and approve any changes made to Owner's Project Requirements.
- 5. Review and approve the Construction Documents.
- 6. Provide qualified personnel for videotaping and editing of training sessions.
- 7. Videotape construction progress.
- 8. Review and comment on the Commissioning Authority's Commissioning Process Progress Reports.
- 9. Review and comment on the Commissioning Authority's verification reports.
- 10. Review and accept the Commissioning Authority's Commissioning Process Report.

COMMISSIONING AUTHORITY

- 1. Organize and lead the Commissioning Team.
- 2. Facilitate and document the Owner's Project Requirements.
- 3. Verify that the Commissioning Process activities are clearly stated in all scopes of work.
- 4. Integrate the Commissioning Process activities into the project schedule.
- 5. Prepare a Commissioning Plan that describes the extent of the Commissioning Process to accomplish the Owner's Project Requirements. Update the Commissioning Plan during each phase of the project to incorporate changes and additional information.
- 6. Review and comment on the ability of the design documents to achieve the Owner's Project Requirements for the commissioned systems and assemblies.
- 7. Prepare the Commissioning Process activities to be included as part of the project specification. Include a list of all individual trade contractor responsibilities for all the Commissioning Process activities (list contractors by name, firm, and trade specialty if known).
- 8. Execute the Commissioning Process through the writing and review of Commissioning Process Reports, organization of all Commissioning Team meetings, tests, demonstrations, and training events described in the Contract Documents and approved Commissioning Plan. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each Commissioning Process activity. The Commissioning Authority shall act as chair at all commissioning events and ensure execution of all agenda items. The Commissioning Authority shall prepare minutes of every Commissioning Process activity and send copies to all Commissioning Team members and attendees within five workdays of the event.
- 9. Review the plans and specifications (during the Pre-Design and Design Phases) with respect to their completeness in all areas relating to the Commissioning Process. This includes verifying that the Owner's Project Requirements have been achieved, and that there are adequate devices included in the design to properly test the systems and assemblies and to document the performance of each piece of equipment, system, or assembly.
- 10. Schedule all document review coordination meetings.
- 11. Attend the project's pre-bid meeting to detail the design professional or contractor Commissioning Process requirements.
- 12. Schedule the pre-design and pre-construction Commissioning Process meeting within 60 days of the award of the contract at some convenient location and at a time suitable to the attendees. This meeting will be for the purpose of reviewing the complete Commissioning Process and establishing tentative schedules for the Design Phase and Construction Phase commissioning activities.
- 13. Develop the initial format to be used for Issues Logs throughout and for each phase of the Commissioning Process.
- 14. Schedule the initial owner training session so that it will be held immediately before the contractor training. This session will be attended by the owner's O&M personnel, the design professionals, the contractor, and the Commissioning Authority. The Commissioning Authority will review the Owner's Project Requirements and the design professional(s) will review the Basis of Design.

- 15. Review proposed contractor-provided training program to verify that the Owner's Project Requirements are achieved.
- 16. Attend a portion of the contractor-provided training sessions to verify that the Owner's Project Requirements are achieved.
- 17. Receive and review the Systems Manual as submitted by the contractor. Verify that it achieves the Owner's Project Requirements. Insert systems descriptions as provided by the design professional(s) in the Systems Manual.
- 18. Witness system and assembly testing. Verify the results and include a summary of deficiencies.
- 19. Supervise the Commissioning Team members in completion of tests. The test data will be part of the Commissioning Process Report.
- 20. Periodically review Record Drawings for accuracy with respect to the installed systems. Request revisions to achieve accuracy.
- 21. Verify that the Systems Manual and all other design and construction records have been updated to include all modifications made during the Construction Phase.
- 22. Repeat implementing of tests to accommodate seasonal tests or to correct any performance deficiencies. Revise and resubmit the Commissioning Process Report.
- 23. Prepare the final Commissioning Process Report.
- 24. Assemble the final documentation, which includes the Commissioning Process Report, the Systems Manual, and all record documents. Submit this documentation to the owner for review and acceptance.
- 25. Recommend acceptance of the individual systems and assemblies to the owner (in accord with the defined project requirements).

DESIGN PROFESSIONAL

- 1. Participate and assist in the documentation of the initial Owner's Project Requirements.
- 2. Document revisions to the Owner's Project Requirements and obtain approval from the owner.
- 3. Document the Basis of Design
- 4. Prepare Contract Documents, including the integration of the Commissioning Process requirements and activities provided by the Commissioning Authority.
- 5. Prepare Contract Documents that coordinate required interfaces between systems and assemblies.
- 6. Attend the Pre-Design and Design Phase coordination and review meetings.
- 7. Respond to Commissioning Team design submission review comments and other issues in a timely manner.
- 8. Attend the pre-bid and pre-construction meetings as scheduled by the Commissioning Authority.
- 9. Specify and verify that the operation and maintenance of the systems and assemblies has been adequately detailed in the Construction Documents.
- 10. Review and incorporate as appropriate the Commissioning Authority's comments from submittal reviews.

- 11. Participate in the initial operation and maintenance personnel and occupant training session by presenting the project Basis of Design.
- 12. Participate in other training as detailed in the training program.
- 13. Review test procedures submitted by the contractor.
- Review and comment on the Commissioning Authority's periodic Commissioning Process Progress Reports and Issues Log reports.
- 15. Review and accept record documents as required by Contract Documents.
- 16. Review and comment on the final Commissioning Process Report.
- 17. Recommend final acceptance of the systems to the owner.

CONSTRUCTION MANAGER

- 1. Include costs for Commissioning Process activities in the contract price.
- 2. Include Commissioning Process requirements and activities in all contractors' contracts.
- 3. Provide adequate accessibility as required to properly operate and maintain the facility.
- Provide acceptable representation with the means and authority to prepare and coordinate implementation of the Commissioning Process as detailed in the Contract Documents.
- 5. Issue a statement certifying that all work has been completed and that the facility is operational, in accordance with Contract Documents.
- 6. Issue the appropriate final reports to the design professionals for review and acceptance.
- 7. Remedy deficiencies identified by the Commissioning Authority during verification of the installation or testing.
- 8. Review and comment on the final Commissioning Process Report.

CONTRACTOR

- 1. Include costs for Commissioning Process activities in the contract price.
- 2. Include Commissioning Process requirements and activities in each purchase order or subcontract written.
- 3. Obtain cooperation and participation of all subcontractors and manufacturers.
- 4. Attend the pre-construction and Commissioning Team meetings.
- 5. Include Commissioning Process milestones in the project schedule.
- 6. Implement the training program as detailed in the Contract Documents.
- 7. Provide submittals to the owner, design professionals, and the Commissioning Authority.
- 8. Notify the Commissioning Authority when systems and assemblies are ready for testing.

- 9. Demonstrate the performance of assemblies and/or operation of systems to the Commissioning Authority.
- 10. Complete the Construction Checklists as the work is accomplished. Provide the completed Construction Checklists to the Commissioning Authority.
- 11. Continuously maintain the Record Drawings and submit as detailed in the Contract Documents.

MANUFACTURERS

- 1. Provide all information required for the operation and maintenance of the system or assembly as part of the initial submittal.
- 2. Provide the requirements to maintain the warranty as part of the initial submittal.
- 3. Coordinate and accomplish factory tests as detailed in the Contract Documents.
- 4. Provide training as detailed in the training program contained in the Contract Documents.
- 5. Demonstrate operation and performance of the system or assembly as detailed in the Contract Documents.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX G COMMISSIONING PLAN

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

The following is an example outline for a Commissioning Plan. The basic structure of this example is such that each phase of the plan has its own section detailing what activities will be accomplished and guidance on who accomplishes them and how they are completed. The results from each activity are then included in an appendix. The intent of this format is for the Commissioning Plan to become the Final Commissioning Process Report at the end of the project by filling in the results as the project progresses.

Depending upon the size and scope of the Commissioning Process activities, it may be beneficial to have three Commissioning Plans: one for the Pre-Design Phase, one for the Design Phase, and one for the Construction Phase. If separate Commissioning Plans are used, then care must be taken to inform those that are involved in only a portion of the process of the previous material.

SAMPLE TABLE OF CONTENTS

COMMISSIONING PLAN OVERVIEW COMMISSIONING PROCESS DESCRIPTION PRE-DESIGN PHASE Develop Owner's Project Requirements

Develop Initial Commissioning Plan Commissioning Process Issues Step 1 - Identify and Record Issues Step 2 - Calculate Avoided Costs Step 3 - Evaluate Range of Avoided Costs DESIGN PHASE Review and Modify Project Specifications Verify Basis of Design Update Commissioning Plan Accomplish Design Reviews Develop Commissioning Process Contract Document Requirements Pre-Bid Meeting CONSTRUCTION PHASE Conduct Pre-Construction Meeting Contractor Submittal Review Construction Checklists Delivery Book Pre-Installation Checks Installation and Start-Up Checks Training Testing OCCUPANCY AND OPERATIONS PHASE Final Commissioning Process Report Seasonal Testing **Ongoing Training** Warranty Review Lessons-Learned Meeting CONTACT INFORMATION SCHEDULE REQUIREMENTS APPENDIX A - OWNER'S PROJECT REQUIREMENTS APPENDIX B - BASIS OF DESIGN APPENDIX C - PROJECT SPECIFICATIONS APPENDIX D - COMMUNICATION STRUCTURES APPENDIX E - ROLES AND RESPONSIBILITIES APPENDIX F - COMMISSIONED SYSTEMS [listing of systems and assemblies] APPENDIX G - COMMISSIONING PROCESS SCHED-ULE **APPENDIX H - PRE-BID MEETING APPENDIX I - PRE-CONSTRUCTION MEETING** APPENDIX J - SUBMITTAL REVIEW APPENDIX K - COMMISSIONING PROCESS ISSUES APPENDIX L - CONSTRUCTION CHECKLISTS **APPENDIX M - TESTS APPENDIX N - TRAINING** APPENDIX O - SYSTEMS MANUAL **APPENDIX P - MEETING MINUTES APPENDIX Q - CORRESPONDENCE** APPENDIX R - WARRANTY REVIEW APPENDIX S - LESSONS LEARNED

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX H ACCEPTANCE PLAN

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

Developing and documenting the acceptance procedures in an acceptance plan is an important task for the successful implementation of the Commissioning Process. The acceptance plan details the key Commissioning Process activities that must be accomplished at the end of each phase in a project in order to move on to the next phase.

The following provides a description of the details that should be included in the acceptance plan and demonstrates a format that could be used.

PRE-DESIGN PHASE

The Owner's Project Requirements and the Commissioning Plan are formally accepted by the Owner during the Pre-Design Phase, after review and comment by the Commissioning Authority. The general process for accepting these documents is:

- 1. The Commissioning Authority develops a draft of each document and provides it to the Commissioning Team.
- 2. The Commissioning Team provides comments on the draft documents.
- 3. The Commissioning Authority works with the Commissioning Team to resolve any issues.
- 4. The Commissioning Authority recommends acceptance of the documents to the Owner and provides copies for review.
- 5. The Owner reviews the modified documents and accepts.

DESIGN PHASE

Updated Owner's Project Requirements, updated Commissioning Plan, Basis of Design, and Contract Documents are formally accepted by the Owner during the Design Phase. The Owner's Project Requirements and the Commissioning Plan follow the same process as detailed in the Pre-Design Phase.

The general process for accepting the Basis of Design is:

- 1. The Commissioning Authority provides a list of information required and the format for the Basis of Design to the design professionals prior to the start of design.
- 2. The design professionals gather and organize the information during the creation of the design.
- 3. The design professionals submit the Basis of Design to the Owner and Commissioning Authority for review and comment with each design submittal.

4. Upon correction and resubmittal, the Owner accepts the Basis of Design based upon the recommendation of the Commissioning Authority.

The general process for accepting the Contract Documents is:

- 1. The design professionals submit the final package to the Owner and Commissioning Authority for review.
- 2. The Commissioning Authority evaluates the Contract Documents using random sampling to determine their ability to achieve the Owner's Project Requirements.
- 3. The Commissioning Authority meets with the design professionals to discuss and resolve comments.
- 4. Upon resolution of comments, the Commissioning Authority recommends to the Owner acceptance of the documents.
- 5. Owner reviews the comments, their resolution, and accepts the Contract Documents.

CONSTRUCTION PHASE

Updated Owner's Project Requirements, updated Commissioning Plan, updated Basis of Design, Systems Manual, training program, and a preliminary and a final Construction Phase Commissioning Process Report are formally accepted by the Owner during the Construction Phase. The Owner's Project Requirements, Commissioning Plan, and Basis of Design follow the same process as previously detailed.

The general process for accepting the Systems Manual is:

- 1. The Commissioning Authority tracks the Contractor submittals for the required documentation.
- 2. Within XX days of submittal acceptance for a system or assembly, the Contractor submits a draft Systems Manual to the Owner, Commissioning Authority, and design professionals.
- 3. The Commissioning Authority consolidates the reviews and meets with the design professionals to discuss and resolve.
- 4. The Contractor submits to the Commissioning Authority changes to the accepted submittals throughout construction.
- 5. XX days prior to the first training session, the Contractor submits the final Systems Manual to the Owner, Commissioning Authority, and design professionals.
- 6. The Owner accepts the final Systems Manual based upon the recommendation of the Commissioning Authority.

The general process for accepting the training program is:

- 1. The Commissioning Authority provides the training agendas to the Contractor.
- 2. The Contractor develops the training program, including identifying the trainer, the schedule of sessions, and the material to be developed. This information is submitted to the Owner, Commissioning Authority, and design professionals for review and comment.
- 3. Based upon the recommendation of the Commissioning Authority, the Owner accepts the training program.

- 4. The Contractor then develops the training material and submits it to the Owner, Commissioning Authority, and design professionals for review and comment XX days prior to the first training session.
- 5. Based upon the recommendation of the Commissioning Authority, the Owner accepts the training materials.
- 6. The Contractor implements the training program.
- 7. The Commissioning Authority randomly quizzes the trainees two weeks after the completion of a session.
- 8. The Contractor submits copies of all training materials and edited videotapes of the sessions.
- 9. The Commissioning Authority recommends acceptance of the completed training program to the Owner.

The general process for accepting the facility is:

- 1. Throughout construction the Commissioning Authority randomly samples the completion of the Construction Checklists for achieving the Owner's Project Requirements.
- 2. The Commissioning Authority directs the completion of system and assembly testing by the Contractor and documents the results.
- 3. The Commissioning Authority works with the Contractor in resolving any issues identified during testing.
- 4. The Commissioning Authority verifies that all system documentation is received from the Contractor.
- 5. The Commissioning Authority presents a preliminary Construction Phase Commissioning Process Report prior to occupancy that provides an evaluation of achieving each element of the Owner's Project Requirements, including recommendations to the Owner for acceptance/rejection of the facility.
- 6. The Commissioning Authority provides a final Construction Phase Commissioning Process Report with details on the Commissioning Process Activities completed during the Construction Phase.

OCCUPANCY AND OPERATIONS PHASE

Updated Owner's Project Requirements, updated Basis of Design, updated Systems Manual, seasonal test results, and Commissioning Process Report are formally accepted by the Owner during the Occupancy and Operations Phase. The Owner's Project Requirements, Basis of Design, and Systems Manual follow the same process as previously detailed.

The general process for accepting the seasonal test results

- is:
- 1. The Commissioning Authority directs the completion of seasonal system and assembly testing by the Contractor and documents the results.
- 2. The Commissioning Authority works with the Contractor in resolving any issues identified during testing.
- 3. The Commissioning Authority verifies that all updated system documentation is received from the Contractor.
- 4. The Commissioning Authority recommends to the Owner acceptance of the seasonal testing results.

The general process for accepting the Commissioning Process Report is:

- 1. The Commissioning Authority provides the Commissioning Process Report to the Owner, design professionals, and Contractor for review and comment.
- 2. The Commissioning Authority incorporates comments and provides a final copy to the Commissioning Team members.
- 3. The Owner accepts the Commissioning Process Report, ending the Commissioning Authority's responsibilities.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX I OWNER'S PROJECT REQUIREMENTS WORKSHOP GUIDANCE

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

The Owner's Project Requirements are considered the heart and soul of the Commissioning Process. When the Owner's Project Requirements are not developed, the owner, designer, contractors, and operation and maintenance (O&M) personnel each interpret the building requirements, including their individual responsibilities, from the standpoint of their own specific needs. This often creates a range of diverse views of the constructed project's needs. Unfortunately, while critical for a successful project, the Owner's Project Requirements are rarely developed. Developing Owner's Project Requirements that reflect the actual needs of the owner, the users or occupants, service and operating units, and sometimes the community is one of the, if not the, most important aspects for successful implementation of the Commissioning Process.

The following sections detail an example format to follow in developing the Owner's Project Requirements and a discussion of how to obtain the required information. Note that historically the Owner's Project Requirements have often been referred to as "design intent" or "project intent."

FORMAT

While there have been many formats used for presenting criteria for the Owner's Project Requirements, the Owner's Project Requirements workshop is one that has been well received by owners, designers, contractors, and O&M personnel. The workshop initially addresses general needs/requirements and progresses to specific requirements (i.e., moves from project needs to system/equipment/control needs). It is organized around and focuses upon assemblies and systems that have been identified as targets of the Commissioning Process. The workshop needs to be well organized, and it is very desirable to have the results formatted for immediate input into a computer analysis program for rapid feedback on consensus of the group. Information from the workshop is only one of various resources from which the Owner's Project Requirements document is developed. Following is a description of some of the information that can be included in an Owner's Project Requirements document.

Key sections of the Owner's Project Requirements document are:

- Background A narrative description to provide context about the project.
- Objectives For any project there are goals that must be achieved for the project to be successful. Goals can range from first cost, to time schedule, to number of change orders, or to life-cycle cost. Regardless of which goals are identified, they must be summarized up front to ensure everyone is on the same page.
- Green building concepts This is an optional section for owners who wish to focus upon the sustainability aspects of their building.
- Functional uses and requirements In addition to general documentation produced by the architect on functional uses of the building (office, storage, kitchen, etc.), the specific requirements for each functional area must be documented. This can include such items as security, safety, comfort, energy, maintainability, and indoor air quality.
- Lifespan, cost, and quality It is important to clearly document the owner's expectations for lifespan of materials, cost of construction, and the level of quality desired. By providing this information, unrealistic expectations are identified and eliminated.
- Performance criteria Often the most difficult to define, performance criteria detail minimum acceptable performance benchmarks for various aspects of the facility.
- Maintenance requirements The maintenance requirements are a mixture of the level of knowledge of the current O&M staff (what can they maintain) and the expected complexity of the proposed systems (what they can learn). If there is a significant gap between the two, no matter how well the building is constructed, it will not be maintained or operated properly.

The following are examples of Owner's Project Requirements elements that are common to most of the Technical Commissioning Process Guideline topics;

- Benchmarks for performance Specific criteria for the functional use of each space, assembly, and system must be defined. These include temperature, humidity, airflow, light, noise, durability, aesthetics (materials and colors), service life, reliability, redundancy, and the like. Typically, upper and lower limits are provided for general spaces, with exceptions noted as required.
- Problems to avoid Since occupant/user/operator complaints are common, it is important to identify and document those problems that have caused complaints in the past. If these problems are not documented and the situation recurs, the occupants often consider the entire project as a failure.

 Specific occupant requirements – Specific items that are deemed important to the various occupants in a building must be identified and documented. In speculatively built buildings, this section would detail the limits to which occupants can make use of their spaces. For example, a chemical laboratory cannot be put in a space designed and constructed for general office use without significant changes to the systems and possibly to the building as a whole.

OBTAINING THE INFORMATION

While it may be easy to obtain the information related to development of the Owner's Project Requirements, it is difficult to obtain quality information that the owner, O&M staff, service contractors, customers (i.e., students, patients, retail customers, renters), visitors, subtenants, occupants, and the community all agree upon. In quality-based processes, it is critical that input be obtained from all the users (the various user groups) and that the consensus of and differences between the groups be documented. There usually are requirements for which users do not all agree. These must be documented as unresolved items. Normally, the owner will make final decisions on what the priority order of Owner's Project Requirements will be. However, the owner and the rest of the Commissioning Team must be aware of all requirements so that the final product will include as many individual group requirements as are deemed appropriate and within the budget.

A simple three-step process is recommended for developing the Owner's Project Requirements:

- 1. Owner's Project Requirements workshop.
- 2. Owner's Project Requirements documentation (report).
- 3. Project team approval of the Owner's Project Requirements.

Owner's Project Requirements Workshop

The Owner's Project Requirements workshop is typically facilitated by the Commissioning Authority (CxA), who elicits the primary concerns of the project team. The workshop is organized to encourage identification of all requirements, to encourage interaction and discussion among all team members, and to arrive at group consensus of priorities for the Owner's Project Requirements. This is accomplished through the presentation of multiple questions in an ordered structure. A typical process uses a modified Nominal Group Technique workshop format. This is a formal means of gathering the highest level of consensus that approaches the real needs of the group. The procedure consists of the following steps:

- Provide each question or open concept to each individual participating in the workshop.
- Allow three to five minutes of quiet writing time for each individual to respond with as many answers and ideas as he/she can.
- Record individual responses in a round-robin fashion no discussion at this point, just record the responses on a visual flipchart, overhead, chalkboard, or multi-computer link to all participants.

- Review all responses, consolidate similar ones, and clarify so all in the group have the same understanding of all responses.
- Have individuals rank the responses for importance (1 through 5).
- Determine a group ranking from individual rankings.
- A re-discussion of the top 10 items—and any responses ranked most important—is desired, followed by a second round of individual and group combined rating/ ranking.

The questions asked during this workshop must be broad in nature, elicit discussion, result in a variety of viewpoints, and must not leave the workshop. The questions should not focus on such items as "at what temperature are you comfortable?" but should be broader, such as "how do you define comfort?" or "how will you measure the cost success of this project?" (versus a broader question, such as "how will you determine if this was a successful project?").

Owner's Project Requirements Documentation

The Owner's Project Requirements workshop will identify key items and priorities important to the project team, the owner, users, and the Commissioning Team. However, it does not provide specific values. For example, the number one Owner's Project Requirement may be good air circulation in the rooms. It is the responsibility of the Commissioning Authority to take the individual requirements developed by the project team and translate them into physical properties that can be measured, designed, and documented.

This transformation of the Owner's Project Requirements often requires input from a variety of sources, including the design team, contractors, specialists, standards, and guidelines. Typically, the Commissioning Authority has sufficient experience in the planning, design, construction, and operation of facilities to provide the oversight of such a task. If not, then experts should be retained to aid in the development of the Owner's Project Requirements.

Project Team Approval of the Owner's Project Requirements

After several iterations and reviews of the Owner's Project Requirements by the project and design teams, the requirements must be approved to provide the design team adequate direction for their design. It is important to distinguish development of the Owner's Project Requirements from the traditional role of the architect in the planning or programming process. The Owner's Project Requirements define the criteria required for success, whereas the architect's document may only address specific space size and occupant flow requirements. Where the Owner's Project Requirements may state that the functional use of the facility is X, Y, and Z, the architect's document may specify the locations of, the size of, and the flow of people through X, Y, and Z.

SUMMARY

The Owner's Project Requirements workshop is one means to provide consistency in the implementation of the Commissioning Process from project to project. It should be a topic addressed in the lessons-learned workshop during the Occupancy and Operations Phase of the Commissioning Process. Other techniques for developing the Owner's Project Requirements, such as interviews and surveys, do not allow interaction between the user groups. Further, it has been shown that the results or answers are biased by the beliefs of the expert who develops the questions for the interviews or surveys. Frequently, using such techniques the questions can be analyzed and the conclusions pre-determined whether the interviews or surveys are completed or not.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX J OWNER'S PROJECT REQUIREMENTS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

A general format for an Owner's Project Requirements document is presented in this annex. The structure provided is intended to encompass the facility requirements and enable the addition of sections depending upon the systems and assemblies to be constructed.

Introduction – Includes an overview of the project and the general reasons why the project is being undertaken. A description of the owner's processes (Commissioning Process) is typically contained in this section.

Key Owner's Project Requirements – Includes a listing of the key Owner's Project Requirements that the Commissioning Process will focus upon and that the owner (Commissioning Team) has determined are critical to the success of the project.

General Project Description - The size and scope of the project are included in this section.

Objectives – The objectives for accomplishing this project are detailed in this section.

Functional Uses – The expected functional uses (spaces) for the facility are detailed in this section. A short description of each functional use is included to provide the context in which it was detailed.

Occupancy Requirements – Includes the number of occupants (users and visitors) and the schedule of occupancy, including all special conditions.

Budget Considerations and Limitations – The expected budgetary restrictions and considerations are contained in this section.

Performance Criteria – The performance criteria upon which the project will be evaluated by the Commissioning Team are included in this section. Each performance criterion should be measurable and verifiable. Include subsections as appropriate to organize and explain the criteria:

- General
- Economic
- User Requirements
- Construction Process
- Operations
- Systems
- Assemblies

Owner's Project Requirements Version History – Includes a summary of the changes made throughout the Pre-Design, Design, Construction, and Occupancy and Operations Phases. This information is critical to understand and document the trade-offs made over time and the resulting impact on the project.

The following table will assist in the development of the Owner's Project Requirements document in accordance with Section 5.2.2.4 using the format presented in this annex. The table is also applicable for those developing Technical Supporting Guidelines as described in Annex A. Inclusion of specific criteria (such as the entries in this example matrix) will depend upon the project and the owner's needs. The Key Owner's Project Requirements Section should emphasize those OPR that are essential to the success of the project.

TABLE J-1 Example Matrix for Developing Owner's Project Requirements

		OPR Document Section							
	Cuideline () 2005 Subelause 5.2.2.4 Cri	Introduction	Key Owner's Project Require- ments	General Project Description	Objectives	Functional Uses	Occu- pancy Require- ments	Budget Con- siderations and Limita- tions	
	teria	1	2	3	4	5	6	7	
(a)	Project schedule and budget			Schedule				Budget	
(b)	Commissioning Process scope and budget	Scope						Budget	
(c)	Project documentation requirements, including format for submittals, training materials, reports, and the Systems Manual. Consideration should be given to use of electronic format documents and records where appropriate		Х						
(d)	Owner directives		Х						
(e)	Restrictions and limitations			Х					
(f)	User requirements		Х						
(g)	Occupancy requirements and schedules					Х	X		
(h)	Training requirements for Owner's person- nel		Х						
(i)	Warranty requirements		Х						
(j)	Benchmarking requirements		Х						
(k)	Operation and maintenance criteria for the facility that reflect the Owner's expecta- tions and capabilities and the realities of the facility type		Х						
(1)	Equipment and system maintainability expectations, including limitations of oper- ating and maintenance personnel		Х		Х				
(m)	Quality requirements for materials and con- struction		Х						
(n)	Allowable tolerance in facility system operations				Х				
(0)	Energy efficiency goals		Х		Х				
(p)	Environmental and sustainability goals		Х		Х				
(q)	Community requirements		Х						
(r)	Adaptability for future facility changes and expansion		Х		х	Х			
(s)	Systems integration requirements, espe- cially across disciplines					Х			
(t)	Health, hygiene, and indoor environment requirements		Х				Х		
(u)	Acoustical requirements		Х						
(v)	Vibration requirements		Х						
(w)	Seismic requirements		Х						
(x)	Accessibility requirements		Х						
(y)	Security requirements		Х						
(z)	Aesthetics requirements		Х						
(aa)	Constructability requirements		Х						
(bb)	Communication requirements		Х						
(cc)	Applicable codes and standards			Х					

TABLE J-1	(Continued) Example Matrix for Developing Owner's Project Requirements
	(continuou) Example matrix for Bereleping officer of reject requiremente

		OPR Document Section							
			Performance Criteria						
		General	Economic	User Requirements	Construction Process	Operations	Systems	Assemblies	OPR Version History
	Guideline 0 Body	8	9	10	11	12	13	14	15
(a)	Project schedule and budget								
(b)	Commissioning Process scope and budget								
(c)	Project documentation requirements, including format for submittals, training materials, reports, and the Systems Manual. Consideration should be given to use of electronic format documents and records where appropriate								
(d)	Owner directives								
(e)	Restrictions and limitations								
(f)	User requirements			X					
(g)	Occupancy requirements and schedules								
(h)	Training requirements for Owner's person- nel				Х	х			
(i)	Warranty requirements					Х			
(j)	Benchmarking requirements		Х		Х	Х	Х		
(k)	Operation and maintenance criteria for the facility that reflect the Owner's expecta- tions and capabilities and the realities of the facility type					Х	Х	Х	
(1)	Equipment and system maintainability expectations, including limitations of oper- ating and maintenance personnel				Х	Х	Х		
(m)	Quality requirements for materials and con- struction	Х			Х		Х	Х	
(n)	Allowable tolerance in facility system operations					Х	Х		
(0)	Energy efficiency goals		Х			Х	Х	Х	
(p)	Environmental and sustainability goals	Х							
(q)	Community requirements	Х							
(r)	Adaptability for future facility changes and expansion				Х	Х	Х	Х	
(s)	Systems integration requirements, espe- cially across disciplines	Х			Х				
(t)	Health, hygiene, and indoor environment requirements			Х					
(u)	Acoustical requirements	Х		Х	Х				
(v)	Vibration requirements	Х			Х				
(w)	Seismic requirements	Х			Х				
(x)	Accessibility requirements	Х		Х	Х	Х			
(y)	Security requirements	Х		Х	Х				
(z)	Aesthetics requirements	Х		Х	Х				
(aa)	Constructability requirements	Х			Х				
(bb)	Communication requirements	Х		Х	Х				
(cc)	Applicable codes and standards								

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX K BASIS OF DESIGN

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

The Basis of Design document records the major thought processes and assumptions behind design decisions made to meet the Owner's Project Requirements. The Owner's Project Requirements are intended to capture "what" the owner needs and expects from a project. The Construction Documents detail "how" the Owner's Project Requirements will be physically achieved. The Basis of Design captures important information linking the "what" and "how."

Basis of Design documentation is distinct from the Construction Documents, is seldom included in drawings and specifications, and is generally not needed by the Contractor to meet his/her obligations. It is exceptionally valuable to the Commissioning Team, however, when evaluating the ability of a design and its components to met the Owner's Project Requirements.

The objective of specifically documenting Basis of Design information is to provide the parties involved with a project, at each phase in the process, an understanding of the underlying thinking that led to the selection of specific components, assemblies, systems, and system integrations. A design narrative that provides an overview of assemblies and systems in verbal format is usually an integral element of the Basis of Design.

The Basis of Design document will typically be developed incrementally as work on a project moves from Pre-Design, to Design, and into the Construction Phase. Changes to the Basis of Design that often occur as a design evolves must be documented.

Content of the Basis of Design document will vary from project to project and system to system, but in general it should address the following:

- Specific codes, standards, and guidelines considered during design of the facility and designer interpretations of such requirements.
- Information regarding ambient conditions (climatic, geologic, structural, existing construction) used during design.
- Assumptions regarding usage of the facility.
- Expectations regarding system operation and maintenance.
- Performance criteria that the system was designed to meet linked to the Owner's Project Requirements.
- Specific design methods, techniques, software used in design.
- A narrative statement of design that verbally describes how the designer intends to meet the Owner's Project Requirements.

- A narrative statement of operation that verbally details how the facility is expected to operate under various situations (such as normal operation, extreme event, emergency).
- A listing of specific manufacturer makes and models used as the basis for drawings and specifications.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX L SPECIFICATIONS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

1. SPECIFICATIONS FOR THE COMMISSIONING PROCESS

1.1 This annex provides guidance on writing specifications for Commissioning Process activities to be performed by construction contractors. A guide specification is included with the assumption that the construction contractor is involved only during the construction phase and for the correction and warranty period.

1.2 Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facility systems and assemblies meets defined objectives and criteria. The Commissioning Process begins at project inception during the Pre-Design Phase and continues for the life of the facility through the Occupancy and Operations Phase. During the Pre-Design Phase, the Owner's Project Requirements (OPR) are determined and documented by the Commissioning Team, which includes the Owner, Commissioning Authority (CxA), design professionals, operation and maintenance personnel, occupants, and users. Throughout each phase of the project, deliverables (drawings, specifications, submittals, construction, training, documentation, etc.) are verified against the OPR.

1.3 An important document created during the Commissioning Process is the Basis of Design document or report (BoD). The design professionals create this document or report during the design phase. The BoD records the concepts, calculations, decisions, and product selections to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. It can include energy, environmental, sustainability, and other certification criteria, both formal and informal. The BoD includes both narrative descriptions and lists of individual items that support the design process.

1.4 ASHRAE or NIBS Guideline 0 provides guidance on content and basic format. While the OPR are Owner-developed criteria, few Owners have the resources to develop the

OPR. Owners without these resources depend on the Commissioning Team (see a definition and discussion of the term *Commissioning Team* in this guideline) to assist them in developing the OPR.

1.5 The OPR and BoD must be included or referenced in the construction Contract Documents for informational purposes only.

1.6 The construction contractor's obligation is to construct the building and its systems and assemblies according to the requirements prescribed in the Contract Documents. There normally are no performance requirements relating to the OPR stated in the Contract Documents. The exceptions to this include situations where contractors are required to provide designs for systems or assemblies to be signed and sealed by licensed professionals.

2. THE COMMISSIONING AUTHORITY (CxA)

2.1 The primary role of the CxA is to verify achievement of the OPR throughout the project, from Pre-Design Phase through Occupancy and Operations Phase. The Owner should perform this role.

2.2 When the Owner cannot perform the CxA duties with qualified personnel, then the CxA should have a separate professional services agreement with the Owner, as this avoids conflicts of interest and provides independence from the other parties (the Owner's project manager, designers of record, construction managers, suppliers, and construction contractors). This professional services agreement defines the duties, rights, and responsibilities of the CxA for each phase of the project. This separate relationship allows the CxA to act independently as director of Commissioning Process activities, to focus on achieving the OPR, and to communicate directly with the Owner.

2.3 The CxA is a group of personnel with expertise and experience in the design, construction, and operations of the various systems and assemblies included in the project. These personnel are led by an individual who has expertise and experience in successfully implementing the Commissioning Process.

2.4 If the CxA is an employee, associate, or partner of the same organization as the designer of record or construction management firm, there is a conflict of interest. While not a recommended approach, in these instances the CxA must have a separate professional services agreement, be organizationally separate from the design team or construction management team, and define and manage the conflicts of interest

to provide the Owner with the independence required for the Commissioning Process to be successful.

2.5 The CxA does not perform testing; it directs the process and directs the recording of the results. The CxA plans, schedules, and supervises Commissioning Process activities to verify achievement of the OPR. The Contractor completes construction checklists, performs tests, and accomplishes other Commissioning Process activities.

3. ORGANIZATIONAL STRATEGY FOR INCLUSION OF COMMISSIONING ACTIVITIES IN THE SPECIFICATIONS

3.1 Specifications (as a part of the construction Contract Documents) should include only the Commissioning Process activities the contractors perform during the life of the construction contract, including the work required during the correction period and for warranties.

3.2 Supplementary Conditions: Modify the General Conditions of the Contract for Construction in a document titled "Supplementary Conditions." Among other provisions, define the CxA and include the CxA's duties, rights, responsibilities, and limits of authority and additional requirements for substantial completion. AIA Document A511, "Guide for Supplementary Conditions," provides guidance about how to write Supplementary Conditions.

3.3 General Requirements for the Commissioning Process: Specifications in Division 1 include the general requirements for contractors relating to Commissioning Process activities. The "Summary" Section describes, in general, how the Contractors, separate Contractors (if there is more than one Prime Contractor), or the Construction Manager must interact with the CxA. Administrative procedures for the Commissioning Process are specified in the Division 1 Section "Commissioning."

3.3.1 The remainder of the specification language, with the exception of Division 1 sections for temporary facilities and controls, should be mute on the subject of who must perform the work.

3.3.2 Other Division 1 Commissioning Sections should describe the testing requirements for systems and assemblies.

3.3.2.1 References in Table L-1 are to MASTER-SPEC® section numbers and titles existing at the time this annex was written. Refer to the current MASTERSPEC consolidated table of contents because section numbers and titles may have changed.

SEC NO.	DOCUMENT/SECTION	LIST OF CONTENTS	SCOPE OF CONTENTS
01100	SUMMARY	Work covered by Contract Docu- ments	Describe Commissioning Process activities as a part of the project.
		Identification of separate prime contractors	Alert the Contractor that the Owner has contracted for commissioning with a separate Commissioning Authority.
			Delineate scope of Commissioning Process.
01290	PAYMENT PROCEDURES		No special Commissioning Process requirements.
01310	PROJECT MANAGEMENT AND COORDINATION	Provisions about coordination of Commissioning Process activi- ties among contractors and sub- contractors; project meetings.	Add requirements to include CxA in coordination meetings (particularly "Pre-Construction Meeting"). Coordination of meetings and conferences.
01330	SUBMITTAL PROCEDURES	Procedures for submittals	Submittal requirements for Commissioning Process activity reports and schedules should be specified in Sections 01811 to 01819.
			Add requirements here for additional copies from Con- tractor to CxA and for approved submittals to be dis- tributed to CxA.
01400	QUALITY REQUIREMENTS		Coordinate with Commissioning Process activities, witnessing of tests, and test reports.
01500	TEMPORARY FACILITIES AND CONTROLS		Include office space for CxA and utility services for Commissioning Process activities.
01600	PRODUCT REQUIREMENTS		No special Commissioning Process requirements.
01731	CUTTING AND PATCHING		No special Commissioning Process requirements.
01770	CLOSEOUT PROCEDURES		Include key Commissioning Process milestones to achieve substantial completion and closeout.
01782	OPERATION AND MAINTE- NANCE DATA		Include requirements for CxA to review and recom- mend approval of Systems Manual. Same procedures as described for Section 01330—
			Submittals.
01810	GENERAL COMMISSIONING REQUIREMENTS		General administrative and procedural requirements without regard to specific systems and assemblies.
01811	BUILDING ASSEMBLY COMMISSIONING REQUIREMENTS	Substructure Superstructure Building Shell Exterior Wall Assemblies Roof Assemblies Building Interior Separations Paths of Egress	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01812	CONVEYING SYSTEM COM- MISSIONING REQUIRE- MENTS	Elevators and Lifts Escalators and Moving Walks	Lists of Construction Checklists Prerequisites To Testing System or Assembly Test Requirements Test Reports
01813	PROTECTIVE SYSTEM COMMISSIONING REQUIREMENTS	Fire Suppression (including pumps, sprinkler and standpipe piping, and terminal devices) Detection and Alarms (including fire, smoke, gas, and leak) Lightning Protection (this is not part of electrical distribution) Cathodic Protection (this is not part of electrical distribution)	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports

SEC NO.	DOCUMENT/SECTION	LIST OF CONTENTS	SCOPE OF CONTENTS
01814	PLUMBING SYSTEM COMMISSIONING REQUIREMENTS	Water Distribution Sanitary Waste Storm Drainage Other Plumbing Systems	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01815	HVAC&R SYSTEM COMMIS- SIONING REQUIREMENTS	Heat Generation (including cen- tral equipment, distribution sys- tems, and terminal devices) Refrigeration (including central equipment, distribution systems, and terminal devices) Ventilation (including central equipment, distribution systems, and terminal devices) HVAC Control Systems (includ- ing central equipment, distribu- tion systems, and terminal devices)	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01816	ELECTRICAL SYSTEM COMMISSIONING REQUIREMENTS	Power Distribution (including central equipment, distribution circuits, and terminal devices) Lighting (includes fixtures and controls)	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01817	COMMUNICATIONS SYS- TEMS COMMISSIONING REQUIREMENTS	Voice and Data Sound and Video	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01818	ELECTRONIC SAFETY AND SECURITY SYSTEMS COM- MISSIONING REQUIRE- MENTS	Security Access, Perimeter Secu- rity, Intrusion Detection, Alarm and Detection Systems (includ- ing fire and smoke and leak detec- tion)	Lists of Construction Checklists Prerequisites to Testing System or Assembly Test Requirements Test Reports
01820	DEMONSTRATION		Coordination requirements with the CxA
	INDIVIDUAL SECTIONS IN DIVISIONS 2 THROUGH 16	Field Quality Control Tests Adjusting and Balancing Cleaning Demonstration	A statement requiring system, subsystem, or equip- ment to be commissioned as a part of its parent system. A statement requiring Contractor to complete con- struction checklists and perform tests.

TABLE L-1 (Continued) Description of Specification Sections

3.3.3 *Extent of Testing*: The contractor's involvement in Commissioning Process tests must be clearly defined. The extent of this testing is determined by the Commissioning Team during the Design Phase based upon the OPR.

3.4 Component Commissioning Process Specifications: Sections in Divisions 2 through 16 should specify testing and reporting requirements for products and equipment that are part of a system or assembly and then be referenced to the appropriate Commissioning Process sections in Division 1 for the overall system or assembly requirements.

3.4.1 During construction the CxA verifies that contractor activities, such as installation and start-up; testing; demonstration and training of the Owner's operator and maintenance personnel; and Systems Manual, achieve the OPR. Coordinating activities by the contractor in support of the CxA should be specified within the section where the component is specified (i.e., in individual sections in Divisions 2 through 16) if special requirements are necessary. The following are examples of requirements to include in individual sections in Divisions 2 through 16:

3.4.1.1 *Installation and Start-up*: Include requirements for involvement of factory-authorized service representative in individual sections and for the completion of construction checklists.

3.4.1.2 *Testing*: Include requirements to support the CxA in verifying test results, ranging from coordinating testing, to witnessing the test, to utilizing contractor personnel and test equipment to verify the test report.

3.4.1.3 *Demonstration and Training*: Include special requirements unique to the component within its own section.

3.4.1.4 Operation and Maintenance Data: Include unique requirements for the type of information required (e.g., particular requirements about parts lists, service schedules, preventive maintenance lists, and emergency operations) for long-term maintenance of the OPR.

3.4.2 In each section include an article under "General" that refers to Division 1 for Commissioning Process activities for system or assembly requirements. An example is as follows:

- 1.XX Commissioning Process Activities
 - A. The roofing materials specified in this Section are included in the Commissioning Process as a part of the building envelope system and roofing subsystem and integrated with flashing, coping, and insulation.
 - B. Complete the construction checklists and perform tests specified in the Division 1 Section "Building Assemblies Commissioning Requirements."

4. INTRODUCTION TO GUIDE SPECIFICATIONS

This Specification Section was written in cooperation with Architectural Computer Services, Inc. (ARCOM), who are the exclusive publishers and distributors of MASTER-SPEC, a product of the American Institute of Architects. MASTERSPEC Section 01 9113—General Commissioning Requirements—is included in Guideline 0 by special agreement between ASHRAE and ARCOM.

4.1 The section includes boxed notes that are instructions to guide specifiers during editing of the specifications for a project.

4.2 The section includes optional text in boldface font and square brackets (e.g., **[optional text**]). These optional text items include text that often occurs and provides an easy way to include these requirements in the master for consideration for each project.

4.3 The section includes insert instructions in boldface font and angle brackets (e.g., **<Insert instructions**>). These instructions are placed where text must be inserted and provide some guidance about the nature of the text that must be inserted. Insert instructions are used when there are an infinite number of options that could occur making the use of **[Optional text]** impractical.

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SECTION 01 9113 - GENERAL COMMISSIONING REQUIREMENTS

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Throughout the Section, the optional text "[each]" is included with the term "Contractor." Retain "each" for projects that include multiple prime contractors; delete for projects that have a single prime contractor.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

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.

Documents referenced in paragraph below should be prepared during schematic design phase or earlier and updated as design progresses. They should be provided to Contractor when the commissioning process is implemented on Project.

- B. OPR and BoD documentation are included by reference for information only.
- 1.2 SUMMARY
- A. This Section includes general requirements that apply to implementation of the commissioning process without regard to specific systems, assemblies, and components.
- B. Related Sections include the following:

List below only requirements that the reader might expect to find in this Section but are specified elsewhere. The first four and the last three subparagraphs are not yet available in MASTERSPEC but should be written and included if total building commissioning is implemented.

- 1. Division 01 Section "Facility Substructure Commissioning" for commissioning process activities for foundations and basement systems and assemblies.
- 2. Division 01 Section "Facility Shell Commissioning" for commissioning process activities for superstructure, exterior enclosure, and roofing systems and assemblies.
- 3. Division 01 Section "Interiors Commissioning" for commissioning process activities for interior construction, stairways, and interior finishes systems and assemblies.
- Division 14 Section "Commissioning of Conveying Equipment" for commissioning process activities for dumbwaiters, elevators, escalators and moving walks, lifts, turntables, and scaffolding systems, assemblies, equipment, and components.
- 5. Division 21 Section "Commissioning of Fire Suppression" for commissioning process activities for fire suppression systems, assemblies, equipment, and components.
- 6. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.
- Division 23 Section "Commissioning of HVAC&R" for commissioning process activities for commissioning heating, ventilating, air-conditioning, and refrigeration systems, assemblies, equipment and components.
- 8. Division 25 Section "Commissioning of Integrated Automation" for commissioning process activities for commissioning integrated automation systems, assemblies, equipment and components.
- 9. Division 26 Section "Commissioning of Electrical" for commissioning process activities for electrical systems, assemblies, equipment, and components.
- 10. Division 27 Section "Commissioning of Communications" for commissioning process activities for communication systems, assemblies, equipment, and components.
- 11. Division 28 Section "Commissioning of Electronic Safety and Security" for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.
- 12. Division 33 Section "Commissioning of Utilities" for commissioning process activities for water, wells, sanitary sewerage, storm drainage, fuel distribution, hydronic and steam energy, electrical, and communications utilities systems, assemblies, equipment, and components.
- 1.3 DEFINITIONS

Retain acronyms, abbreviations, and terms below that remain after this Section has been edited.

A. BoD: Basis of Design. A document, prepared by Architect, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

- B. Commissioning Plan: A document, prepared by CxA, that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxA: Commissioning Authority.
- D. OPR: Owner's Project Requirements. A document, prepared by Owner, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- E. Systems, Assemblies, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, equipment, and components.
- 1.4 COMMISSIONING TEAM
- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of [each]Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by Owner:
 - 1. CxA: An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.
- 1.5 OWNER'S RESPONSIBILITIES
- A. Provide the OPR documentation to the CxA and [each]Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

Coordinate activities specified in paragraph below with Owner-Architect and Architect-Consultant agreements.

- C. Provide the BoD documents, prepared by Architect and approved by Owner, to the CxA and [each]Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
- 1.6 [EACH]CONTRACTOR'S RESPONSIBILITIES

Coordinate this Article with requirements specified in Division 01 Section "Summary of Multiple Contracts" for Project Coordinator's responsibilities.

- A. [Each]Contractor and their subcontractors shall assign representatives with expertise and authority to act on their behalf and schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 2. Cooperate with the CxA for resolution of issues recorded in "Issues Log."
 - Attend and participate in commissioning team meetings held [weekly] [biweekly] [monthly] [variable] <Insert frequency>.
 - 4. Integrate and coordinate commissioning process activities with construction schedule.
 - 5. Review and accept construction checklists provided by the commissioning authority.
 - Complete [paper] [electronic] construction checklists as Work is completed and provide to the commissioning authority on a [daily] [weekly],<Insert frequency>. basis.
 - 7. Review and accept commissioning process test procedures provided by the commissioning authority.
 - 8. Accomplish commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

Include CxA responsibilities in this Article that have impact on Contractor activities and responsibilities.

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Convene commissioning team meetings.
- D. Provide Project-specific construction checklists and commissioning process test procedures.
- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, CxA will report the failure in the "Issues Log."

- F. Prepare and maintain issues log.
- G. Prepare and maintain completed construction checklist log.
- H. Witness systems, assemblies, equipment, and component startup.
- I. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 9113

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX M CONSTRUCTION CHECKLISTS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

OVERVIEW

Construction Checklists consist of two types:

Component/Equipment Based: These Construction Checklists are utilized for components and pieces of equipment that are delivered, installed, and started up during construction. There is an individual checklist for each individual component or piece of equipment.

System/Assembly Based: These Construction Checklists are utilized for systems and assemblies where separate checklists cannot be applied to subcomponents of the system or assembly. There is a single checklist for the entire system.

The following provides a generic structure to follow for the development of Construction Checklists for any equipment, component, system, or assembly.

[INSERT EQUIPMENT/COMPONENT NAME] CHECKLIST

TAG ID:_____

GENERAL INSTRUCTIONS:

- 1. This form is to be completed as the work is completed on [insert equipment/component name].
- 2. Complete Section 1 Model verification upon delivery of equipment/component to either the job site or storage location.
- 3. Complete Section 2 Pre-installation checks just prior to initial installation.
- 4. Complete Section 3 Installation as installation progresses.
- 5. Fill in data, circle item, and initial as indicated.

1. [INSERT EQUIPMENT/COMPONENT NAME] MODEL VERIFICATION

	Specified	Submitted	Installed
[list items to check, such as make, model, and size]			

2. PRE-INSTALLATION CHECKS

The following must be completed upon delivery of equipment/component to the work site.

		Contractor	Initial	CxA
2A	Physical Checks			
	[insert physical checks to be verified prior to installation, such as "free of damage" and cleanliness]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
2B	Component Verification			
	[insert component checks to be verified prior to installation, such as location and type of components]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		

3. INSTALLATION

The following items need to be verified during installation. Fill in blanks with check, specific information, or circle "yes" or "no." For any negative responses, complete Section 4.

		Contractor	Initials	CxA
3A	[insert title of major installation step]			
	[insert items to verify as installation step is accomplished]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
3B	[insert title of major installation step]			
	[insert items to verify as installation step is accomplished]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
3C	[insert title of major installation step]			
	[insert items to verify as installation step is accomplished]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
3D	[insert title of major installation step]			
	[insert items to verify as installation step is accomplished]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
3E	[insert title of major installation step]			
	[insert items to verify as installation step is accomplished]	Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		

4. NEGATIVE RESPONSES (ATTACH SHEETS AS NECESSARY)

Item	Reason for negative response	Resolution

[INSERT SYSTEM/ASSEMBLY NAME] INSTALLATION CHECKLIST

GENERAL INSTRUCTIONS

- 1. This form is to be completed daily by each [insert system/assembly name] work crew at the end of its shift.
- 2. Date and describe work completed in the appropriate section (1 for pre-installation and 2 for installation).
- 3. Verify achievement of quality requirements by circling "Yes" or "No." For negative responses, complete Section 3.
- 4. Initial.

1. [INSERT SYSTEM/ASSEMBLY NAME] PRE-INSTALLATION CHECKS

Date	Description of Work Performed		Items (see descriptions below)					
		[insert title A]	[insert title B]	[insert title C]	[insert title D]	[insert title E]		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		

[INSERT TITLE A]:	[INSERT DESCRIPTION OF TITLE A]
[INSERT TITLE B]:	[INSERT DESCRIPTION OF TITLE B]
[INSERT TITLE C]:	[INSERT DESCRIPTION OF TITLE C]
[INSERT TITLE D]:	[INSERT DESCRIPTION OF TITLE D]
[INSERT TITLE E]:	[INSERT DESCRIPTION OF TITLE E]

	Description of		Drawings	Percent				
Date	Work Performed	[insert title F]	[insert title G]	[insert title H]	[insert title I]	Updated?	Complete	Initial
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		
		Yes / No	Yes / No	Yes / No	Yes / No	Yes / No		

2. [INSERT SYSTEM/ASSEMBLY NAME] INSTALLATION CHECKS

<u>[INSERT TITLE F]</u> :	[INSERT DESCRIPTION OF TITLE F]
<u>[INSERT TITLE G]</u> :	[INSERT DESCRIPTION OF TITLE G]
<u>[INSERT TITLE H]</u> :	[INSERT DESCRIPTION OF TITLE H]
<u>[INSERT TITLE I]</u> :	[INSERT DESCRIPTION OF TITLE I]

DRAWINGS UPDATED: THE INSTALLED SYSTEM IS SHOWN ON THE RECORD DRAWINGS.

3. CONFLICTS (ATTACH SHEETS AS NECESSARY)

Date	Description of Conflict	Suggested Resolution	Resolved?
			Yes / No

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX N QUALITY-BASED SAMPLING EXAMPLES

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

DESIGN PHASE SUBMISSIONS

A critical step in the Commissioning Process is the review of the design submissions from the design professionals. It is important to remember that the role of the Commissioning Authority is to verify that the Owner's Project Requirements are met and that the system is designed in a quality manner. There are three distinct reviews that are completed on a drawing set – general, coordination, and field specific. A review of the specifications is also required. The general steps of completing a drawing review are as follows:

GENERAL REVIEW

- 1. *Review the Owner's Project Requirements*: Since the drawing review is to verify that the Owner's Project Requirements were met, prior to the review, the Owner's Project Requirements should be reviewed to familiarize the reviewer with the key criteria of the facility.
- 2. Document the General Review Criteria: The criteria from which to accomplish the general review of the submission must be documented. The criteria should be based on general quality characteristics and specific Owner's Project Requirements criteria. The general quality characteristics should include items such as:
- Continuation of items (ductwork, pipes, etc.) from page to page
- Labeling, including correct room numbering
- Details corresponding to actual components
- Schedules including basis of design information
- All information legible (not hidden by crossing lines or text)
- Owner's Project Requirements information is included on drawings
- 3. Accomplish Quick General Review: The general review is intended to familiarize the reviewer with the submission. If during this review significant items are identified as of poor quality, then the review process should be stopped and the design professionals contacted to discuss the quality concerns. If the general quality is good, move on to the Coordination Review.

COORDINATION REVIEW

1. *Determine Sampling Areas*: For each floor plan area (i.e., if there are five sheets for each floor, then there are five floor plan areas for each floor) select a single 10" by 10" square

randomly. A simple way to do this is to divide the drawing sheet into 15 squares (5 by 3) and select square number 3 on the first sheet (area) and then 5, 7, etc., for each remaining area. This selection is accomplished typically using the architectural sheets.

- 2. *Select Review Samples on Drawings*: Using the sampling strategy chosen in Step 1, mark the sample areas to be reviewed in each area. This should be accomplished for each trade (landscaping, architectural, structural, plumbing, mechanical, electrical, etc.).
- 3. *Accomplish Coordination Review*: For each area, compare the squares between each discipline. The intent of this review is to identify coordination problems with the placement and installation of components. Items of specific interest include:
- Placement of multiple pieces of equipment/components in the same location
- Accessibility to equipment/components for maintenance/replacement
- Use of consistent terminology (e.g., room numbers,)
- Elevations provided where multiple systems are placed in the same area
- Other trade duties clearly identified (e.g., electric wiring for HVAC equipment, holes for sinks)

If significant coordination problems are identified, stop the review and contact the design professionals to discuss. If the coordination is good, continue on with the Field Specific Review.

FIELD SPECIFIC REVIEW

- 1. Determine the Review Sampling Procedure: Use random sampling that selects every x^{th} square on the drawings to be verified. Squares that are completely blank (no walls, equipment, etc.) are not included in the counting. For example, if there are 10 pages of drawings and each drawing is split into 15 grids (5 × 3), there will be 150 potential grids to review. If a 20% sample rate is desired, then 30 grids would be reviewed, or every 5 grids. The starting grid should be chosen using a random selection process (die, 1-6 in a hat, etc.).
- 2. Document Review Criteria: The criteria from which to review the drawings should be based on specific Owner's Project Requirements criteria. This typically includes items such as accessibility, maintainability, meeting sustainability goals, comfort conditions, documentation of Owner's Project Requirements and Basis of Design, and operating details.
- 3. *Select Review Samples on Drawings*: Using the sampling strategy chosen in Step 1, mark the sample areas to be reviewed.
- 4. *Accomplish Detailed Statistical Review*: Using the review criteria from Step 2 and the selections from Step 3, accomplish a detailed review of the drawings. This includes verifying that the specifications match those shown on the drawings (see below for specification review details). For

example, if a VAV box is in the selected square, the steps in accomplishing the detailed review might include:

- (a) Review design calculation inputs for matching architectural assumptions and the Owner's Project Requirements.
- (b) Compare calculation results with the total airflow of the diffusers downstream of the VAV box and with the VAV box schedule.
- (c) Compare location of VAV box with maintenance requirements of the selected make and model (Basis of Design).
- (d) Compare VAV box location on drawings with requirements in the specifications.
- (e) Review the Owner's Project Requirements for other issues that the VAV box could impact.
- 5. Document Concerns: During the review of the drawings keep detailed notes of problems found or concerns with certain items. Also, at the end of the review, a general summary of the quality of the drawings should be developed. A letter detailing the quality of the drawings should then be sent to the design professionals and the owner with specific recommendations and directions given.
- 6. *Review the Drawing Review Procedure*: After the drawing review is completed, this document should be reviewed and modified to improve the process for the next time.

SPECIFICATION REVIEW

- 1. Determine the Review Sampling Procedure: The purpose of this review is to determine the general quality of the specifications. During the Field Specific Review the actual details are checked. The sampling procedure should check approximately 10% of the specifications. The easiest way of doing this is to check every xth page of the specifications (i.e., if there are 100 pages, check every 10th page).
- 2. *Accomplish General Review*: The review should focus on the quality of the specification, specifically:
- Are there extraneous sections that do not pertain to the project (i.e., medical gas in an office building, 15 types of valves when only 2 used, etc.)?
- If a manufacturer has been listed, has the engineer checked to verify that the Owner's Project Requirements are met?
- Are there any "or as equals"? ("As equal" should always be defined)
- Are the directions clear and concise?
- 3. *Develop Summary of Review* Develop a summary of the review. If there are problems with the specifications, contact the design professionals and discuss.

DESIGN PROFESSIONAL ACTIONS

Comments provided by the Commissioning Authority need to be formally replied to by the design professionals. If systemic issues are identified during the Commissioning Authority's review, the design process should be stopped and the issues resolved. It is expected at the next submission that the Commissioning Authority will again use random sampling that will result in a review of different areas on the drawings and the specifications and that will identify whether the systemic issue has been resolved. Back-checking of the specific items may be appropriate, but not as the sole means of verifying resolution of the issue.

(This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX O SYSTEMS MANUAL

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

Developing the Systems Manual encompasses gathering all of the information related to the systems, assemblies, and the Commissioning Process and incorporating it into a usable information resource with indexes and cross-references. This resource shall include the final Owner's Project Requirements, Basis of Design, the final Commissioning Plan, Commissioning Process Report, manufacturer installation manuals, manufacturer operations and maintenance manuals, system schematics, verified Record Drawings, and test results. This information is edited and organized to focus upon the key systems (roofing, walls, fire alarm, chilled water, hot water, etc.) in the building. Coordination with operations and maintenance personnel in developing standard formats and divisions (shops) is accomplished to simplify future Systems Manual development.

Also included in the Systems Manual is the development of periodic maintenance and information for insertion into a computer maintenance management system (CMMS), including equipment make and model information, checking requirements, maintenance requirements, and troubleshooting items.

The Commissioning Authority shall be responsible for verifying the development of the Systems Manual.

The entity responsible for developing the Systems Manual shall include all items involved in the project and capture the system and assembly data in either an electronic or printed version. In addition, printed operations, service, maintenance, spare parts list, and repair manuals may be provided. This entity (owner, contractor, design professional, other) shall have the skills of design, construction, and operations required to develop a cohesive Systems Manual.

The required details for a full Systems Manual are enhanced in each of the technical Commissioning Process Guidelines. The Systems Manual will have multiple sections depending upon the number of systems focused upon during the Commissioning Process. The Systems Manual will include a detailed table of contents with a notation as to resource storage location if not in the actual manual. The following outline is a recommended format:

1. General.

(a) Executive Summary (facility level).

This section includes an overall description of the building and its systems, including a listing of major capabilities and limitations imposed by the design or building code. The description should include type of facility, general description (number of floors, gross area, net area, type of occupancy, etc.), and general system descriptions. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information should be included in this section.

(b) Owner's Project Requirements (facility level).

A copy of the final Owner's Project Requirements for the facility is included in this section. This document was initially developed during the Pre-Design Phase and was updated throughout the project by the Owner, Commissioning Authority, or design professionals.

(c) Basis of Design (facility level).

This section includes the final Basis of Design document at a facility level. This document is written by the design professionals during the Design Phase and is updated by them to include any changes during the Construction Phase.

(d) Construction Record documents and specifications (not included in specific systems sections).

This section includes elements of the record set of Construction Documents (including specifications) that are not covered under specific systems—updated to reflect the final installation.

(e) Approved submittals (not included in specific system sections).

This section includes a copy of the approved submittals (not included under specific systems) with all field modifications and accessories clearly marked. In addition, the comments from original submittals shall be included.

(f) Facility operating procedures for all normal, abnormal, and emergency modes of operation (facility level).

This section includes detailed operating procedures for the facility during normal, abnormal, and emergency modes of operation. This is not intended to be automatic control sequences, but general operating procedures. This would include items such as building access during various situations (normal operation, after-hours operation, fire alarm, civil disturbance operation, emergency power operations, etc.).

(g) A list of recommended operational record keeping procedures at the facility level, including sample forms, trend logs, or others, and a rationale for each.

This section includes direction to the operation and maintenance personnel as to what information needs to be

documented and kept on the operation of the facility and why these records are important or will benefit the Owner or operations and maintenance personnel in the future.

(h) Maintenance procedures, schedules, and recommendations (facility level).

This section includes the manufacturer's recommendations for maintenance procedures and when maintenance should be performed on systems not included in specific system sections.

(i) Ongoing Optimization (facility level).

This section includes guidance for the ongoing optimization of the facility. Included in the section are schedules of periodic benchmarking using checklists and tests developed for the original construction, procedures for maintaining the Owner's Project Requirements and Basis of Design documents, and guidance on what to do when the Owner's Project Requirements are not achieved.

(j) Attachments:

Commissioning documents listing and storage location.

[*The following section is completed for each system or assembly requiring operation and maintenance.*]

- 2. xxx System/Assembly.
 - (a) Executive Summary (xxx System/Assembly).

This section includes a description of the systems/ assemblies covered in this section, including a listing of capabilities and limitations imposed by the design or building code. The description should include type of system/assembly, general description, and schematics. A list of contractors, subcontractors, suppliers, and design professionals involved with this system along with their contact information should be included.

(b) Owner's Project Requirements (xxx System/ Assembly level).

A copy of the final Owner's Project Requirements dealing with this system/assembly is included in this section. This document was initially developed during the Pre-Design Phase and was updated throughout the project by the Owner, Commissioning Authority, or design professionals.

(c) Basis of Design (xxx System/Assembly level).

This section includes the final Basis of Design document (including the design intent) as related to the specific systems included in this section. This document is typically written by the design professionals during the Design Phase and is updated by them to include any changes during the Construction Phase.

(d) Construction Record documents and specifications (xxx System/Assembly).

This section includes the record set of Construction Documents (including specifications) that has been updated to reflect the final installation of the specific system/assembly included in this section. (e) Approved submittals (xxx System/Assembly).

This section includes a copy of the approved submittals for the components associated with the system/ assembly with all field modifications and accessories clearly marked. In addition, the comments from original submittals shall be included.

 (f) Operating procedures for all normal, abnormal, and emergency modes of operation (xxx System/ Assembly).

This section includes detailed operating procedures for xxx systems/assemblies during normal, abnormal, and emergency modes of operation. This is not intended to be automatic control sequences, but general operating procedures.

(g) A list of recommended operational record-keeping procedures, including sample forms, trend logs, or others, and a rationale for each (xxx System/ Assembly).

This section includes direction to the operations and maintenance personnel as to what information needs to be documented and kept on the operation of the systems and why these records are important or will benefit the Owner or operations and maintenance personnel in the future.

(h) Maintenance procedures, schedules, and recommendations (xxx System/Assembly).

This section includes the manufacturer's recommendations for maintenance procedures and when maintenance should be performed.

(i) Ongoing optimization (xxx System/Assembly).

This section includes guidance for the ongoing optimization of the system/assembly. Included in the section are schedules of periodic benchmarking using checklists and tests developed for the original construction, procedures for maintaining the Owner's Project Requirements and Basis of Design documents, and guidance on what to do when the Owner's Project Requirements are not achieved.

(j) Operations and maintenance manuals (xxx System/ Assembly).

This section includes the manufacturer's printed operations and maintenance manuals for the specific equipment/components provided for the xxx system/ assembly. Also included is a parts and recommended spare parts list, a troubleshooting guide for common situations, and one-line diagrams for each applicable system.

(k) Training records (xxx System/Assembly).

This section includes information on training provided and attendees. In addition, information on ongoing training shall be provided.

(l) Commissioning Process Report for xxx System/ Assembly.

This section includes the Final Commissioning Process Report for the xxx system/assembly, including all test procedures, test results, and blank test forms. (This annex is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

INFORMATIVE ANNEX P TRAINING MANUAL AND TRAINING NEEDS

This annex provides an example of how to implement part of Guideline 0. It is not intended to be a comprehensive representation or a best practice example. Practitioners applying the Commissioning Process should carefully follow Guideline 0 and applicable commissioning technical guidelines tailored to their specific projects.

This annex is a collection of various requirements for training and identifies needs for the Training Manual. The Training Manual includes the Training Plan, which is composed of the Training Syllabus and Training Agenda that are provided to the contractor by the Owner with help from the CxA. The Training Manual also contains the results of training, including the Training Material and Training Evaluations completed by the Contractor. It is an example to provide direction, in that training needs vary substantially for each construction project or new building. The following is an example of a Training Manual outline or syllabus for the Training Manual with a focus on electrical and mechanical systems.

TRAINING SYLLABUS

Overview

This syllabus describes the objectives of the various sessions, lectures, and demonstrations that form a part of the training program developed for the Do-It-Right Building.

Sessions

There are two main sessions on the electrical systems and two main sessions on the mechanical systems that will provide training to the OK Service personnel. The first session will be conducted at the time of start-up and check-out and the second session will be about two months later. Sessions will be a minimum of two days duration for the basics in each system and be conducted as specified below. The sessions will be conducted at the site.

All training sessions will be visually recorded using either videotape (VHS format) or standard compact disk (CD) in PC format. The CD format is desired for longevity and keyword searching. The sessions can be recorded on videotape and then transferred to CDs.

A training agenda in the format enclosed will be provided for each session. This will be submitted three weeks prior to the scheduled training session. All listed owner's representatives will sign this prior to proceeding with the training.

A list of training topics that are appropriate for consideration are listed in the attached Training Agenda Topics list.

The Commissioning Authority will be notified of the scheduled training time and provided with a copy of the training material fifteen days prior to each training session. The Commissioning Authority will review the material and share comments with the Owner and the design professionals. If any aspects do not meet the requirements of the specifications, this will be communicated through the design professionals. The Commissioning Authority will attend 25% or more of the training sessions.

A receipt acknowledging completion of each item of instruction will be secured.

The training will be evaluated based upon the criteria in the attached evaluation form.

Electrical Systems

The training shall include:

- General familiarization and operating procedures for the entire electrical installation.
- Routine maintenance procedures for equipment.
 - Specific operating and maintenance procedures for:Switchboards
 - Emergency power supply system
 - Fire alarm system

Factory-trained technicians will provide operating and maintenance instructions on the following:

System/Equipment	Minimum Session Duration hours
Emergency power supply system	Х
Fire alarm system	Х
Lighting control systems	Х
Switchboards	Х
Medium voltage pad-mounted switchgear	Х

Mechanical Systems

The training shall include:

- General familiarization with and operating procedures for the entire plumbing, laboratory gas, pure water, compressed air, fuel, HVAC&R, and fire protection systems installation.
- Routine maintenance procedures for equipment.
- Specific operating and maintenance procedures for:
 - Hot water system consisting of boilers, pumps, controls, and hydronic specialties.

- Chilled water systems consisting of chillers, cooling towers, pumps, controls, and hydronic specialties.
- Automatic temperature control system consisting of all associated hardware, software, and program logic; this is to be arranged by systems.
- Laboratory air-side control system consisting of supply, hood, and general exhaust valves, reheat coils, and room control panel.
- Clean agent fire suppression systems, including emergency procedures, abort functions, and safety requirements.
- Laboratory hood exhaust air system.

Factory-trained technicians will give instruction on the following specialty systems and equipment:

System/Equipment	Minimum Session Duration, hours
Variable speed drives	Х
Chillers	Х
Automatic temperature con- trols	Х
Water treatment systems	Х
Laboratory control systems	Х

DDC System

There will be two formal training sessions on the DDC system. Each of the sessions will be conducted by factory-trained personnel for a minimum duration of xx 8-hour days. Materials and training will be provided for up to xx operators per session (selected by the Owner).

There will be a separate training course provided on the DDC system for supervisory personnel. This training will briefly cover the material of the operator training session but will be focused on the more advanced features of the system with emphasis on the energy conservation strategies and reporting capabilities of the system and how to implement them. The training session will be conducted by factory-trained personnel for a minimum duration of xx 8-hour days, for a total of xx training hours. Materials and training will be provided for up to xx persons selected by the Owner.

TRAINING AGENDA

Project:	Do-It-Right—Wonderful Sky Building			
Training Material:	Systems Manual; Evaluation Forms; Record Forms; Specification Sections, Miscellaneous Manufac- turer's Documentation, Field Equipment (for demonstrations)			
SECTION 1. AUDIENCE AND GENERAL SCOPE				

Intended audience type:	☑ O&M Staff,	Supervisory Personnel	
	☑ Laboratory Users		
General scope of training:	□ A. Overview	☑ B. Intermediate	☑ C. Detailed

SECTION 2. INSTRUCTORS

Instructor (Factory Trained)	Company

SECTION 3. AGENDA

SESSION A – ELECTRICAL AND FIRE PROTECTION SYSTEMS

	Lectures/Demonstrations	Dates	Location	Duration (hr x freq*)	Instructor ID(s)
A1	Emergency power supply system			8×2	
A2	Fire alarm system			8×2	
A3	Lighting control			4×2	
A4	Switchboards			4×2	
A5	Medium voltage pad-mounted switchgear			4 x 2	
A6	O&M procedures for clean agent fire suppression systems, including emergency procedures, abort functions, and safety requirements			4 x 2	

Total duration of training (h) 64	Total duration of training (h)>	64
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SESSION B – MECHANICAL AND PLUMBING SYSTEMS

	Lectures/Demonstrations	Dates	Location	Duration (hr x freq*)	Instructor ID(s)
B 1	Variable speed drives			4×2	
B2	Chillers			4×2	
B 3	General familiarization and operating procedures for plumb- ing equipment			3×2	
B4	Water treatment systems			2×2	
Total	duration of training (h)	>		26	

SESSION C - CONTROL SYSTEM

	Lectures/Demonstrations	Dates	Location	Duration (hr x freq)	Instructor ID(s)
C1	Laboratory control systems			$8 \times 2^*$	
C2	Automatic temperature controls			$10 \times 2^*$	
C3	DDC system operations (for up to xx operators)			$32 \times 2^*$	
C4	DDC system emphasis on advanced features of system, energy conservation strategies, and reporting capabilities and how to implement them (for up to xx supervisors)			16 × 1	
	Total duration of training (h)		>	116]

* Frequency is 2 formal training sessions as per spec. sections 15900, pg. 16, Part 2.1, and 16800, pg. 5, Part 7.3. The first session shall be conducted at the time of start-up and check-out and the second session shall be approximately 2 months later.

SECTION 4. APPROVALS

This Training Program has been approved by the following individuals, subject to any additions and clarifications noted. (This is not an approval of training completion.)

Do-It-Right, Inc. Representative

Commissioning Authority

Date

Date

TRAINING AGENDA TOPICS

(Suggested General Topics to Be Included)

	Suggested List of Subjects	Requested by D-I-R, Inc. (✓)	Desired Duration (h)
1.	Overview and description of the purposes of the system		
2.	System troubleshooting: description of diagnostic step-by-step procedures for determining the source of problems on the system level; review technical service manual in detail		
3.	Component maintenance: instruction of required procedures for weekly, monthly, and annual preventive checks and timely repairs to preserve system integrity		
4.	Component troubleshooting: description of diagnostic procedures for determining the source of problems on the component level		
5.	Review of control drawings and schematics (have copies for attendees)		
6.	Startup, loading, normal operation, unloading, shutdown, unoccupied operation, seasonal changeover, etc., as applicable		
7.	Integral controls (packaged): programming, troubleshooting, alarms, manual operation		
8.	Building automation system (BAS) controls: programming, troubleshooting, alarms, manual operation, interface with integral controls		
9.	Interactions with other systems, operation during power outage and fire		
10.	Relevant health and safety issues and concerns and special safety features		
11.	Energy-conserving operation and strategies		
12.	Any special issues to maintain warranty		
13.	Common troubleshooting issues and methods, control system warnings and error messages, including using the control system for diagnostics		
14.	Special requirements of tenants for this equipment's function		
15.	Service, maintenance, and preventive maintenance (sources, spare parts inventory, special tools, etc.)		
16.	Question and Answer Period		
	Total hours requested		
	Total hours required by specifications		

Training Evaluation

Session: _____

Date: _____

Location:

Purpose: This form is used to evaluate each training session. Based upon this evaluation, later sessions can be improved. This form will be completed by the Commissioning Authority and one D-I-R employee in the training session after each session.

Every attendee fills out one copy of this form. Mark questions that are not applicable with N/A.

		1 = very well to 5 = not at all					
1.	How were the objectives of this training session met?	1	2	3	4	5	N/A
2.	Do you know where the components/systems are located?	1	2	3	4	5	N/A
3.	Do you know what area the components/systems are serving?	1	2	3	4	5	N/A
4.	Do you understand the various types and purpose of these components/systems?	1	2	3	4	5	N/A
5.	Do you understand/know how to systematically troubleshoot common problems with these components/systems?	1	2	3	4	5	N/A
6.	Do you know how the components/systems operate under all normal modes?	1	2	3	4	5	N/A
7.	How well do you understand the importance of meeting the design intent for the systems covered?	1	2	3	4	5	N/A
8.	Are you able to efficiently find the relevant information in the Systems Manual to oper- ate and maintain the systems/components you were trained for in this session?	1	2	3	4	5	N/A
9.	Do you know how to perform the needed maintenance on the equipment and/or do you know to get the information you need?	1	2	3	4	5	N/A
10.	Do you know how to get updated technical service information for the components/systems?	1	2	3	4	5	N/A

Explain why any questions got very low or very high ratings from you:

What topics would you desire to be covered that were absent from this training session?

You may provide other comments concerning anything about this training session (e.g., information prior to training, content):

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

BID AND PERMIT SET

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of buildings and site improvements.
 - 2. Removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and removing site utilities.
 - 4. Salvaging items for reuse by Owner.
 - a. Salvage portable building ramps and stairs.
 - b. Salvaged wood wainscoting.
 - 1) Refer to Finish Schedule, reception desk and library desk for reuse of salvaged wood wainscoting.
 - 2) Salvage only the quantity of wood required to accomplish scope of work required. Save best appearance panels, of best quality for reuse. Save more than required for selection purposes, however, do not save all removed wood.
 - c. Other items as indicated in Salvage Matrix on Drawing AD0.0.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of the premises and phasing requirements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

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

STRUCTURE DEMOLITION

BID AND PERMIT SET

- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.
 - 2. Refer to salvage matrix on Drawing AD0.0.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- C. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Hazardous Materials: Are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation will be executed by BSD before start of demolition work. Refer to Section 011000 "Summary" for anticipated project schedule.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

BID AND PERMIT SET

C. On-site storage or sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, Beaverton School District (BSD) will remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 - 1. Coordinate with Salvage Matrix on Drawings.
 - 2. Store items in a secure area until delivery to Owner for items to be salvaged by Contractor.
 - 3. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Owner will arrange to shut off utilities.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

BID AND PERMIT SET

- 3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 **PROTECTION**

- A. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
 - 1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings.
 - 2. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain adequate ventilation when using cutting torches.
 - 3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

BID AND PERMIT SET

- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations according to backfill requirements in Geotechnical report.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
BID AND PERMIT SET

3.8 DISPOSAL OF DEMOLISHED MATERIALS

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

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.
 - 2. Removal of existing wall, doors, and exterior construction at existing east wall of PAC.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

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

BID AND PERMIT SET

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 2. Coordination for shutoff, capping, and continuation of utility services.

1.7 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

BID AND PERMIT SET

3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective utility demolition systematically, from the existing on-site structures to the off-site connection points.
 - 2. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.5 CLEANING

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

3.6 SELECTIVE DEMOLITION SCHEDULE

A. Remove: existing on-site overhead power and power poles, on-site storm and storm drain appurtenances, public storm catch basins, on-site sanitary sewer.

BID AND PERMIT SET

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 033543 "Polished Concrete Finishing" for interior polished concrete applications.
 - 2. Division 21 Division 28 for coordination of MEP penetrations.
 - 3. Division 32 for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

BID AND PERMIT SET

- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Vapor barrier.
 - 10. Semirigid joint filler.
 - 11. Joint-filler strips.
- D. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACIcertified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

BID AND PERMIT SET

- C. Testing Agency Qualifications: An independent agency acceptable to authorities having jurisdiction and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from asdrawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

BID AND PERMIT SET

- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray or white.
 - 2. Fly Ash: ASTM C 618, Class F or C.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4-inch (25 mm) nominal.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.5 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III.
 - 1. ABC Polymer Industries, LLC; FiberForce 300 (aka, Fibril-Tuf).

2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 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. Williams Products, Inc.
 - 2. Profile: Flat dumbbell without center bulb.
 - 3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

BID AND PERMIT SET

2.7 VAPOR AND RADON BARRIER

- A. Sheet Vapor Barrier and Radon Barrier, at Slab-on-Grade: ASTM E 1745 Class A, with a minimum thickness of 20 mils. Include manufacturer's recommended adhesive or pressure-sensitive tape (minimum 2-inch width).
 - 1. Basis-of-Design Product: Raven Industries, Inc.; Vapor Block Plus VBP20.
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GCP Applied Technologies (formerly Grace Construction Products).
 - b. Raven Industries, Inc.
 - c. Stego Industries, LLC.
 - d. W. R. Meadows, Inc.

2.8 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Hardener: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Basis-of-Design Product: Curecrete Distribution Inc.; Ashford Formula.
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ChemMasters, Inc.
 - b. ChemTec Int'l.
 - c. Dayton Superior.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Kaufman Products, Inc.
 - f. L&M Construction Chemicals, Inc.
 - g. Metalcrete Industries.
 - h. Nox-Crete Products Group.
- B. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound (S CONC): ASTM C 1315, Type 1, Class A.
 - 1. Basis-of-Design Product: W.R. Meadows; Vocomp 30.
- C. Penetrating Moisture Vapor Barrier: Spray-applied clear liquid to seal slabs against vapor transmission ASTM C 1315, for concrete slabs-on-grade scheduled to receive adhered flooring materials. Confirm compatibility of sealer with flooring material and adhesives.
 - 1. Basis-of-Design Product: Spray-Lock SCP 327, Time of Placement by Spray-Lock Concrete Protection; www.concreteprotection.com.
 - 2. Application: Use on concrete floors where other finish floor materials are installed over concrete.

BID AND PERMIT SET

2.9 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

- 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
- 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
- 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Slag Cement: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - 5. Silica Fume: 10 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.3 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Provide mixtures for building elements as indicated on the Structural Drawings.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.

BID AND PERMIT SET

- 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

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

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

BID AND PERMIT SET

- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

3.5 VAPOR BARRIER INSTALLATION

- A. Sheet Vapor Barrier: Place, protect, and repair sheet vapor barrier according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 12 inches (300 mm) and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

BID AND PERMIT SET

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

BID AND PERMIT SET

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

- 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with inplace construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: match supporting construction.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3.14 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

BID AND PERMIT SET

- 2. Do not apply to concrete that is less than 14 days old.
- 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

BID AND PERMIT SET

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.

BID AND PERMIT SET

- 2. Steel reinforcement welding.
- 3. Headed bolts and studs.
- 4. Verification of use of required design mixture.
- 5. Concrete placement, including conveying and depositing.
- 6. Curing procedures and maintenance of curing temperature.
- 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 100 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of three laboratory-cured specimens at 7 days and one set of three specimens at 28 days.
 - a. Test one set of three field-cured specimens at 7 days and one set of three specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
 - 7. When strength of field-cured cylinders is less than 85 percent of companion laboratorycured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 - 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 - 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

BID AND PERMIT SET

- 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 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 polished concrete finishing and scoring (PC-1):
 - 1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete materials, concrete treatment materials, and accessories.

1.3 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures, if available. Coordinate with Owner for their testing agency representative.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete contractor.
 - e. Polished concrete finishing contractor.
 - 2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

BID AND PERMIT SET

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- C. Mock-up: A mock-up is required to provide the approved basis for comparison and acceptance of completed polished concrete finishing on the Project. The mock-up will be reviewed for approval based on appearance, sequence of installation, quality of execution, and conformance with design intent as indicated in the Project Documents. The basis for approval of the mock-up will be the approved verification sample.
- D. Qualification Data: For polished concrete finish applicator.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Work of this Section shall be performed by installer having knowledge of finish methods, concrete mix designs, and equipment suitable for the concrete finish specified. Installer shall:
 - 1. Have completed a minimum of five years with successful installations with specified finishes.
 - 2. Be a qualified firm that is approved, authorized, trained or licensed by finish system manufacturer to install manufacturer's product.
- B. Designate an Individual to be responsible for quality control. Individual shall be on site at all times work is actively in progress. Mock-up: Before casting concrete, perform concrete polishing mock-up to demonstrate surface finish and standard of workmanship. Mock-up to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Perform mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Mock-ups shall include, but not limited to the following cast-concrete application and condition:
 - a. Existing concrete slab-on-grade, minimum 3 feet by 3 feet area.
 - b. New concrete floor slab, minimum 3 feet by 3 feet area.

BID AND PERMIT SET

C. Field Mockup Panel: After approval of verification sample and before casting concrete, produce field mockup to demonstrate the approved range of selections made under Sample submittals. Produce a full-scale panel, approximately 6 feet by 6 feet (1.83 m by 1.83 m) minimum, to demonstrate the expected range of finish, color, and appearance variations.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Polished concrete surfaces shall match Architect's control reference sample. Installer is responsible for coordinating concrete mix designs, placement, finishing procedures and any other concrete related items impacting finishing for concrete floors to receive polished concrete finishing to coordinate with existing exposed concrete slabs to remain.
- B. Slip-Resistance: Polishing process shall result in a slip-resistant floor surface meeting the following coefficient of friction as tested in accordance with applicable ANSI standards:
 - 1. Average Static Coefficient of Friction (SCOF), ANSI B101.1: Minimum 0.60.
 - 2. Average Dynamic Coefficient of Friction (DCOF), ANSI B101.3: Minimum 0.42.

2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
 - 1. Basis-of-Design Product: Lythic Densifier by Solomon Colors, Inc; www.lythic.com.

PART 3 - EXECUTION

3.1 POLISHING

- A. Polish:
 - 1. Match design reference sample.
 - 2. Aggregate Exposure: Grade 1 with Class C, medium aggregate exposure finish; 800 grit polish. Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

BID AND PERMIT SET

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

3.2 CLEANING AND PROTECTION

- A. Clean and protect floor finishes from damage during remaining construction period.
- B. Coordinate subsequent work to ensure finished concrete is free from damage and deterioration at Substantial Completion.

END OF SECTION 033543

BID AND PERMIT SET

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

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. Architectural precast concrete stair treads.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.
 - 2. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to steel stair framing.

1.3 DEFINITIONS

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and waterabsorption tests.
- C. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate end conditions, chamfers and extent and location of each surface finish.
 - 4. Detail loose and cast-in hardware and connections.

BID AND PERMIT SET

- 5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to stair frame construction.
- 6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
- 7. Indicate relationship of architectural precast concrete units to adjacent materials.
- 8. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).
- E. Delegated-Design Submittal: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the stair structural frame from architectural precast concrete.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Material Certificates: For the following items:
 - 1. Cementitious materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Bearing pads.
- C. Material Test Reports: For aggregates.
- D. Source quality-control test reports.
- E. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.

BID AND PERMIT SET

- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- C. Quality-Control Standard: For manufacturing procedures and testing requirements, qualitycontrol recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- D. Sample Panel: After sample approval and before fabricating architectural precast concrete units, produce a sample stair tread panel of specified color, approximately 12 inches (300 mm) long, for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
- E. Mockups: After sample panel approval but before production of architectural precast concrete units, construct full-sized mockup of a stair tread to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.8 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other re-handling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fabricators of stair treads: Subject to compliance with requirements, Basis-of-Design Product:
 - 1. Stepstone, Inc.; CalArc Long-Span Steptreads.
 - 2. Profile and Color: Modern Profile, Color BS504, French Gray.
 - 3. Non-Slip Nosing: manufacturer's standard exposed aggregate strip.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.
- B. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated.

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Galvanized Reinforcing Bars: deformed bars, with ASTM A 767/A 767M, Class II zinc coating and chromate treatment.
- D. Epoxy-Coated Reinforcing Bars: deformed bars, ASTM A 775/A 775M epoxy coated.

PRECAST ARCHITECTURAL CONCRETE

BID AND PERMIT SET

- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn -steel wire into flat sheets.
- F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- G. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS FOR STAIR TREADS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 270, uncoated, seven-wire, low-relaxation strand.
 - 1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

2.6 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 116 or ASTM C 33.
- C. Lightweight Aggregates: Except as modified by PCI MNL 116 or ASTM C 33 with absorption less than 11 percent.
- D. Admixtures:
 - 1. Air-entraining admixtures: ASTM C260.
 - 2. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C494 or C1017.
 - 3. Viscosity-Modifying Admixture.
 - 4. Coloring Admixture: To match BASF Black (14.75#/cy). ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, non-fading, and alkali resistant.
 - 5. Metakaolin Admixture: ASTM C 618, Class N.
 - 6. Calcium chloride or admixtures containing chlorides shall not be used.

2.7 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.

- C. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- D. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.
- E. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.
- F. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or ASTM F 1554, Grade 36 (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
- G. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
- H. Shop-Primed Finish: Prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibiting primer, complying with performance requirements in FS TT-P-664 according to SSPC-PA 1.
- I. Welding Electrodes: Comply with AWS standards.

2.8 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
 - 1. Chloroprene (Neoprene): Conform to Div II, Section 18 of ASSHTO Standard Specifications for Highway bridges.
 - 2. Random Oriented Fiber Reinforced: Shall support a compressive stress of 3,000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
 - 3. Plastic: Multi-monomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion.

2.9 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units including composite wood blocking at all openings in insulated panels.

2.10 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing
BID AND PERMIT SET

and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.11 CONCRETE MIXTURES

- A. Normal-Weight Concrete Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
- B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 116.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide BASF Corporation; Admixture Systems; MasterPel 240 or a comparable product by one of the following:
 - 1) Euclid Chemical Company (The); an RPM company.

2.12 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

2.13 FABRICATION

- A. Fabrication procedures shall be in general compliance with the PCI MNL-116 section specified in 1.5.D (QUALITY ASSURANCE).
- B. Formwork: Comply with ACI 347. Prefabricated mold shall be one-piece seamless rigid molds for exposed faces. Prevent deformation of molds and maintain mold surfaces free of irregularities, dents, sags, or damage of any kind.

BID AND PERMIT SET

- C. Anchorage Hardware: Fabricate with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations.
- D. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.
- E. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and the PCI MNL 116 section specified in 1.5.D (QUALITY ASSURANCE) for fabricating, placing, and supporting reinforcement.
- F. Reinforce precast concrete tread units to resist handling, transportation, and erection stresses.
- G. Mix concrete according to the PCI MNL 116 section specified in 1.5.D (QUALITY ASSURANCE) and requirements in this Section. After concrete batching, no additional water may be added.
- Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in the PCI MNL 116 section specified in 1.5.D (QUALITY ASSURANCE) for measuring, mixing, transporting, and placing concrete.
- I. Cure concrete, according to requirements in PCI MNL 116, by accelerated heat curing using lowpressure live steam or radiant heat.
- J. Damaged, chipped or discolored units shall be replaced, patched or refinished as directed by the Architect and/or Engineer, and to their approval.

2.14 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:
 - 1. Honed Finish: At tread walking surface and front vertical face of tread use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - 2. Abrasive-Blast Finish: At leading edge of tread provide a 2 inch wide strip abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - 3. As-Cast Surface Finish: At surfaces not otherwise indicated provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.

- B. Finish exposed surfaces of architectural precast concrete units to match honed finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.16 SOURCE QUALITY CONTROL

- A. Quality Control Testing: Test and inspect precast concrete according to the PCI MNL 116 section specified in 1.5.D (QUALITY ASSURANCE) requirements.
- B. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting stair frame and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
- C. Connect architectural precast concrete units in position by bolting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.

- D. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
- E. Grouting or Dry-Packing Connections: Grout connections where required or indicated. Pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 116.

3.4 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean grout and other deleterious material from concrete surfaces and adjacent materials immediately.

BID AND PERMIT SET

- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

BID AND PERMIT SET

SECTION 035300 - CONCRETE TOPPING

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. Emery-aggregate concrete floor topping.
 - 2. Iron-aggregate concrete floor topping.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each concrete floor topping, for tests performed by a qualified testing agency.
- B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- B. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.
 - 1. Build mockups approximately 100 sq. ft. (9.3 sq. m) in the location indicated or, if not indicated, as directed by Architect.
 - 2. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.

BID AND PERMIT SET

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.
 - 1. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 and 86 deg F (10 and 30 deg C).
- B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR TOPPINGS

- A. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.
 - 1. Compressive Strength (28 Days): 10,000 psi (69 MPa); ASTM C109/C109M.
- B. Iron-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded iron aggregate, portland cement, plasticizers, and other admixtures to which only water needs to be added at Project site.
 - 1. Compressive Strength (28 Days): 12,000 psi (83 MPa); ASTM C109/C109M.

2.2 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

BID AND PERMIT SET

- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 25 percent solids content, minimum.

2.3 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids epoxy resin with a Type A Shore durometer hardness of 80 according to ASTM D2240.
- B. Joint-Filler Strips: ASTM D1752, cork or self-expanding cork.
- C. Portland Cement: ASTM C150/C150M, Type I or II.
- D. Sand: ASTM C404, fine aggregate passing No. 16 (1.18-mm) sieve.
- E. Water: Potable.
- F. Acrylic-Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. Epoxy Adhesive: ASTM C881/C881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.
- H. Power-Actuated Fasteners: Fastener systems with an evaluation report based on ICC-ES AC70.

2.4 MIXING

A. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Verify that base concrete slabs comply with scratch finish requirements specified in Section 033000 "Cast-in-Place Concrete."
- C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D4263.

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

3.2 PREPARATION

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm).
 - 1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
 - 2. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
 - 3. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semirigid joint filler.
 - 4. To both sides of joint edges and at perimeter of existing base slab, mechanically remove a 4-inch- (100-mm-) wide and 0- to 1-inch- (0- to 25-mm-) deep, tapered wedge of concrete and retexture surface.
- B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface unless otherwise indicated.
 - 2. Terminate full-width, joint-filler strips 1/2 inch (13 mm) below topping surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- C. Install power-actuated fasteners according to written directions of floor topping manufacturer at perimeter of areas that are to receive floor topping, including both edges of locations where joints will be formed in floor topping.

3.3 FLOOR TOPPING APPLICATION

- A. Start floor topping application in presence of manufacturer's technical representative.
- B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Section 033000 "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.
- C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.
- D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.

BID AND PERMIT SET

- E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
 - 1. Screed surface with a straightedge and strike off to correct elevations.
 - 2. Slope surfaces uniformly where indicated.
 - 3. Begin initial floating, using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- F. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
 - 1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
 - a. Finish surfaces to specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15, and measure within 24 hours according to ASTM E1155 (ASTM E1155M) for a randomly trafficked floor surface.
 - b. Finish and measure surface, so gap at any point between surface and an unleveled freestanding 10-foot- (3-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).
- G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.
 - 1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
- H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
 - 1. Form joints in concrete floor topping over contraction joints in base slabs unless otherwise indicated.
 - 2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
 - 3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

3.4 PROTECTING AND CURING

A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.

BID AND PERMIT SET

- B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.
- C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with water, continuous water-fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.5 JOINT FILLING

- A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.6 REPAIR

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.7 FIELD QUALITY CONTROL

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

BID AND PERMIT SET

- B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:
 - 1. Sample Sets: At point of placement, a set of three molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft. (93 sq. m), plus one set of samples for each subsequent 5000 sq. ft. (464 sq. m) of topping, or fraction thereof, but not less than six samples for each day's placement. Samples shall be tested according to ASTM C109/C109M for compliance with compressive-strength requirements.
 - 2. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
 - 3. Concrete floor topping shall be tested for compliance with surface flatness and levelness tolerances.
- C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 035300

BID AND PERMIT SET

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Steel reinforcing bars.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.4 QUALITY ASSURANCE

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 45 00 "Quality Control" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness and, in pattern as directed by Architect.

1.5 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice

BID AND PERMIT SET

or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- C. Integral Water Repellent: Provide concrete masonry units made with factory mix integral water repellent for exposed units.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals Building Systems; Rheopel Plus.
 - b. Grace Construction Products, W. R. Grace & Co. Conn.; Dry-Block.
- D. CMUs: ASTM C 90.
 - 1. Density Classification: Medium weight.

BID AND PERMIT SET

- E. Decorative CMUs: ASTM C 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CMU8: Nominal 8 inches high by 16 inches long by 8 inches deep; "Natural" or "Charcoal" color; ground-face block finish.
 - b. CMU12: Nominal 12 inches high by 16 inches long by 8 inches deep; "Charcoal" color. Use a solid block for top of wall; ground-face block finish.
 - 2. Pattern and Texture: As selected by Architect.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for coldweather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144.
- D. Aggregate for Grout: ASTM C 404.
- E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation Chemicals Building Systems; Trimix-NCA.
 - b. Euclid Chemical Company (The); an RPM company; Accelguard 80.
 - c. Grace Construction Products, W. R. Grace & Co. Conn.; Morset.
- F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals Building Systems; Rheopel Mortar Admixture.
 - b. Grace Construction Products, W. R. Grace & Co. Conn.; Dry-Block Mortar Admixture.
 - c. SPEC MIX; SPEC MIX Intergral Water Repellent IWR Mortar.
- G. Water: Potable.

BID AND PERMIT SET

2.4 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hotdip galvanized-steel wire.
- C. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 07 62 00 "Sheet Metal Flashing

BID AND PERMIT SET

and Trim" and as follows:

- 1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
- 2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
- 3. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.8 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type N.
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for

BID AND PERMIT SET

interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

- 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1.
 - 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

BID AND PERMIT SET

- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
 - 2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
 - 3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 2 inches (50 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch (13-mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

3.8 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

BID AND PERMIT SET

- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of siteprepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at seven days and at 28 days.

3.10 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soilcontaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

BID AND PERMIT SET

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Clay face brick.
- B. Products Installed but Not Furnished under This Section:
 - 1. Steel lintels in masonry veneer.
 - 2. Steel shelf angles for supporting masonry veneer.
- C. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for steel lintels and shelf angles.
 - 2. Section 071900 "Graffiti Seal and Water Repellent" for clear coatings on masonry veneer.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type and color of brick and colored mortar.
- C. Material Certificates: For each type and size of product.

1.3 QUALITY ASSURANCE

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
- B. Building Exterior Integrated Mockup: Provide materials construction for exterior wall mockup as specified in Section 014000 "Quality Requirements".

1.4 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost

BID AND PERMIT SET

or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

- 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C 216.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Basis-of-Design Face Brick Manufacturer: Mutual Materials; www.mutualmaterials.com.
 - b. Brick Sizes:
 - BR-1: Norman brick, 2-1/2 inches tall by 11-1/2 inches long by 3-1/2 inches deep; Color, Ebony; Mission texture; approximate area, 75 percent of brick veneer area.
 - 2) BR-2: Same brick as BR-1, except provide in Smooth texture; approximately 25 percent of brick veneer area.

BID AND PERMIT SET

- 3) BR-3: Standard, solid brick; 2-1/2 inches high by 7-1/2 inches long by 3-1/2 inches deep; Color Ebony; Mission texture. Use at "ACMA" Frame and Surrounds on South Façade.
- 4) BR-4: Same as BR-3 except, provide in Smooth texture. Use for "ACMA" letters on South Façade.
- 2. Grade SW.
- 3. Type FBX.
- 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
- 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
- 6. Trim Units: As noted on Drawings.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for coldweather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Solomon Colors, Inc.; SGS Mortar Colors.
- E. Water: Potable.

2.4 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.

- 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- C. Adjustable Anchors for Connecting to cold-formed metal framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hotdip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hotdip galvanized-steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hotdip galvanized-steel wire.
 - 3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.
- E. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
 - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication.
 - 3. Fabricate wire ties from 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 - 4. Fabricate wire connector sections from 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized, carbon-steel wire.
 - 5. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonryveneer anchors specified.
 - 6. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.
 - 7. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, 1-1/4 inches (32 mm) wide by 6 inches (152 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches

BID AND PERMIT SET

(152 mm) long, stamped into center to provide a slot between strap and base for inserting wire tie.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hohmann & Barnard, Inc; DW-10-X.
 - 2) Wire-Bond; 1004X, Type III X.
- 8. Seismic Masonry-Veneer Anchors: Connector section and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having slotted holes for inserting vertical leg of connector section. Connector section consists of a rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dur-O-Wal; a Hohmann & Barnard company; D/A 213S.
 - 2) Hohmann & Barnard, Inc; DW-10-X-Seismiclip.
 - 3) Wire-Bond; RJ-711 with Wire-Bond clip.

2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
 - 1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 - 2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
- B. Flexible Flashing: Use the following unless otherwise indicated:
 - 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Carlisle Coatings & Waterproofing Inc; CCW-705-TWF Thru-Wall Flashing.
 - Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier Wall Flashing.
 - 3) Polyguard Products, Inc.; Polyguard 400.
 - 4) W.R. Meadows, Inc; Air-Shield Thru-Wall Flashing.

- 2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch (1.02 mm) thick.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Carlisle Coatings & Waterproofing Inc; Pre-Kleened EPDM Thru-Wall Flashing.
 - 2) Firestone Specialty Products; FlashGuard.
 - 3) Heckmann Building Products, Inc.; No. 81 EPDM Thru-Wall Flashing.
 - 4) Hohmann & Barnard, Inc; Epra-Max EPDM Thru-Wall Flashing.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fill a head joint and consisting of a rectangular eggcrate design.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Heckmann Building Products, Inc.; Weep-Thru Mortar Deflector.
 - b. Hohmann & Barnard, Inc; Mortar Trap.
 - c. Mortar Net USA, Ltd; Mortar Net.
 - 2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without

discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Use Type N unless another type is indicated.
- C. Pigmented Mortar: Use colored cement product.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of mortar cement by weight.
 - 3. Application: Use pigmented mortar for exposed mortar joints.
 - 4. Color: As selected by Architect from manufacturer's full color range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).

BID AND PERMIT SET

- 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Joints:

- 1. Match existing adjacent horizontal and vertical joint dimensions, unless noted otherwise.
- 2. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).
- 3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry:
 - 1. BR-1: 1/3 running bond.
 - 2. BR-2: 1/3 running bond.
 - 3. BR-3: Running bond. "ACMA" logo sign shall be installed using a "skittling" pattern.
 - 4. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

BID AND PERMIT SET

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
- B. Provide not less than 2 inches (50 mm) of airspace between back of masonry veneer and face of insulation.

3.6 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - 4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.7 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.8 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

BID AND PERMIT SET

3.9 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soilcontaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

BID AND PERMIT SET

SECTION 051200 - STRUCTURAL STEEL 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. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.
- B. Related Requirements:
 - 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
 - 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surfacepreparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- D. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

BID AND PERMIT SET

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.

BID AND PERMIT SET

- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
BID AND PERMIT SET

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Construction: Combined system of braced frame and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - 1. W-Shapes: 60 percent.
 - 2. Channels and Angles: 60 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 25 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels and Angles: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M unless indicated otherwise. Where Grade 50 plate or bar is indicated, ASTM A 572/A 572M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: As indicated.
 - 2. Finish: Black except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

BID AND PERMIT SET

- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain, unless where indicated otherwise. Where indicated to be galvanized, provide mechanically deposited zinc coating.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- F. Threaded Rods: ASTM A 36/A 36M unless indicated otherwise.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 3. Finish: Plain, unless where indicated otherwise. Where indicated to be galvanized, provide mechanically deposited zinc coating, ASTM B 695, Class 50.

2.4 FILLER

A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.5 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- 2.6 GROUT
 - A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

BID AND PERMIT SET

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shoppriming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning".
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

BID AND PERMIT SET

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless indicated otherwise.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.9 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Galvanized surfaces.
 - 5. Surfaces enclosed in interior construction.
- B. Preparation for Shop Priming: Clean surfaces to be painted per primer manufacturer's written instructions. Remove loose rust and mill scale and other spatter, slag, flux deposits, and any other potential bond-breaking materials.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

BID AND PERMIT SET

- 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame .
- 3. Hot dip galvanized all steel framing exposed to the exterior environment, including within wall cavities.

2.11 SOURCE QUALITY CONTROL

- A. Provide source quality control if fabricator is not AISC Certified.
- B. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- C. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-inplace concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Pretension anchor rods where indicated. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect prior to performing cuts. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless indicated otherwise.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - b. Ultrasonic Inspection: ASTM E 164.

- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 FILLER APPLICATION

A. Apply filler to all exposed steel holes present on brace frame construction.

3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 051200

BID AND PERMIT SET

SECTION 051215 – BUCKLING RESTRAINED BRACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Furnishing buckling restrained braces as shown on Drawings.
 - 2. Engineering design of buckling restrained braces to meet the strength and deformation requirements specified on the Drawings and by this Section.
 - 3. Preparation of a Previous Test Results Report.
 - 4. Performance of uniaxial and subassemblage tests where a Previous Test Results Report cannot be furnished.
- B. Scope: Within base contract price, allow for the design and furnishing of buckling restrained braces, preparation of a Previous Test Results Report including performance of uniaxial and subassemblage tests which will meet the loads and deformation requirements of this project.
- C. Related Sections and Documents:
 - 1. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
 - 2. Division 5 Section "Structural Steel."

1.2 REFERENCES

- A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.
- B. ASTM American Society for Testing and Materials:
 - 1. A6 Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.
 - 2. A36 Specification for Steel.
 - 3. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 4. A490 Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
 - 5. A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 6. A563 Specification for Carbon and Alloy Steel Nuts.
 - 7. A572 Specification for High Strength Low Alloy Columbium-Vanadium Steel of Structural Quality.
 - 8. F844 Specification for Washers, Steel, Plain (Flat) Unhardened for General Use.

BID AND PERMIT SET

- 9. A1085 Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
- C. AlSC American Institute of Steel Construction:
 - 1. Specification LRFD Specification for Structural Steel Buildings, 14th Edition.
 - 2. Code Code of Standard Practice for Steel Buildings and Bridges, 2010 Edition.
 - a. The General Conditions, Supplementary Conditions and Division 1 shall govern in the case of conflicts with provisions of the Code.
 - 3. AISC Seismic Provisions 341-10, Section F4 Buckling Restrained Braced Frames.
- D. AWS American Welding Society:
 - 1. D1.1 Structural Welding Code, 2000 Edition.
 - 2. 353 Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications.
- E. RCSC Research Council on Structural Connections:
 - 1. Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2000 Edition.
- F. SSPC Steel Structures Painting Council's, "Systems and Specifications":
 - 1. SP1 Solvent Cleaning.
 - 2. SP2 Hand Tool Cleaning.
 - 3. SP3 Power Tool Cleaning.
 - 4. SP6 Commercial Blast Cleaning.

1.3 DEFINITIONS

- A. Brace Test Specimen: A single buckling-restrained brace element used for laboratory testing intended to model the brace in the Prototype.
- B. Buckling Restrained Brace: Specialty structural bracing element consisting of a yielding steel core and a system of restraints that precludes buckling of the steel core at forces and inelastic deformations corresponding to the requirements of AISC Seismic.
- C. Buckling-restraining System: A system of restraints which resists buckling of the steel core in buckling restrained braces. This system includes the casing on the steel core and structural elements adjoining its connections.
- D. Casing: An element that resists forces transverse to the axis of the buckling restrained brace.
- E. Heavy Plates: Plates used in the Steel Core that are 2 inches thick or thicker.

BID AND PERMIT SET

- F. Previous test Results Report: A report that documents the buckling restrained brace manufacturer's compliance with the requirements specified on the Drawings and in this Section.
- G. Prototype: The brace, connections, members, steel properties, and other design, detailing, and construction features to be used in the actual building frame.
- H. Seismic Critical Weld (SCW): Welds used to manufacture the steel core.
- I. Steel Core: The axial-force-resisting element of buckling restrained braces.
- J. Sub-assemblage Test Specimen: The combination of the brace, the connections and testing apparatus that replicate as closely as practical the axial and flexural deformations of the brace in the Prototype.

1.4 RELATED REQUIREMENTS

- Provide buckling restrained braces that contain recycled content in accordance with LEED MR
 4 Recycled Content. Define percentage amounts of pre-consumer and post-consumer recycled content in each product.
- B. Provide buckling restrained braces containing steel manufactured regionally and extracted regionally in accordance with LEED MR 5. Define percentage amounts of steel manufactured regionally and extracted regionally in each product.

1.5 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Prior to bid, furnish schedule for submittal of Previous Test Results Report, performance of specimen tests if required, and manufacture and delivery of buckling restrained braces.
- C. Previous Test Results Report.
- D. Specimen Test Plan.
- E. Manufacturer's Quality Assurance Plan.
- F. Design Calculations. Structural calculations by a professional engineer, registered in the State of Oregon, that is knowledgeable with the results of the cyclic testing for the BRB's and experienced in the design of BRB's based on engineering analysis. Provide design calculations showing the adequacy of proposed BRBs, gusset plates, and gusset plate welds to achieve Performance Requirements specified herein.
- G. Shop Drawings:
 - 1. Provisions of Article 4.4 of AISC Code pertaining to time for review are superseded by provisions of Division 1 Section "Submittal Procedures."

BID AND PERMIT SET

- 2. Show size and configuration of steel core for full length of BRB. Indicate casing size, thickness and length. Show shape and thickness of gusset plates at each end; give complete information necessary for the attachment of buckling restrained braces to structure including type and size of pins or bolts and welds, surface preparation and finish; show methods of assembly. Identify tolerances for elements of structural steel frame to receive braces.
- 3. Indicate welded connections using standard AWS symbols.
- H. Certificates of compliance with specified standards or evidence of equal quality:
 - 1. All steel.
 - 2. Welding filler materials.
 - 3. Concrete mortar.
 - 4. Primer paint.
- I. Certified manufacturer's test reports: Submit to Testing Laboratory for record purposes.
 - 1. All steel: Tensile tests and chemical analysis. Include all trace elements for steel to receive seismic critical welds.
 - a. Steel core plates: Coupon test results for each lot of steel used in fabrication showing initial yield, ultimate tensile stress, and ultimate elongation.
 - 2. Plates (2.0" and thicker): Charpy V-Notch.
 - 3. Steel strands: Coupon test results for each lot of steel used in fabrication showing initial yield, ultimate tensile stress, and ultimate elongation.
 - 4. Welder Performance Qualification Records (WPQR's).
- J. Product Data
 - 1. Weld Filler Material.

1.6 REDESIGN AND RETESTING

A. Contractor shall obligate Buckling Restrained Brace Manufacturer to provide buckling restrained braces that conform to the requirements of this Specification. Should prototype and specimen braces as designed and fabricated by Manufacturer not conform to the project requirements, Buckling Restrained Braces shall be redesigned and retested until requirements of this Specification are satisfied at no additional cost to the owner. Any cost of redesign by the engineer of record due to the different brace or the connections shall be paid by the manufacturer requesting the changes.

BID AND PERMIT SET

1.7 QUALITY ASSURANCE

- A. Quality Assurance Plan: Contractor shall provide a detailed Quality Assurance plan prior to manufacturing production braces. The Quality Assurance plan shall include descriptions of manufacturing procedures, quality control testing program for materials, and all points of internal inspection and sign-off for control and monitoring of the fabrication and assembly process. Plan will include Quality Control for erection, including attendance at mandatory preerection conference and observation of initial installed braces.
- B. Design Engineer Qualifications: A Professional Engineer, registered in the State of Oregon that is knowledgeable with the results of cyclic testing of BRB's and the requirements of this specification and experienced in the design of BRB's based on engineering analysis shall approve and stamp all drawings.
- C. Pre-Erection Conference: Contractor shall schedule meeting with the Owner, Architect, buckling restrained brace Manufacturer, and the Steel Erector's personnel supervising installation of buckling restrained braces to review installation procedures including handling, fit-up and fastening.
- D. Coupon Tests: Perform coupon test results for each lot of steel used in fabrication of steel core areas showing initial yield, ultimate tensile stress, and ultimate elongation. Coupons shall be taken from plates at point of brace manufacture and shall be used as the basis for brace design
- E. Qualification Tests: The design of braces shall be based on results from qualifying cyclic tests. Tests shall consist of at least two successful cyclic tests: one is required to be a test of a brace subassemblage that includes brace connection imposed rotations and the other may be either a uniaxial or subassemblage test.
 - 1. Qualification tests shall conform to requirements of ANSI/AISC 341-05 Appendix T.
 - 2. Qualification tests are permitted to be based on documented full-scale cyclic tests performed for other projects or tests reported in research, provided that in the opinion of the Manufacturer and Design Engineer there is sufficient basis for extrapolation to project conditions.
 - 3. Extrapolation of previous test results beyond the limitations of ANSI/AISC 341-05 Appendix Sections T4 and T5 will not be permitted.
- F. Contractor shall obligate Manufacturer's Representative to visit the site to observe initial installation of buckling restrained braces in accordance with Quality Assurance Plan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Buckling Restrained Brace Manufacturer: Core Brace, Nippon Steel.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

BID AND PERMIT SET

2.2 MATERIALS

- A. Steel Core and Core Projection: ASTMA36 or approved equal.
- B. Casing: ASTM A500 grade B
- C. Welding Materials: Filler material shall possess a minimum Charpy V-notch toughness of 20 ft-lbs at minus 20 deg F.
- D. Shop Primer: Manufacturer's standard.
- E. Debonding Agent: Manufacturer's standard; able to maintain separation of steel core and 'grout encasement when subjected to the loading protocol per AISC Seismic; resistant to aging effects for a life cycle of 25 years.
- F. Fill Material: Manufacturer's standard cementitious grout; demonstrated suitable for function by prototype testing shown by test results to perform acceptably as a confining in-fill material.

2.3 PERFORMANCE REQUIREMENTS

- A. Each Buckling Restrained Brace shall provide the following minimum performance:
 - 1. Initial yield force shall be as indicated on the Drawings to within plus 10 percent or minus 10 percent tolerance.
 - 2. Initial yield stress shall be 42 ksi to within plus 5 percent or minus 10 percent tolerance.
 - 3. Braces shall provide for stable cyclic displacement (lengthening and shortening) corresponding to 200% of 1.0% interstory drift unless values on the drawings indicate otherwise.
- B. Results of full-scale cyclic uniaxial tests of buckling restrained braces of similar size and materials of fabrication shall evidence that the hysteretic behavior in the non-linear range shows no sign of degradation or loss of strength. Graphs of test results shall show no signs of pinched hysteretic behavior. The compression/tension ratio for the same deformation must be equal to or greater than 1.0.
- C. Design braces to satisfy performance requirements within specified tolerances using mill certificates and coupon test data for steel furnished for project.
- D. The portion of the steel core that projects beyond the casing shall as a minimum be designed to develop a min. axial force equal to 125% of the yield force of the Buckling Restrained brace or as necessary to develop the strain at the given inter-story drift.

2.4 FABRICATION

- A. Fabricate steel in accordance with Division 5 Section "Structural Steel."
 - 1. The steel core shall be fabricated and assembled to ensure trueness.

BID AND PERMIT SET

- 2. The maximum dimensions (if any) of the casing of the buckling restrained brace shall be as indicated on the Drawings.
- B. Welded Connections: All exposed welds shall be ground smooth. Any shims, plates, and washers used for erection shall be removed.
- C. Bolted Connections: All holes for bolted connections shall be drilled, and burrs removed in accordance with the AISC Code of Standard Practice. Any shims, plates, and washers used for erection shall be removed.
- D. Pinned Connections: All holes for pinned connections shall be milled to 1/32" greater than the bolt diameter. Any shims, plates, and washers used for erection shall be removed.
- E. Assembly: Assemble components of the Buckling Restrained Brace in a manner to ensure proper performance of the brace.
 - 1. End confining plates shall be provided to ensure confinement of the fill material while allowing for non-restricting movement of the steel core.

2.5 FINISH

- A. Unprotected metal surfaces shall be prepared and painted to provide corrosion protection during transport.
- 2.6 SOURCE QUALITY CONTROL
 - A. Manufacturer's Quality Control: Perform testing and inspection in accordance with approved Quality Assurance Plan.
 - 1. Coupon Tests: Manufacturer shall test coupons from each lot of steel used in fabrication of buckling restrained brace core for initial yield, ultimate tensile stress, and ultimate elongation.
 - B. Notify the Engineer no less than 10 days before the start of fabrication of the buckling restrained braces, to allow the Engineer to observe fabrication and assembly process.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine construction to receive braces to verify that conditions are proper.
- B. Verify that surfaces to receive braces are clean.
- C. Do not proceed with erection until unsatisfactory conditions are corrected.

BID AND PERMIT SET

3.2 ERECTION

- A. Prior to erection, clean faying surfaces of brace to be in contact with bolted connections to a finish of SSPC SP-3.
- B. Braces are erected under Division 5 Section "Structural Steel."
- C. Buckling restrained braces shall not be field cut or altered. Alterations to structural steel components to receive Buckling Restrained Braces shall be as permitted by Division 5 Section "Structural Steel."
- D. No field welding to buckling restrained brace members will be permitted, including attachment of nonstructural components.

END OF SECTION 051215

BID AND PERMIT SET

SECTION 052100 - STEEL JOIST 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. K-series steel joists.
 - 2. KCS-type K-series steel joists.
 - 3. K-series steel joist substitutes.
 - 4. LH-series long-span steel joists.
 - 5. Joist accessories.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists. Joists, bracing/bridging shall not be installed through skylight openings.
 - 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.

BID AND PERMIT SET

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Manufacturer certificates.
- C. Mill Certificates: For each type of bolt.
- D. Comprehensive engineering analysis of all steel joists signed and sealed by the qualified professional engineer responsible for its preparation.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications.
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/240 of the span.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

BID AND PERMIT SET

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Camber joists according to SJI's "Specifications."
- G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.3 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:
 - 1. Joist Type: LH-series steel joists.
 - 2. End Arrangement: Underslung.
 - 3. Top-Chord Arrangement: Parallel unless noted otherwise.
- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber joists according to SJI's "Specifications."
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

BID AND PERMIT SET

2.5 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.
 - 1. Finish: Plain, uncoated.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Welding Electrodes: Comply with AWS standards.
- F. Galvanizing Repair Paint: ASTM A 780/A 780M.
- G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.
- D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

BID AND PERMIT SET

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

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications", joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

3.4 **PROTECTION**

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.

BID AND PERMIT SET

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 052100

BID AND PERMIT SET

SECTION 053100 - STEEL DECKING

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. Roof deck.
 - 2. Acoustic roof deck.
 - 3. Composite floor deck.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and structural concrete fill over steel deck.
 - 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Evaluation Reports: For steel deck, from ICC-ES.
- D. Field quality-control reports.

STEEL DECKING

BID AND PERMIT SET

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. Consolidated Systems, Inc.; Metal Dek Group.
 - 4. New Millennium Building Systems, LLC.
 - 5. Nucor Corp.; Vulcraft Group.
 - 6. Verco Manufacturing Co.
 - 7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

BID AND PERMIT SET

- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span or more.
 - 6. Side Laps: Interlocking seam.
- C. Acoustical Roof Deck:
 - 1. Basis-of-Design Product: Acoustical Cellular Deck PLB-CD AC by Verco; www.vercodeck.com.
 - 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 3. Bottom perforated metal color: White.
 - 4. NRC Rating: 0.85, when using polyisocyanurate roof insulation and plain fiberglass insulation in deck flutes.

2.3 COMPOSITE FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. Consolidated Systems, Inc.; Metal Dek Group.
 - 4. New Millennium Building Systems, LLC.
 - 5. Nucor Corp.; Vulcraft Group.
 - 6. Verco Manufacturing Co.
 - 7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60 (Z180) zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 2. Profile Depth: As indicated.

BID AND PERMIT SET

- 3. Design Uncoated-Steel Thickness: As indicated.
- 4. Span Condition: Triple span or more.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: ASTM A 780/A 780M.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

STEEL DECKING

BID AND PERMIT SET

- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Weld Diameter: 3/4 inch (19 mm), nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated and as follows:
 - 1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

BID AND PERMIT SET

- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 3/4 inch (19 mm), nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
 - 3. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914 mm), and as follows:
 - 1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

BID AND PERMIT SET

3.6 **PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and, apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 053100

BID AND PERMIT SET

SECTION 054000 - COLD-FORMED 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. Exterior load-bearing wall framing.
 - 2. Exterior cladding furring.
 - 3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
 - 4. Soffit framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
 - 3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.

BID AND PERMIT SET

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- E. Evaluation Reports: For nonstandard cold-formed steel framing, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

BID AND PERMIT SET

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ClarkDietrich Building Systems.
 - 2. Nuconsteel, A Nucor Company.
 - 3. SCAFCO Corporation.
 - 4. Steel Construction Systems.
 - 5. Steel Network, Inc. (The).
 - 6. Steel Structural Systems.
 - 7. Steeler, Inc.
 - 8. United Metal Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch (19 mm).
 - 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

BID AND PERMIT SET

- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60 (Z180).
 - a. Provide G90 (Z275) for applications outside the weather resistant barrier (WRB).
- C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60 (Z180).
 - a. Provide G90 (Z275) for applications outside the weather resistant barrier (WRB).

2.4 FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance.
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance.
 - 2. Flange Width: 1-1/4 inches (32 mm).

BID AND PERMIT SET

- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.05 inch (1.27 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.05 inch (1.27 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.05 inch (1.27 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.05 inch (1.27 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

BID AND PERMIT SET

2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.05 inch (1.27 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled expansion anchor or adhesive anchor.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

BID AND PERMIT SET

- 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
- 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

BID AND PERMIT SET

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

BID AND PERMIT SET

- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

BID AND PERMIT SET

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated on Drawings.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

BID AND PERMIT SET

- 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

BID AND PERMIT SET

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

BID AND PERMIT SET

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for overhead doors and grilles.
 - 2. Steel framing and supports for countertops.
 - 3. Steel framing and supports for mechanical and electrical equipment.
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 5. Elevator machine beams, hoist beams, and divider beams.
 - 6. Steel shapes for supporting elevator door sills.
 - 7. Shelf angles.
 - 8. Metal ladders.
 - 9. Metal ship's ladders.
 - 10. Elevator pit sump covers.
 - 11. Miscellaneous steel trim including steel angle corner guards.
 - 12. Metal bollards.
 - 13. Downspout guards.
 - 14. Abrasive metal nosings, treads and thresholds.
 - 15. Metal downspout boots.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 042000 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Section 042613 "Masonry Veneer" for installing loose lintels in masonry veneer.
 - 4. Section 051200 "Structural Steel Framing".

BID AND PERMIT SET

5. Section 077200 "Roof Accessories" for roof hatches.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Prefabricated building columns.
 - 3. Metal nosings and treads.
 - 4. Paint products.
 - 5. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for overhead doors.
 - 2. Steel framing and supports for countertops.
 - 3. Steel framing and supports for mechanical and electrical equipment.
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 5. Elevator machine beams, hoist beams, and divider beams.
 - 6. Metal ladders.
 - 7. Metal bollards.
 - 8. Abrasive metal nosings, treads and thresholds.
 - 9. Loose steel lintels.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

BID AND PERMIT SET

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Checker Plate: Structural carbon steel, 1/4-inch thick, with rhombic-shaped projections for nonslip surface; hot-dipped galvanized.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide product compatible with system as required per Sections 099113 "Exterior Painting," 099123 "Interior Painting," as appropriate for location and painting system indicated.

BID AND PERMIT SET

- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normalweight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

BID AND PERMIT SET

- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with primer specified in Division 09.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

BID AND PERMIT SET

- C. Galvanize and prime shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-inplace concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

- 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
- 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges; unless indicated otherwise.
- 3. Rungs: 3/4-inch- (19-mm-) diameter steel bars; unless indicated otherwise.
- 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
- 5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
- 6. Cross-over Platform: Galvanized checker plate.
- 7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
- 8. Galvanize exterior ladders, including brackets.

2.9 METAL SHIP'S LADDER

- A. Provide aluminum ship's ladder and pipe crossovers where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 - 1. Treads shall be not less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, and riser height shall be not more than 9-1/2 inches (241 mm). Ladder angle, 60 degrees.
 - 2. Fabricate ship's ladder stringers and railings from aluminum.
 - 3. Fabricate treads and platforms from welded or pressure-locked aluminum bar grating. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
 - 4. Comply with applicable railing structural requirements in Section 055113 "Metal Pan Stairs."
 - 5. Basis-of-Design Product: No. 523A Ship Ladder by O'Keeffe's, Inc.
- B. Provide angle supports as indicated.
- C. Include angle stiffeners, and fixed and removable sections as indicated.

BID AND PERMIT SET

2.10 ELEVATOR PIT SUMP COVERS

- A. Fabricate from 3/16-inch (4.8-mm) abrasive-surface floor plate with four 1-inch- (25-mm-) diameter holes for water drainage and for lifting.
- B. Provide steel angle supports as indicated.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with primer specified in Division 09.

2.12 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe unless indicated otherwise.
 - 1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.

2.13 DOWNSPOUT GUARDS

- A. Fabricate downspout guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.
- B. Galvanize and prime downspout guards.

2.14 ABRASIVE METAL NOSINGS, TREADS AND THRESHOLDS

- A. Cast-Metal Units: Cast iron, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Nosings: Cross-hatched units, 4 inches (100 mm) wide with 1-inch (25-mm) lip, for casting into concrete.

BID AND PERMIT SET

- 2. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches (38 by 38 mm), for casting into concrete.
- 3. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch (19-by-19-mm) nosing, for application over bent plate treads or existing stairs.
- 4. Thresholds: Fluted-saddle-type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with tapered edges.
- 5. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches (125 mm) wide by 5/8 inch (16 mm) high, with tapered edge.
- 6. Thresholds: Plain-stepped- (stop-) type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with 1/2-inch (12-mm) step.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
 - 1. Provide two rows of holes for units more than 5 inches (125 mm) wide, with two holes aligned at ends and intermediate holes staggered.
- D. Apply bituminous paint to concealed surfaces of cast-metal units.

2.15 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
 - 1. Outlet: Vertical, to discharge into pipe.

2.16 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.

2.17 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

BID AND PERMIT SET

- 2.18 FINISHES, GENERAL
 - A. Finish metal fabrications after assembly.
 - B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.19 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 099113 "Exterior Painting", primers specified in Section 099123 "Interior Painting"
- D. Preparation for Shop Priming: Clean surfaces to be painted per primer manufacturer's written instructions. Remove loose rust and mill scale and other spatter, slag, flux deposits, and any other potential bond-breaking materials.
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

BID AND PERMIT SET

- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

BID AND PERMIT SET

3.4 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

BID AND PERMIT SET

SECTION 055113 - METAL PAN STAIRS

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. Pre-engineered and pre-assembled steel stairs with concrete-filled treads and landings.
 - 2. Deferred submittal including structural design and engineering of stairs.
- B. Related Requirements:
 - 1. Section 057300 "Decorative Metal Railings" for guardrails and stair risers for metal pan stairs.
 - 2. Section 062023 "Interior Finish Carpentry" for wood hand railings attached to steel stair construction.
 - 3. Section 096513 "Resilient Base and Accessories" for rubber stair treads.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 SUBMITTALS

A. Product Data: For metal pan stair materials.

BID AND PERMIT SET

- B. Deferred Submittal:
 - 1. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 2. Calculations: Submit stair calculations prepared by and stamped by professional engineer, demonstrating compliance with design criteria.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Deferred Submittal: Engage a qualified professional engineer to design stairs and railings.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

BID AND PERMIT SET

- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7-10.
- E. Component Importance Factor: 1.5.

2.2 APPEARANCE REQUIREMENTS

- A. Exposed Metal Fabrications: Metal fabrications exposed to view shall be Architectural grade unless otherwise indicated; the following standards shall be followed:
 - 1. Form exposed work with accurate angles and surfaces and straight edges. Ease exposed edges to small, uniform radius.
 - 2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline.
 - 3. Weld corners continuously. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.
 - 4. Continuously seal joined members at intermittent (stitch) welding with plastic filler.
 - a. Basis-of-Design Product: Bondo Ultimate Filler, by Bondo Corp., Div. of 3M; www.bondo.com.
 - b. At galvanized members, do not apply plastic filler until after hot-dip galvanizing, prior to finishing.
 - 5. Verify that weld sizes, fabrication sequence, and equipment used will limit distortions to allowable tolerances. Prevent weld show-through at visible faces of fabrications.
 - 6. Exposed mechanical fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where noted otherwise.

2.3 MANUFACTURER

- A. Basis-of-Design Manufacturer: Pacific Stair Corp.; www.pacificstair.com.
 - 1. Basis-of-Design Product: Model No. L100 Concrete Filled Treads and Landings, by Pacific Stair, with Architect designed stair risers, guardrails and handrails.

2.4 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, roller marks, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M or ASTM A572.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

- E. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230).
- F. Perforated Metal Stair Risers: As specified in Section 057300 "Decorative Metal Railings".

2.5 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts.
- D. Post-Installed Anchors: Post installed concrete anchors with ICC approval in cracked concrete.
 - 1. Provide Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- C. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
- D. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.

BID AND PERMIT SET

- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes OK.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.8 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Service Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of galvanized steel plates or channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of galvanized steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

BID AND PERMIT SET

- C. Metal Pan Stairs: Form subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).
 - 1. Steel Sheet: Galvanized-steel sheet, where indicated.
 - 2. Directly weld metal pan risers and subtreads to stringers; locate welds on top of subtreads where they are concealed by concrete fill.
 - 3. Shape metal pans to include nosing integral with riser.
 - 4. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
 - 5. Provide sub-landings of configuration indicated or, if not indicated, the same as subtreads. Weld sub-landings to landing framing.

2.9 STAIR RAILINGS

- A. Metal Railings: Coordinate with Section 055213 "Pipe and Tube Railings".
- B. Guardrails: Comply with applicable requirements in Section 057300 "Decorative Metal Railings."
 - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
- C. Wood Railings: Coordinate with Section 062023 "Interior Finish Carpentry".
- D. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes OK.

2.10 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

BID AND PERMIT SET

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding or bolting to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

BID AND PERMIT SET

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

3.4 QUALITY CONTROL

A. Tests and Inspections: The Owner will employ the services of an independent testing laboratory for performing test and to conduct inspection services on all shop fabricated and on-site structural welding and bolting plus expansion anchor, grouted anchor, and adhesive anchor placement required for this construction and as required per the Statement of Special Inspections within the Structural Drawings.

END OF SECTION 055113

BID AND PERMIT SET

SECTION 055116 - METAL FLOOR PLATE STAIRS

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. Commercial-type egress stairs with steel framing tread and landing supports.
 - 2. Delegated design.
- B. Related Requirements:
 - 1. Section 016116 "Delegated Design Requirements".
 - 2. Section 034500 "Precast Architectural Concrete" for stair treads.
 - 3. Section 057300 "Decorative Metal Railings" for stair risers and guardrails for metal floor plate stairs.
 - 4. Section 062023 "Interior Finish Carpentry" for wood hand railings attached to steel stair construction.
 - 5. Section 099123 "Interior Painting" for stair framing and railing finish.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 SUBMITTALS

- A. Product Data: For metal floor plate stairs and the following:
 - 1. Metal.
 - 2. Paint products.
 - 3. Grout.

BID AND PERMIT SET

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Design Build Deferred Submittal: For stairs and associated railings indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data:
 - 1. For testing agency.
 - 2. For professional engineer.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 016116 "Delegated Design Requirements," to design stairs.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

BID AND PERMIT SET

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, roller marks, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 PRODUCTS

- A. Stair Framing: As indicated on Drawings.
- B. Stair Treads: Precast concrete, as specified in Section 034500 "Precast Architectural Concrete."
- C. Stair Risers: Perforated metal as specified in Section 057300 "Decorative Metal Railings."

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

BID AND PERMIT SET

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Form exposed work with accurate angles and surfaces and straight edges.
- C. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.
- D. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," industrial class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel plate headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.
- C. Metal Floor Plate Stairs: Form tread and landing supports to configurations shown from steel angles or shapes of thickness needed to comply with performance requirements, but not less than 1/4 inch (6.4 mm).
 - 1. Weld steel supporting brackets to stringers and screw pre-cast treads to brackets.

BID AND PERMIT SET

2.8 STAIR TREADS

A. As specified in Section 034500 "Precast Architectural Concrete".

2.9 STAIR RAILINGS

- A. Guardrails: Comply with applicable requirements in Section 057300 "Decorative Metal Railings."
 - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
- B. Wood Railings: Coordinate with Section 062023 "Interior Finish Carpentry".
- C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes OK.

2.10 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs, Field Preparation: SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

BID AND PERMIT SET

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 055116

BID AND PERMIT SET

SECTION 057300 - DECORATIVE METAL RAILINGS

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. Decorative steel guardrail, stair railings and stair risers.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications."
 - 2. Section 055113 "Metal Pan Stairs."
 - 3. Section 055116 "Metal Floor Plate Stairs."
 - 4. Section 061053 "Miscellaneous Rough Carpentry" for blocking in interior, metal framed walls.
 - 5. Section 062023 "Interior Finish Carpentry" for wood handrails.
 - 6. Section 099123 "Interior Painting" for finish of steel railings and stair framing.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

BID AND PERMIT SET

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Steel railings and perforated metal.
 - 2. Paint products.
 - 3. Grout.
- B. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.
- C. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Welded connections. Confirm all weld finishes for each location prior to fabrication.
 - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples shall be full height.
- D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- E. Delegated-Design, Deferred Submittal: For components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Welding certificates.
- G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.7 QUALITY ASSURANCE

- A. Structural Design: Structural elements shall be designed by a structural engineer licensed to practice in State of Oregon.
- B. Installer Qualifications: Fabricator of products.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."

BID AND PERMIT SET

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Source Limitations: Obtain each type of railing from single source from single fabricator.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 016116 "Delegated Design Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
 - 2. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.3 GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

BID AND PERMIT SET

- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
- 2.4 STEEL
 - A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 - C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- 2.5 STAINLESS STEEL
 - A. Tubing: ASTM A554, Grade MT 304.
 - B. Pipe: ASTM A312/A312M, Grade TP 304.
 - C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.
 - D. Sheet, Strip, Plate, and Flat Bar: ASTM A666, Type 304.
 - E. Bars and Shapes: ASTM A276, Type 304.
 - F. Perforated Sheet Metal:
 - 1. Material: Type 304, mill finish stainless steel, 11-gauge (0.12-inch thick), 3/8-inch diameter round perforations, on 1/2-inch staggered centers; 51 percent open area.
 - 2. Sheet Size: 48 inches by 120 inches.
 - 3. Basis-of-Design Product: McNichols perforated metal, Item No. 1838121141.
- 2.6 FASTENERS
 - A. General:
 - 1. Steel components: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
 - 2. Stainless-steel components: Type 304 stainless-steel fasteners.
 - B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be shop primed with zinc-rich primer.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.7 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that are compatible with and comply with Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION, GENERAL

- A. Provide complete assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles, surfaces and straight edges and true to line and level.

BID AND PERMIT SET

- F. Connections: Fabricate railings with welded connections unless otherwise indicated.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces, except as indicated below. Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" types indicated for the following location:
 - a. Where graspable: Finish no. 1 welds: No evidence of a welded joint.
 - b. Where exposed to view: Finish no. 2: Completely sanded joint, some undercutting and pinholes OK.
 - 1) Fill pinholes where directly exposed to view with filler and sand smooth.
 - c. Where semi-exposed to view: Finish no. 3 welds: Partially dressed weld with spatter removed.
- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.

2.9 RAILINGS

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
 - 1. Perforated metal guardrails: Weld perforated metal to steel frame in shop. Mechanicallyattach guard and stair railings to support steel in field. Factory prime and field finish paint.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

BID AND PERMIT SET

- C. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- D. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.10 STEEL FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- B. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Install railings as indicated on Drawings.
- B. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal railings to in-place construction or to stairs. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors for securing railings and for properly transferring loads to in-place construction.
- E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

BID AND PERMIT SET

- 2. Set railing posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
- 3. Align railings so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- F. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- G. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.3 RAILING CONNECTIONS

- A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

- A. Architect and Structural engineer will approve all core-drilling prior to installation, where required.
- B. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed to match adjacent concrete and placed to comply with anchoring material manufacturer's written instructions.
- C. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

BID AND PERMIT SET

- D. Anchorage Joint: As indicated.
 - 1. Cover anchorage joint with flange of same metal as post.
 - 2. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post at exterior conditions, and anchoring material flush with adjacent surface at interior conditions.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.
- C. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, fasten brackets directly to steel framing or concealed wood blocking using self-tapping screws of size and type required to support structural loads or with toggle bolts installed through flanges of steel framing..

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

END OF SECTION 057300

BID AND PERMIT SET

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, cants, and nailers.
 - 2. Wood furring and grounds.
 - 3. Wood sleepers.
 - 4. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 075423 "Thermoplastic Polyolefin (TPO) roofing".
 - 3. Section 076200 "Sheet Metal Flashing and Trim".

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

BID AND PERMIT SET

- 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
- 4. 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. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fireretardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 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.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 15 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.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

BID AND PERMIT SET

- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. General:
 - 1. General Contractor shall furnish and install minimum 2x6 continuous fire-retardant treated wood blocking in stud partitions for anchorage of wall attached items, including but not limited to the following:

Kitchen/restroom sinks	Dispensers
Hand rails	Magnetic/manual door stops
Hose bibs	Door hold open devices
Alarms	Gym equipment
Monitors	Projection equipment
Door stops	Mirrors
Casework	Toilet partitions
Grab bars	Shelving
Artwork	Casework
Blinds, shades	Signage
Electrical framing	Fire extinguishers

- 2. Metal blocking is not acceptable. Only use wood blocking, even in metal-framed partitions.
- B. Additionally, provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Nailers.
 - 2. Rooftop equipment bases and support curbs.
 - 3. Cants.
 - 4. Furring.
 - 5. Grounds.
- C. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- D. Concealed Boards: 15 percent maximum moisture content of the following species and grades:

BID AND PERMIT SET

- 1. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
- E. 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.
- F. 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.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 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, 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.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

BID AND PERMIT SET

2.7 METAL FRAMING ANCHORS

- A. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), highstrength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- B. 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 (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide minimum 2x6 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 (406 mm) o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) on center with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

BID AND PERMIT SET

- 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) on center. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
- 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
- 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) on center.
- G. 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.
- H. Comply with AWPA 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.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. 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.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install minimum 2 by 6 nailer and blocking where indicated and where required for screeding or 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.

BID AND PERMIT SET

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 **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

BID AND PERMIT SET

SECTION 061600 - SHEATHING

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. Exterior wall sheathing.
 - 2. Interior wall sheathing.
 - 3. Parapet sheathing.
 - 4. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
 - 2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 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 plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fireretardant-treated material, an inspection agency acceptable to authorities having jurisdiction that

BID AND PERMIT SET

periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 EXTERIOR WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Dens-Glass Gold by G-P Gypsum Corporation, or comparable product by, but not limited to, one of the following:
 - a. American Gypsum.
 - b. LaFarge North America Inc.
 - c. National Gypsum Company.
 - d. Temple-Inland Inc.
 - e. United States Gypsum Co.
 - 2. Type and Thickness: Regular, 1/2 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.3 INTERIOR WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Dens-Armor Plus by G-P Gypsum Corporation, or comparable product by, but not limited to, one of the following:
 - a. American Gypsum.
 - b. LaFarge North America Inc.
 - c. National Gypsum Company.

BID AND PERMIT SET

- d. Temple-Inland Inc.
- e. United States Gypsum Co.
- 2. Type and Thickness: Regular, 5/8-inch thick.
- 3. Board Size: 48 by 96 inches for vertical installation.

2.4 PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Dens-Glass Gold by G-P Gypsum Corporation, or comparable product by, but not limited to, one of the following:
 - a. American Gypsum.
 - b. LaFarge North America Inc.
 - c. National Gypsum Company.
 - d. Temple-Inland Inc.
 - e. United States Gypsum Co.
 - 2. Type and Thickness: Regular, 1/2 inch thick.
 - 3. Board Size: 48 by 96 inches for vertical installation.

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. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

BID AND PERMIT SET

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

BID AND PERMIT SET

- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 - 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 - 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

BID AND PERMIT SET

SECTION 062023 - INTERIOR FINISH 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 wall panels, including interior:
 - a. Hardwood plywood veneer panels.
 - b. MDF paneling.
 - c. Grille paneling.
 - d. Salvaged wood paneling.
 - 2. Wood handrails.
 - 3. Interior trim.
 - 4. Floating wood shelves.
 - 5. Hardware for finish carpentry.
- B. Related Requirements:
 - 1. Section 057300 "Decorative Metal Railings" for coordination with metal guardrails.
 - 2. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - 3. Section 095113 "Acoustical Panel Ceilings" for wood grille ceiling support.
 - 4. Section 099123 "Interior Painting"

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors 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

BID AND PERMIT SET

type of preservative used and net amount of preservative retained. Include chemicaltreatment manufacturer's written instructions for finishing treated material.

- 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples: For each exposed product and for each color and texture specified.

1.5 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of paneling indicated for construction, finishes, installation, and other requirements.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Provide a 10-foot long mockup section of MDF wainscot incorporating a panel seam, outside corner, and cap.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - 2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.7 FIELD CONDITIONS

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

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

PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
 - A. Hardwood Lumber: NHLA, American Hardwood Lumber Grades.
 - B. Softwood Plywood: DOC PS 1.
 - C. Hardwood Plywood: HPVA HP-1, hardwood plywood standard.
 - D. MDF: ANSI A208.2, Grade 130.

2.2 WOOD WALL PANELS

- A. Plywood Paneling: Veneer hardwood plywood materials for wood paneling.
 - 1. Veneer species: Select White Oak (Quercus alba).
 - 2. Grade: Manufacturer's standard "Select Veneer" (A Grade).
 - 3. Cut: Rift cut veneer.
 - 4. Match: Slip match, with flitch width matching.
 - 5. Size: As required for application.
 - 6. Finish: Transparent finish specified in Section 099123 "Interior Painting".
 - 7. Applications: Use for fixed panels at interior walls.
- B. Interior MDF Boards and Paneling:
 - 1. MDF: ANSI A208.2, Grade 155-F11 made with binder containing no urea-formaldehyde resin.
 - a. Density: 48.5 lbs / cubic foot.
 - 2. Provide paneling and boards of thickness shown or, if not shown, 3/4-inch minimum thickness. Assemble by gluing and concealed fastening.
 - 3. Finish: Paint to match adjacent walls, as specified in Section 099123 "Interior Painting."

BID AND PERMIT SET

- C. Interior Wood Grille for walls and ceilings (WS-1):
 - 1. Basis-of-Design Product: 1100 Series Cross Piece Grille by 9Wood; www.9wood.com.
 - a. Wood Slat Species: Western Hemlock.
 - b. Dimensions and Spacing: As detailed on Drawing A10.10.
 - c. Finish: Manufacturer's standard clear finish.
 - d. For ceiling support, refer to Section 095113 "Acoustical Panel Ceilings."
 - 2. Fastening: Manufacturer's standard furring strips attached to wall framing or wood blocking.
- D. Wood Paneling, Salvaged (WP-S):
 - 1. Reclaimed Wood: Subject to compliance with requirements, provide reclaimed wood salvaged from the site. Refer to Section 024116 "Structure Demolition" for salvage requirements.

2.3 INTERIOR TRIM

- A. MDF: ANSI A208.2, Grade 155-F11 made with binder containing no urea-formaldehyde resin.
 - 1. Finish: White color, as selected by Architect.
- B. Wood Boards:
 - 1. Species, for Transparent Finish: Select White Oak (Quercus alba).
 - 2. Species for Opaque Finish (WB-1 and WB-2): Paint grade hardwood with no finger joints.
 - 3. Grade: FAS (First and Seconds).
 - 4. Profiles: As indicated.
 - 5. Finger Jointing: Not allowed.
 - 6. Finish: Transparent, as specified in Section 091123 "Interior Painting".
 - 7. Applications: For standing and running trim, seating, floating shelves, and other items as indicated on drawings.

2.4 WOOD HANDRAILS

- A. Material: White Oak (Quercus alba).
 - 1. Profile: Round, 1-5/8 inch outside diameter.
 - 2. Finish: White or Clear, as selected by Architect.
 - 3. Applications: Stairway handrails and ballet Barre Rails.
- B. Mounting Brackets:
 - 1. For ballet barres: Steel, rectangular wall bracket with saddle rail support.
 - 2. Basis-of-Design Product: Cabriole-Double Wall-Mounted ballet barre bracket by Custom Barres; www.custombarres.com; 1-5/8-inch open-saddle diameter; white finish.

BID AND PERMIT SET

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
 - 1. Provide stainless steel tamper resistant screws and grommets where exposed fasteners are indicated as indicated on drawings.
 - 2. Provide countersunk tamper resistant steel screws without grommets at Safe Room.
- B. Hardware:
 - 1. Floating shelf support brackets: Aksel XD, 2 Rod bracket, 10-inch (254-mm) long arms, by Shelfology.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

- 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
- 4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
- 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.
- 6. Refer to Division 09 Sections for final finishing of installed paneling

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - 2. Install trim after gypsum-board joint finishing operations are completed.
 - 3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

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

BID AND PERMIT SET

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

END OF SECTION 062023

BID AND PERMIT SET

SECTION 064100 - ARCHITECTURAL CASEWORK

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. Architectural wood cabinets.
 - 2. Architectural plastic-laminate-faced casework.
 - 3. Plastic laminate countertops.
 - 4. Solid surface countertops (SS-1 and SS-2).
 - 5. Cabinet hardware and accessories.
 - 6. Wood furring, blocking, shims, and hanging strips for installing architectural wood 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.
 - 2. Section 123216 "Manufactured Casework" for music room storage cabinets.
 - 3. Section 224000 "Plumbing Fixtures" for coordination of fixtures with cabinets.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

- A. Product Data: For each type of product, including panel products, cabinet accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

BID AND PERMIT SET

- 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
- 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- 5. Apply AWI Quality Certification Program label to Shop Drawings.
- 6. For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Initial Selection:
 - 1. Shop-applied transparent finishes.
 - 2. Plastic laminates.
 - 3. Solid surface material.
 - 4. Painted and primed finishes.
- D. Samples for Verification:
 - 1. Lumber for Transparent Finish: for each species and cut, finished on one side and one edge.
 - 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets.
 - 3. Plastic laminates,12 by 12 inches (300 by 300 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 4. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
 - b. Miter joints for standing trim.
 - 5. Exposed cabinet accessories, one unit for each type and finish.
 - 6. For the Following Countertop Products:
 - a. Countertop material, 6 inches (150 mm) square.
 - b. Wood trim, 8 inches (200 mm) long.
 - c. One full-size solid surface material countertop, with front edge, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.
- E. Qualification Data: For fabricator.
- F. Product Certificates: For each type of product, including but limited to the following:
 - 1. Wood products.
 - 2. High-pressure decorative laminate.
 - 3. Glass.
 - 4. Adhesives.
- G. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- H. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

BID AND PERMIT SET

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fireretardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical architectural cabinets as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Overage: Ensure appropriate amount of overage to account for quality requirement; for all wood types allow for approximately 25 percent additional materials to allow sorting and rejecting to meet quality requirements.

1.6 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.

1.7 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 and relative humidity at occupancy levels during the remainder of the construction period.
- B. 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 (16 and 32 deg C) and relative humidity between 17 and 50 percent during the remainder of the construction period.
- C. 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

BID AND PERMIT SET

Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets with sequence-matched wood paneling, wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.

2.2 ARCHITECTURAL CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.3 PLYWOOD PANELS FOR CASEWORK

- A. Grade: Premium.
- B. Type of Construction: Custom as indicated on drawings.
- C. Reveal Dimension: As indicated.

BID AND PERMIT SET

- D. Plywood Panels for Exposed Surfaces:
 - 1. Veneer species: Select White Oak (Quercus alba).
 - 2. Grade: Manufacturer's standard "Select Veneer" (A Grade).
 - 3. Cut: Rift cut veneer.
 - 4. Match: Slip match, with flitch width matching.
 - 5. Size: As required for application.
 - 6. Finish: Shop-applied, transparent finish.
 - 7. Applications: Use for fixed panels at casework.

2.4 PLASTIC-LAMINATE-FACED CASEWORK

- 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 labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Basis-of-Design Products:
 - 1. Colors and Finish: Refer to Color and Material Schedule on Drawings.
- C. Grade: Premium.
- D. Type of Construction: Frameless.
- E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- F. Reveal Dimension: 1/8 inch (3 mm) unless indicated otherwise.
- G. High-Pressure Decorative Laminate: NEMA LD 3, Factory-laminated markerboard panel of three-ply construction, consisting of backing, fiberboard core material, and high-pressure-laminate writing surface.
- H. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS; to match plastic laminate.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels, unless indicated otherwise.

- I. Materials for Semi-Exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade HGS.
 - a. Edges of Plastic-Laminate Shelves: High-pressure decorative laminate, NEMA LD 3, Grade HGS.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade HGS.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- J. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- L. 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.

2.5 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. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
 - 2. Wood Moisture Content: 8 to 13 percent.
- B. Plywood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Laminate and Countertop Subbase Products: Softwood plywood, DOC PS 1, mediumdensity overlay (MDO).
 - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.6 COUNTERTOPS

- A. High-pressure decorative laminate countertop NEMA LD 3, Grade HGS.
 - 1. Basis-of-Design Product (PL-2): Refer to Finish Schedule on Drawings.
 - a. Colors, Thickness and Finish: Refer to Finish Schedule on Drawings.
 - b. Edge Treatment: Match material, color and finish of countertop.

BID AND PERMIT SET

- B. Solid-Surfacing Material (SS-1): Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Corian by Dupont, as listed on the Color and Materials schedule, or a comparable product of one of the following:
 - a. Avonite Surfaces; Aristech Acrylics LLC.
 - b. Formica Corporation.
 - c. LG Solid Source, L.L.C.
 - d. Nevamar Company, LLC; Decorative Products Div.
 - e. Samsung; Cheil Industries Inc.
 - f. Wilsonart International; Div. of Premark International, Inc.
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
- C. Solid Surfacing Material (SS-2):
 - 1. Basis-of-Design Product: Epoxy Classic Resin Top by Durcon Company, a Wilsonart Company, or approved substitution.
 - 2. Material: Epoxy, factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 3. Thickness: 1-inch (25.4-mm) thick with 1/8-inch (3-mm) bevel edges
 - 4. Color: Black Onyx.
 - 5. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - 6. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
- D. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.
- E. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

BID AND PERMIT SET

2.7 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hinges: No concealed (European-style) hinges allowed. Hospital grade overlay hinges required.
 - 1. Five-knuckle, overlay hinge that meets ANSI/BHMA 156.9, Grade 1.
 - 2. Basis-of-design product: RPC 374-26D by Rockford Process Control, LLC, or approved substitution.
- C. Back-Mounted Pulls: BHMA A156.9, B02011:
 - 1. Length: 4-inch centers, stainless steel wire pull.
 - 2. Basis-of-Design Product: Functional Pull 2211, No. BP221170 by Richelieu Hardware; www.richelieu.com.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Drawer Slides: Select from the following as necessary to meet cabinet design.
 - 1. Knape & Vogt: 8400, 4100, 6400.
 - 2. Fulterer: FR 5000.
 - 3. Accuride: 3832C, 3834C, 3832CSC, 3834CSC, 2632.
 - 4. Full-exterention slides shall have minimum capacity of 75 pounds.
- G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- H. Door Locks: Basis-of-design product: No. 100DR by Olympus Lock, or approved substitution.
- I. Drawer Locks: Basis-of-desin product: No. 200DW by Olympus Lock, or approved substitution.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Satin Stainless Steel: BHMA 630.

2.8 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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 nonferrousmetal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.9 FABRICATION

- A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets: 1/16 inch (1.5 mm) unless otherwise indicated.
- B. Complete fabrication, including assembly, finishing, 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 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.

2.10 SHOP FINISHING

- A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. General: Shop finish transparent-finished architectural wood cabinets at fabrication shop as specified in this Section.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- D. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: System 5, conversion varnish.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.

BID AND PERMIT SET

- 4. Staining: Clear to match Architect's sample.
- 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- 6. Filled Finish for Open-Grain Woods After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
- 7. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter per ASTM D 523 to match Architect's approved sample.

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, including removal of packing and backpriming.

3.2 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 CABINET 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 inches (3 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. For shop finished items use filler matching finish of items being installed.
- F. Cabinets: Install without distortion.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

BID AND PERMIT SET

- 2. Maintain veneer sequence matching of cabinets with transparent finish.
- 3. 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 sheet metal screws through metal backing or metal framing behind wall finish.
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.4 COUNTERTOP INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to
BID AND PERMIT SET

finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

- 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.5 SOLID SURFICE AND PLASTIC PANEL INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.6 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 cabinets on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064100

SECTION 071113 - BITUMINOUS DAMPPROOFING

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. Cold-applied, emulsified-asphalt dampproofing.
 - 2. Molded-sheet drainage panels.
 - 3. Protection course.
 - 4. Accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials. Manufacturers to consider including the following:
 - 1. BASF.
 - 2. Tremco.

BID AND PERMIT SET

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Trowel Coats: ASTM D 1227, Type II, Class 1.
- B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- D. Patching Compound: As recommended in writing by dampproofing manufacturer.
- E. Protection Course: ASTM D 6506, 1/8-inch- (3-mm-) thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel:
 - 1. Composite subsurface drainage panel consisting of a studded, nonbiodegradable, moldedplastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core; and with a vertical flow rate of 150 gpm per ft. (6,105 L/min. per m).
 - 2. Basis-of-Design Product: CETCO, Aquadrain 15XP drainage panel.
 - 3. Wall base drain: CETCO, Aquadrain 100BD.
 - 4. Accessories: Primers, tapes, adhesives, and termination bars as required for complete installation, per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 - 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

BID AND PERMIT SET

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m) or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).
- B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m) or primer and one trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m).
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).

3.5 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install protection course before installing drainage panels.

3.7 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 071700 - BENTONITE WATERPROOFING

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. Bentonite waterproofing.
 - 2. Molded-sheet drainage panels.
 - 3. Protection Course.
 - 4. Accessories.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for excavating and backfilling.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and installation instructions.
- B. Shop Drawings: Include installation details for waterproofing, penetrations, and interface with other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of waterproofing material.
- B. Preconstruction Test Reports: For water samples taken at Project site along with recommendations resulting from these tests.
- C. Sample Warranty: For manufacturer's special warranty.

BID AND PERMIT SET

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturer's written instructions and warranty requirements.
 - 1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
 - 2. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPOSITE BENTONITE MEMBRANE

- A. Composite Bentonite with Protective Facing: Minimum 170-mil- thick membrane consisting of loose bentonite with a protective, nonwoven-geotextile facing.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. CETCO, a subsidiary of AMCOL International Corp; CETCO Voltex DX.

2.2 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel:
 - 1. Composite subsurface drainage panel consisting of a studded, nonbiodegradable, moldedplastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core; and with a vertical flow rate of 150 gpm per ft. (6,105 L/min. per m).
 - 2. Basis-of-Design Product: CETCO, Aquadrain 15XP drainage panel.
 - 3. Wall base drain: CETCO, Aquadrain 100BD.
 - 4. Accessories: Primers, tapes, adhesives, and termination bars as required for complete installation, per manufacturer's written instructions.

2.3 **PROTECTION COURSE**

- A. Protection Course: ASTM D 6506, 1/8-inch- (3-mm-) thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Adhesive: As recommended in writing by waterproofing manufacturer.

2.4 ACCESSORIES

- A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.
- B. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.
- C. Bentonite Tubes: Manufacturer's standard 2-inch- diameter, water-soluble tube containing approximately 1.5 lb/ft. of granular bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- D. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.
- E. Plastic Protection Sheet: Polyethylene sheeting according to ASTM D 4397; thickness as recommended in writing by waterproofing manufacturer to suit application but at least 6 mils (0.15 mm) thick.
- F. Cement Grout Patching Material: Grout mix compatible with substrate being patched and recommended in writing by waterproofing manufacturer.
- G. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- diameter washers under fastener heads.
- H. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Section 079200 "Joint Sealants."
- I. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.
- J. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.
- B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.
- C. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories according to manufacturer's written instructions.
 - 1. Before installing, verify the correct side of waterproofing that shall face substrate surface.
 - 2. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for bentonite tubes and mastic.
 - 3. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
 - 4. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.

BID AND PERMIT SET

- B. Apply bentonite tubes continuously on footing against base of wall to be waterproofed.
- C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.
- D. Install protection course before backfilling or placing overburden when recommended in writing by waterproofing manufacturer.
 - 1. Inspect and repair waterproofing after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

3.4 COMPOSITE POLYETHYLENE/BENTONITE MEMBRANE INSTALLATION

- A. Install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches unless otherwise indicated. Stagger end joints between membranes a minimum of 24 inches. Seal joints with permanent seam tape.
- B. Below Structural Slabs-on-Grade: Apply waterproofing membrane with polyethylene side down, and staple ends and edges.
 - 1. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches up or beyond perimeter slab forms.
 - 2. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
- C. Slabs: Starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches.
- D. Concrete Walls: Apply mastic to form continuous 3/4-inch cant or fillet at intersection of footings and walls.
 - 1. Starting at lowest point, install a layer of waterproofing membrane horizontally, extending a minimum of 6 inches onto the footing. Lap membrane ends and edges a minimum of 2 inches.
 - 2. Secure membrane to wall.
 - 3. Apply mastic to form continuous 3/4-inch layer around penetrations.
 - 4. Termination at Grade: Extend waterproofing membrane to underside of adjacent slab on grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
- E. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections. Encase tieback heads, rods, nuts, and plates according to waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
 - 1. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped minimum of 4 inches and nailed to shoring.
 - 2. Inspect and repair waterproofing membrane after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

BID AND PERMIT SET

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed waterproofing installation before covering with other construction, and provide written report stating that installation complies with manufacturer's written instructions.
 - 1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

END OF SECTION 071700

SECTION 071900 – WATER REPELLENTS

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 film-forming water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Brick veneer masonry.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard colors.
 - 3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
- B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For each type of water repellent.
- C. Preconstruction Test Reports: For water-repellent-treated substrates.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

BID AND PERMIT SET

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."
- C. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, for preconstruction testing, and to set quality standards for materials and execution.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
 - a. Size: 10 sq. ft. each.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on field mockups.
 - 1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.
 - 2. Propose changes to materials and methods to suit Project.
 - 3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.8 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. Concrete surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 - 3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
 - 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
 - 5. Rain or snow is not predicted within 24 hours.
 - 6. Not less than 24 hours have passed since surfaces were last wet.

BID AND PERMIT SET

7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FILM-FORMING WATER REPELLENTS WITH ANTI-GRAFFITI COATING

- A. Silicone-Resin Sealer, Film-Forming Water Repellent: Clear, polymerized, silicone-resin water repellent for dense substrates; in a solvent- or waterborne solution containing not less than 3 and up to 7 percent solids by weight.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Omegaseal 333 manufactured by Diedrich Technologies, Inc. or comparable product by, but not limited to one of the following:
 - a. Dow Corning Corp.
 - b. Prosoco, Inc.
 - c. Evonik Corp.
- B. Graffiti Management: When a protected surface has been attacked, remove graffiti with either 505 Special Coatings Stripper or 606 Multi-Layer Paint Remover, assisted by high pressure water.
 - 1. Initial Application: Use Diedrich 505 Special Coatings Stripper as first product when removing graffiti since, multiple removals are possible without re-application of Omegaseal 333. When areas that have been stripped with 505 show signs of water absorption, reapply the 333 Omegaseal.
 - 2. If initial application is not successful at removing graffiti, use 606 Multi-Layer Paint Remover for the most stubborn types of graffiti damage. Re-application of Omegaseal 333 is required after each use of 606 Multi-Layer Paint Remover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
 - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

BID AND PERMIT SET

- B. Apply coating of water repellent on surfaces to be treated using 15 psi- (103 kPa-) pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Precast Concrete: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.
- C. Apply a second saturation coating, repeating first application to perform as anti-graffiti coating. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

WATER REPELLENTS

SECTION 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
 - 2. Glass-fiber blanket (batt).
 - 3. Mineral wool insulation.
- B. Related Requirements:
 - 1. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
 - 2. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

- 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
- 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET (BATT)

A. Glass-Fiber Blanket (Batt), Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 MINERAL WOOL SEMI-RIGID BOARD

- A. Product: Subject to compliance with requirements, provide Comfortboard 110 by Rockwool or compatible product by manufacturers including, but not limited to, the following:
 - 1. Fibrex Insulations Inc.
 - 2. Isolatek International.
 - 3. Thermafiber.
 - B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Nominal density of 8 lb/cu. ft., Type III, thermal resistivity of 4.35 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

BID AND PERMIT SET

- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsolled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

BID AND PERMIT SET

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket (Batt) Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

BID AND PERMIT SET

- 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
- 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 **PROTECTION**

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072119 – FOAMED-IN-PLACE INSULATION

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. Closed-cell polyurethane spray foam insulation installed in voids of parapet walls where indicated on drawings.
 - 2. Furnish labor, material, equipment and services necessary for installation of closed cell polyurethane spray foam insulation.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for other insulation types.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D1622, Core Density.
 - 2. ASTM D1621, Compressive Strength.
 - 3. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
 - 4. ASTM E96, Test Methods for Water Vapor Transmission Rate of Building Materials.
 - 5. ASTM C518, R-Value.

1.4 SUBMITTALS

- A. Product Data: Provide data on materials, confirming products conform to specified properties, surface burning characteristics, and thermal resistance (R-Value) per inch of thickness.
- B. Manufacturer's installation instructions.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Applicator's Certificate: Certify that applicator meets qualification requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum of three (3) years' experience.
 - 2. Applicator: Company specializing in performing the work of this Section with a minimum three (3) years' experience and certified by the manufacturer.

1.6 MOCK-UP

- A. Provide an in-place mock-up of polyurethane spray insulation, including surface preparation and testing, if needed, to determine moisture content meets manufacturer's requirements.
- B. Construct mock-up 10-feet by 10-feet, including substrate construction.
- C. Locate where directed by Architect.
- D. Mock-up may remain as part of the Work if judged by Architect satisfactory and in compliance with requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Toxicity/Hazardous Materials, Outgassing/Reactivity:
 - 1. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
 - 2. Chlorofluorocarbons (CFCs/HCFCs): Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- B. Store materials in a temperature-controlled area between 70 degrees F and 90 degrees F and out of direct sunlight. Keep drums tightly closed when not in use ad under dry gas pressure of 2-3 psi after they have been opened. Refer to individual product data sheets for specific storage recommendations and shelf life information.
- C. Protect materials during handling and application to prevent damage and contamination.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. BASF Corporation; www.basf.com.

FOAMED-IN-PLACE INSULATION

BID AND PERMIT SET

- B. Demilec USA; www.demilecusa.com.
- C. ICP Adhesives and Sealants; www.icpadhesives.com.
- D. NCFI Polyurethanes, Div. of Barnhardt Manufacturing Co.; www.ncfi.com.

2.2 MATERIALS

- A. Basis-of-Design Product: Handi-Foam E84 Class 1(A) Low-Pressure Spray Polyurethane Foam; ICP Adhesives and Sealants.
- B. ASTM C1029, Type II, two-component, self-adhering, seamless, anti-microbial, low-pressure, spray-applied rigid polyurethane foam insulation:
 - 1. Evaluation Report: ICC-ES Evaluation Report ESR-2717.
 - 2. Thermal Resistance (R-Value/inch): ASTM C518, 5.9 R/In, minimum.
 - 3. Water Vapor Transmission: ASTM E96; 1.0 perms/inch, maximum.
 - 4. Air Permeability: Air leakage not more than 0.005 L/s/M^2 @ 75Pa at 1-inch thickness.
 - 5. Water Absorption: less than 4 percent.
 - 6. Core Density: 2.0-2.3 lbs/cu. ft. per ASTM D1622.
 - 7. Compressive Strength: Not less than 20 lbs./ sq. in. per ASTM D1621.
 - 8. Corrosion: No significant corrosion when in contact with steel under 85 percent relative humidity.
 - 9. Bacterial or Fungal Growth: No growth; no material deterioration.
 - 10. Flame Spread and Smoke Developed Rating: ASTM E84, less than or equal to 25; less than or equal to 450.
 - 11. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 ACCESSORIES

- A. Applied Ignition/ Thermal Barrier: Intumescent coating applied to face of foam insulation as ignition barrier where not protected by 1/2-inch gypsum board thermal barrier.
 - 1. Aldocoat 757 Ignition Barrier by Aldo Products Co., Inc.; www.aldoproducts.com; distributed by NCFI Polyurethanes, or approved substitution, compatible with insulation.
 - 2. Evaluation Report: ICC-ES Evaluation Report ESR-1615.
 - 3. Application: Spray-applied onto foam to cover all exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrate is dry and free of any foreign material that will impede application; test moisture content when required by manufacturer.

BID AND PERMIT SET

- C. Verify that other work on and within spaces to be insulated is complete prior to application.
- D. Notify Architect of conditions that would adversely affect the application or performance.
- E. Installing work over substrate means applicator accepts condition of substrate.

3.2 PREPARATION

- A. Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation, including application of primer where necessary.
- B. Mask and protect adjacent surfaces from overspray or damage.
- C. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will or may compromise application.

3.3 APPLICATION

- A. Apply insulation in accordance with manufacturers' written application instructions.
- B. Apply insulation to a reasonably uniform monolithic density without voids.
- C. Apply to minimum cured thickness of 3-inches plus or minus 1/2-inch, in two separate lifts of approximately 1-1/2 inches each, to limit heat.
- D. At areas without gypsum, American Society for Testing and Materials (ASTM):
 - 1. ASTM D1622, Core Density.
 - 2. ASTM D1621, Compressive Strength.
 - 3. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
 - 4. ASTM E96, Test Methods for Water Vapor Transmission Rate of Building Materials.
 - 5. ASTM C518, R-Value.
- E. Cover by gypsum board thermal barrier, or where indicated, apply intumescent ignition barrier per manufacturer's evaluation report.

3.4 CLEANUP

A. Clean off all overspray from surfaces not intended to receive foam insulation and remove overfill from areas that interfere with other work, and that exceed 3-1/2 inches thick. Remove all masking materials.

3.5 FIELD QUALITY CONTROL

A. Inspect application for proper coverage and, measure insulation thickness and density.

BID AND PERMIT SET

3.6 PROTECTION OF FINISHED WORK

A. Do not permit subsequent work to disturb applied insulation.

END OF SECTION 072119

SECTION 072500 – WEATHER BARRIERS

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 self-adhering, water resistive, vapor permeable weather barriers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Weather-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Weather-Barrier Accessory: A transitional component of the weather barrier that provides continuity.
- C. Weather-Barrier Assembly: The collection of weather-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control moisture and air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review weather-barrier requirements and installation, special details, mockups, weatherleakage and bond testing, weather-barrier protection, and work scheduling that covers weather barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.

BID AND PERMIT SET

- B. Shop Drawings: For weather-barrier assemblies.
 - 1. Show locations and extent of weather barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of weather barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From weather-barrier manufacturer, certifying compatibility of weather barrier and accessory materials with Project materials that connect to or that come in contact with weather barrier.
- C. Product Test Reports: For each weather-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly minimum 6 by 6 foot, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of weather-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of weather barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply weather barrier within the range of ambient and substrate temperatures recommended in writing by weather-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect weather-barrier performance.
 - 2. Do not apply weather barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary weather-barrier materials and weather-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Weather-Barrier Performance: Weather-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous weather barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Weather-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.3 SELF-ADHERING SHEET WEATHER BARRIER

- A. Water resistive vapor permeable weather barrier for rainscreen systems: Zero VOC self-adhered vapor permeable weather barrier sheet membrane consisting of multiple layers of UV stabilized membrane.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Siga Majvest 500 SA or comparable products by, but not limited to the following:
 - a. Grace, W. R. & Co., Perm-A-Barrier VPS.
 - b. Soprema; Sopraseal Stick VP.
 - c. Vaproshield LLC; WrapShield SA.

- 2. Physical and Performance Properties:
 - a. Air Leakage: Maximum 0.00006 cfm/sq. ft. at 1.57 psf when tested in accordance with ASTM E 2178
 - b. Water Vapor Permeance tested to ASTM E 96 Method B: minimum 15 perms.
 - c. Water Resistance tested to AATCC 127, 22 inches (550 mm) hydrostatic head for 5 hours: No leakage.
 - d. Tensile Strength tested to ASTM D 882: 39 lbf/inch, machine direction; 38 lbf/inch, cross-machine direction
 - e. Application Temperature: Ambient temperature must be above 20 degrees F
 - f. Surface Burning Characteristics tested to ASTM E 84: Class A.
 - g. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by weather-barrier manufacturer to produce a complete weather-barrier assembly and that are compatible with primary weather-barrier material and adjacent construction to which they may seal.
- B. Vinyl extrusion with pre-formed fastener and moisture drainage channels configured to create a ventilated airspace between wall cladding and weather-resistive weather barrier.
- C. Penetration sealant: Provide sealant for penetrations as recommended by manufacturer and as specified in Section 079200 "Joint Sealants".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by weather-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for weather-barrier application.
- B. Mask off adjoining surfaces not covered by weather barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for weather barrier.
- H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with weather-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 INSTALLATION

- A. Install materials according to weather-barrier manufacturer's written instructions and details and according to recommendations in ASTM D 6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, weather-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F (16 deg C).
 - 2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
- B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- C. Apply and firmly adhere weather-barrier sheets over area to receive weather barrier. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water.

- 2. Roll sheets firmly to enhance adhesion to substrate.
- D. Apply continuous weather-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.
- E. Seal top of through-wall flashings to weather-barrier sheet with an additional 6-inch- (150-mm-) wide, transition strip.
- F. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- G. Install weather-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous weather barrier.
 - 1. Coordinate weather-barrier installation with installation of roofing membrane and base flashing to ensure continuity of weather barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
- H. Connect and seal exterior wall weather-barrier sheet continuously to roofing-membrane weather barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- I. At end of each working day, seal top edge of weather-barrier material to substrate with termination mastic.
- J. Apply joint sealants forming part of weather-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
- L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of weather-barrier material with foam sealant.
- M. Repair punctures, voids, and deficient lapped seams in weather barrier. Slit and flatten fishmouths and blisters. Patch with weather-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.
- N. Do not cover weather barrier until it has been tested and inspected by testing agency.
- O. Correct deficiencies in or remove weather barrier that does not comply with requirements; repair substrates and reapply weather-barrier components.

BID AND PERMIT SET

3.4 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Weather-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of weather-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of weather-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 - 7. Weather barrier has been firmly adhered to substrate.
 - 8. Compatible materials have been used.
 - 9. Transitions at changes in direction and structural support at gaps have been provided.
 - 10. Connections between assemblies (weather barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 11. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:
 - 1. Weather-Leakage-Location Testing: Weather-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers or ASTM E 1186, chamber depressurization using detection liquids.
 - 2. Weather-Leakage-Volume Testing: Weather-barrier assemblies will be tested for weatherleakage rate according to ASTM E 783 or ASTM E 2357.
 - 3. Adhesion Testing: Weather-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed weather barrier or part thereof.
- E. Weather barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional weather-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient weather-barrier components for retesting as specified above.
- F. Repair damage to weather barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

BID AND PERMIT SET

3.5 CLEANING AND PROTECTION

- A. Protect wall areas covered with self-adhered water-resistive vapor permeable weather barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.
- B. Review condition of self-adhered water-resistive vapor permeable weather barrier prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.
- C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed self-adhered water-resistive vapor permeable weather barrier installations.
- D. Remove and replace water-resistive weather barrier membrane affected by chemical spills or surfactants.
- E. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

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. Polyamide film sheet vapor retarder (VP-1).
 - 2. Polyethylene film sheet vapor retarder (VP-2).
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor barriers.
 - 2. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for vapor retarders in roofing assembly.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SHEET VAPOR RETARDER (VP-1)

- A. Basis-of-Design Product: Siga Majrex Vapor Retarder, by SIGA; www.siga.swiss.
- B. Other Acceptable Product: MemBrain by CertainTeed Corp., Div. of Saint Gobain; www.certainteed.com.
- C. Description:
 - 1. Material: a modified polyethylene/polyamide film or polyamide film that changes its permeability with ambient humidity conditions, all while providing a continuous air seal. The product's permeance is 1 perm or less when tested in accordance with ASTM E96, dry cup method, and increases to greater than 10 perms using the wet cup method.

BID AND PERMIT SET

D. Applications: Provide on interior side of exterior wall framing over unfaced, internal wall cavity insulation.

2.2 POLYETHYLENE SHEET VAPOR BARRIER (VP-2)

- A. Polyethylene Vapor Retarders: Sheet polyethylene film, 6-mil (0.006-inch) thick, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
- B. Applications: Install under wood floor system where indicated on drawings.

2.3 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 1. Basis-of-Design tape product for Siga Majrex: Siga Rissan tape.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
BID AND PERMIT SET

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 **PROTECTION**

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

BID AND PERMIT SET

SECTION 074213 - METAL WALL PANELS

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. Concealed-fastener, lap-seam metal wall tiles (MWP-1).
 - 2. Break metal panels (MWP-3).
 - 3. Perforated profiled metal screen wall panels (MWP-4).
 - 4. Accessories and fasteners.
- B. Related Requirements:
 - 1. Section 074213.23 "Metal Composite Material Wall Panels" for MWP-2.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

BID AND PERMIT SET

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal panel assembly including supports, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel installer, metal panel manufacturer's representative, structural-support installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.

BID AND PERMIT SET

9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.

BID AND PERMIT SET

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners. Include accessories required for weathertight installation.

BID AND PERMIT SET

Β. MWP-1:

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ACMA

- Basis-of-Design Product: Roof/Wall Tiles: 1. Millennium Forms: www.millenniumforms.com.
- 2. Description: Individual roof/wall tiles with 4-sided interlocking design, self-aligning tab, and concealed nailing strip with 2 holes.
- Material: Stainless steel. 3.
 - Base Material: ASTM A240/A240M, stainless steel sheet, Type 304, 2B mill finish. a.
 - Tile Finish: Light Interference Color (LIC) coated; color, Bronze Mill, with 3.8 b. percent color variation.
- 4. Size:
 - Millennium Tile: 15 inches by 9-5/8 inches. a.
 - Exposure: 14-1/2 inches by 8-5/16 inches plus or minus 1/16 inch. b.
- 5. Weight: Millennium Tile: 0.91 lbs./sq. ft.
- Thickness: 26-gage (0.0187 inch plus or minus 0.002 inch) (0.41 mm), mill tolerances 6. apply.
- 7. Density: 0.284 lbs./cu. in.
- Temper: Annealed. 8.
- Tensile Strength: ASTM E8/E8M, 90,000 psi. 9.
- Yield Strength: ASTM E8/E8M, 0.2 percent extension under load, 40,000 psi. 10.
- Elongation: ASTM E8/E8/M, 55 percent in 2 inches. 11.
- 12. Rockwell Hardness: ASTM E18, B82.
- Thermal Conductivity: 9.2 BTU/sq. ft./hr./degree F at 68 degrees F. 13.
- Performance Ratings: Wind, 110 mph. 14.
- Millennium Tile Style: Cupped Tile. 15.
- C. MWP-2: As specified in Section 074213.23 "Metal Composite Material Wall Panels."
- MWP-3: D.
 - 1. Material: Aluminum, smooth surface coil-coated, ASTM B209, 3003-H14 alloy, 0.040 inch (1.0 mm) nominal thickness, unless other thickness required for application.
 - Finish: fluoropolymer coating as specified. 2.
 - 3. Finish colors:
 - Weathered zinc color when adjacent to MWP-1. a.
 - b. Dark bronze when adjacent to Brick BR-1.
- E. MWP-4:
 - 1. Basis-of-Design Product: Concept Series CS-660 perforated panel, Centria; www.centria.com.
 - 2. Material: Aluminum, smooth surface coil-coated, ASTM B209, 3003-H14 alloy, 0.040 inch (1.0 mm) nominal thickness, unless other thickness required for application.
 - 3. Pattern and Perforation: Staggered pattern, 3/8-inch (10-mm) perforations at 9/16 inch (14 mm) spacing, with 40 percent open area.

BID AND PERMIT SET

- 4. Panel Profile: Four-rib profile with recessed flat pan between ribs.
- 5. Panel Coverage: 16 inches (406 mm).
- 6. Panel Height: 0.875 inch (22 mm).
- 7. Rib Spacing: 4 at 4 inches (102 mm).
- 8. Finish: fluoropolymer coating as specified.
- 9. Color: Match color of MWP-2.

2.3 ACCESSORIES

- A. MWP-1 Trim and Flashing: Same material, finish, and gauge as wall tiles except where otherwise noted; see Section 07 62 00 "Sheet Metal Flashing and Trim" for additional fabrication requirements.
 - 1. False Starter: 1-3/4 by 120 inches; 22 -gage
 - 2. Inside Corners: 6-1/8 by 6-1/8 by 120 inches; 22 -gage
 - 3. 1-Piece Outside Corners: 120 inches long; 22 -gage
 - 4. 3-Piece Outside Corners: 120 inches long; 22 -gage; consist of 2 J-channels and 1 Outside Corner Cap (2 by 2 inches).
 - 5. J-Channels: 3-3/8 by 1/2 by 120 inches; 22 -gage
 - 6. Head Flashing: 1-1/2 by 1-3/4 by 120 inches; 22-gage.
- B. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- C. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at perimeter of wall panel areas, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- D. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- E. Panel Fasteners: Concealed self-tapping stainless-steel screws designed to withstand design loads.

- F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

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

BID AND PERMIT SET

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect to match adjacent metal panel color, unless noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and, that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

BID AND PERMIT SET

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 2. Flash and seal panels with weather closures at perimeter of all openings.
- D. Watertight Installation:
 - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - 3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners

BID AND PERMIT SET

where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

- 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
- 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

BID AND PERMIT SET

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and provisions of the General Conditions, Supplementary Conditions and the Sections included under Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Aluminum composite material profiled trim panels.
 - 2. Aluminum composite material wall panels (MWP-2).
 - 3. Support system for composite material wall panels.
 - 4. Delegated design.
- B. Related Requirements:
 - 1. Section 016116 "Delegated Design Requirements".
 - 2. Section 074213 "Metal Wall Panels" for coordination of finishes with MWP-1.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for field formed flashings and other sheet metal work.
 - 4. Section 079200 "Joint Sealants" for perimeter sealant.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

BID AND PERMIT SET

- 7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
- 8. Review procedures for repair of panels damaged after installation.
- 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's product literature for the panel specified.
- B. Shop Drawings: For exterior/interior wall panel assemblies and accessories. Include plans; elevations; sections and details.
 - 1. For wall panels indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Quality Assurance Submittals: Submit the following:
 - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with the specified performance characteristics and criteria, and physical requirements.
- D. Samples for Initial Selections: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- E. Samples for Verification: Provide color samples of selected color. Samples shall involve normal color and texture variations, include sample sets showing the full range of variations expected.
- F. Deferred Submittal, Delegated Design Submittal: For metal composite material wall panel support system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Affidavit certifying that the material meets the requirements specified.

1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of kind indicated.
- B. Manufacturer Qualifications: Minimum of ten years' experience in manufacturing exterior wall panels similar to those required for this project and shall have completed a minimum of five similar projects in the last five years.
- C. Installer Qualifications: Acceptable to manufacturer.

- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Provide mockup of the "frames" around windows; 3-sided corner, vertical wall-to-soffit condition.
 - 2. Build mockup of typical metal panel assembly as shown on Drawings, including corner, soffits, supports, attachments, and accessories.
 - 3. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Section 016000 "Product Requirements".
- B. Ordering: Comply with manufacturer's ordering instructions, and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Store materials in accordance with manufacturer's recommendations.
 - 2. Handle materials carefully to avoid damage to materials and finishes.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication, and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that wall panel assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work.
 - 1. Established dimensions: where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of wall panel assemblies corresponding to the established dimensions.

BID AND PERMIT SET

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Weathertight Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Engage a qualified professional engineer to design metal panel systems.
- B. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Structural Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

BID AND PERMIT SET

- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.
- G. Cyclic Static Air Pressure Differential: Provide a panel system capable of pressure cycle testing in accordance with ASTM E 1233. Testing shall consist of 100 cycles from 5 psf to 25 psf and system must pressure equalize in less than 0.08 seconds when tested as part of AAMA 508-7 test protocol.
- H. Pressure Equalized Rain Screen Performance: Provide a panel system designed to have no streaming water or droplets/mist on more than 5% of the cavity moisture barrier, when tested to AAMA 508-07 which includes static and dynamic testing with imperfect air barriers.
- I. Not Permitted: Vibration harmonics; wind whistles; noises caused by thermal movement; thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system.

2.2 MATERIALS

- A. Metal Composite Material Plate Wall Panels: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, core; formed into flat plate profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
 - 1. Basis-of-Design Product: Alpolic Metal Composite Materials; Mitsubishi Chemical Composites America, Inc.; www.alpolic-americas.com.
 - 2. Aluminum-Faced Composite Wall Panels: Formed with 0.5mm thick aluminum-faced panels.
 - 3. Panel Thickness: 4 mm.
 - 4. Core: fire-retardant, mineral-filled thermoplastic core.
 - 5. Exterior Finish: Refer to Aluminum Finishes articles below.
- B. Attachment Assembly Components: Formed from extruded aluminum.
 - 1. Aluminum Extrusions: ASTM B221, alloy 6063-T6 and/or 6061-T6.

2.3 MANUFACTURERS

A. Source Limitations: Obtain metal composite material plate wall panels from single source from single manufacturer.

BID AND PERMIT SET

- B. Composite Panel Manufacturers: Subject to compliance with requirements, provide aluminum composite material panel products with fire resistant core (FR Core) by the manufacturers indicated, or approved.
 - 1. Approved Manufacturers and Products:
 - a. Alucobond Plus by Alcan Composites; www.alcancomposites.com.
 - b. Reynobond ACM FR by Alcoa Architectural Products; www.alcoa.com.
 - c. Alpolic/fr by Mitsubishi Plastics Composites America, Inc., Div. of Mitsubishi Chemical Corp; www.alpolic.com.

2.4 FABRICATORS

- A. Panel System Fabricator: Subject to compliance with requirements, provide pressure equalized rainscreen wall panel system design, fabrication and installation; by the fabricators indicated, or approved.
 - 1. Basis-of-Design Fabricator: Custom Metal Contracting, Ltd.; www.custommetal.ab.ca.
 - 2. Other Approved Fabricators:
 - a. Keith Panel Systems; www.keithpanel.com.
 - b. Skyline Sheet Metal, Inc.; www.skylinesheetmetal.com.

2.5 FABRICATION, GENERAL

- A. Tolerances:
 - 1. Reinforce panels with stiffeners where applicable to meet design criteria.
 - 2. Panel lines, breaks, and angles shall be sharp and true, and surfaces shall be free from warp or buckle.
- B. Panel surfaces shall be free of scratches or marks caused during fabrication.
- C. If a metallic color is selected ensure that panel grain is maintained. Under no circumstances are panel blank sizes to be rotated even if material waste in increased.
- D. Condensation: Fabricate panels for control of condensation, including vapor inclusion of seals and provisions for breathing, venting, weeping and draining.

2.6 ACCESSORIES

- A. Exposed rivets/fasteners shall be stainless steel.
- B. Concealed fasteners shall be Climaseal coated or stainless steel.
- C. Flashing: Aluminum, same finish as for aluminum panel where exposed; secured with concealed fastening method.

BID AND PERMIT SET

- D. Proprietary extrusions supplied by fabricator.
- E. No exposed sealant to be used at panel-to-panel connections.
- 2.7 FINISHES, GENERAL
 - A. Comply with NAAMM's Metal Finishes Manual for architectural metal products for recommendations for applying and designating finishes.

2.8 FINISHES

- A. Steel Panels and Accessories:
 - 1. Exposed Finish: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Basis-of-Design Products: Provide fluoropolymer finish with PVDF resin by one of the following, no exceptions:
 - 1. Kynar 500 by Arkema.
 - 2. Hylar 5000 by Solvay S.A.
- C. Colors: Basis-of-design color is white, as selected by Architect from manufacturer's standard colors.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- E. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.9 MISCELLANEOUS MATERIALS

- A. Sub-framing and Furring:
 - Metal Framing: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as

required for support and alignment of metal composite material panel system. Provide spacers behind furring to allow for continuous drainage plane when installed horizontally.

- 2. Fiberglass Polymer Framing:
 - a. Sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
 - b. Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
 - c. Basis-of-Design Sub Structure: Smartci System with GreenGirt framing by Advanced Architectural Products, LLC; www.smartcisystems.com.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.10 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

BID AND PERMIT SET

- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Copper Panels: Use copper, stainless-steel or hardware-bronze fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

BID AND PERMIT SET

- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 - 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 - 2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
 - 3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.
 - 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 - 2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.
- G. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
 - 1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
 - 2. Do not apply sealants to joints unless otherwise indicated.
- H. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical drain channels that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
 - 1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
 - 2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
 - 3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
 - 4. Do not apply sealants to joints unless otherwise indicated.
- I. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer.

Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

- 1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
- 2. Do not apply sealants to joints unless otherwise indicated.
- J. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- K. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/8 inch in 5 feet (3 mm in 1500 mm), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Panel Bow: Maximum 0.8 percent of panel dimension in width and length for 72 inch panel.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly shown on Drawings for water penetration according to AAMA 501.2.

BID AND PERMIT SET

- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.
- D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

BID AND PERMIT SET

SECTION 074213.33 – METAL SOFFIT PANELS

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. Aluminum soffit panels.
 - 2. Aluminum trim and accessories.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for metal framing for support of aluminum soffits.
 - 2. Section 061053 "Miscellaneous Rough Carpentry: for wood stud framing and furring for support of aluminum soffits.
 - 3. Section 072100 "Thermal Insulation" for thermal insulation installed behind soffit.
 - 4. Section 079200 "Joint Sealants" for sealants used in conjunction with aluminum soffit installation.
- C. References:
 - 1. ASTM D 958, Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics.
 - 2. AAMA 2605, Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2604, Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels.
 - 4. AAMA 2603, Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 5. ASTM E2768, Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials (30 min Tunnel Test). Results: Zero Flame Spread, Smoke Developed Index of 5. Meets criteria for Class A fire rating.
 - 6. ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - 7. CAN/ULC S114, Standard method of test for determination of non-combustibility in building materials.

BID AND PERMIT SET

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- C. Verification Samples: For each finish product specified, two samples, minimum size 2 inches (51 mm) by 3-1/2 inches (89 mm), representing actual product, color, and gloss.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years' experience producing aluminum finishes of the types specified and AkzoNobel, AAMA 2604 and 2605 Certified.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and gloss are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package and store products under cover in manufacturer's unopened packaging until ready for transport and installation.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

BID AND PERMIT SET

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not fabricate products under environmental conditions outside manufacturer's absolute limits.
- 1.7 SEQUENCING
 - A. Coordinate Work with installation of windows, louvers, and adjacent components or materials.

1.8 WARRANTY

- A. Manufacturer's limited warranty against cracking, peeling and gloss/color retention within the guidelines stated by the American Architectural Manufacturers Association (AAMA).
- B. Standard Colors:
 - 1. D2000 AAMA 2604 15 Year manufacturer's Warranty.
 - 2. D3000 AAMA 2605 20 Year manufacturer's Warranty

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
- B. Movement: Accommodate movement within system without damage to components or movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- C. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: Luxyclad Ltd.; www.luxyclad.com.

BID AND PERMIT SET

2.3 MATERIALS

- A. Extruded Aluminum Siding and Soffits: Luxyclad Aluminum Soffits with alluminate bonded film finish is extruded aluminum with integrated venting system.
 - 1. 6-inch wide, "V" Groove Siding, 8 pieces per box in 24-foot lengths.
 - 2. Color: White, as selected by Architect.
- B. Accessories: Prefinished aluminum: Provide with matching accessories and starter strips as required.
 - 1. 2.5-inch perforated vent strip, 12-foot length.
 - 2. 2.5-inch V groove siding and soffit 12-foot length.
 - 3. J track 12-foot length.
 - 4. Wide Starter Strip 12-foot length.
 - 5. Inside Corner 12-foot length.
 - 6. Outside Corner 12-foot length.
 - 7. Finish Base & Cap (2pc set) 12-foot length.
 - 8. Base & U Cap (2pc set) 12-foot length.
 - 9. Base & Flat Cap (2pc set) 12-foot length.
 - 10. Powder Coated Wide Starter Strip 12-foot length.
 - 11. Quick Screen Clip Stainless Steel.
- C. Thermally-broken façade sub-structure for external continuous insulation: Provide clip sizes and girt lengths required.
 - 1. 3-inch L-Clip.
 - 2. 4-inch L-Clip.
 - 3. 5-inch L-Clip.
 - 4. Custom Request, 6-inch L-Clip.
 - 5. Aluminum T-Girt, 12-foot.

2.4 FINISHES

- A. Lead time varies based on color and supply. Please check with manufacture for anticipated lead time for specified colors.
- B. Pretreatment: E-CLPS Chrome Free five stage aluminum pretreatment system. Complies with AAMA 2603 AAMA 2604 and AAMA 2605 Superior Performance Standard and meets EPA, OSHA, State and Local environmental requirements and contains no chromates, cyanides or other heavy metals. Waste treatment is usually a simple pH neutralization and disposal to the sanitary sewer.
- C. Akzo Nobel Interpon D2000 Series electrostatically applied Architectural Powder Coatings are approved to AAMA 2604 Performance Standard.
 - 1. Gloss Level: Standard Gloss is 30 percent, plus or minus 5 percent.

BID AND PERMIT SET

- D. Akzo Nobel Interpon D3000 Series electrostatically applied Fluromax Architectural Powder Coatings are approved to AAMA 2605 Superior Performance Standard. Note: D3000 powder coatings may have extended lead times. Contact manufacturer for details.
 - 1. Gloss Level: Standard Gloss is 30 percent, plus or minus 5 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until colors have been verified.
- B. Verify framing members are ready to receive panel system.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the material under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Barrier Protection: Do not install over cementitious materials, dissimilar metals or pressure treated material without adequate barrier protection.
 - 1. Install weather barrier horizontally on substrate to receive metal soffits.
 - 2. Weather lap edges 6 inches (150 mm) and ends minimum 6 inches (150 mm).
 - 3. Stagger vertical joints of each layer.
 - 4. Securely staple, nail in place.
- C. Fasten soffit panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Install expansion control joints where indicated.
- F. Use concealed fasteners unless otherwise approved by Architect.
- G. Install soffits, and accessories in accordance with best practice, with all joint members plumb and true.

BID AND PERMIT SET

- H. Horizontal/Compression Joints are required for multi-story installations locate joints at floor lines. Joints are flashed minimum 1/2-inch (12.7-mm) breaks. Do not caulk.
 - 1. Steel framed buildings (including reinforced concrete core with LGMF exterior walls) of more than three floors (or 45 feet per 14 m) require a compression joint every 25 feet at a floor line.

3.4 FIELD QUALITY CONTROL

- A. After installation of cladding, check entire surface for obvious flaws or defects.
- B. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.5 CLEANING AND PROTECTION

- A. After application of soffits, clean as necessary to remove all fingerprints and soiled areas.
- B. Upon completion of soffit application, clean entire area, removing all scrap, packaging, and unused materials related to this work.
- C. Protect installed products until completion of project.
- D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 074213.33

BID AND PERMIT SET

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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. Fully-adhered thermoplastic polyolefin (TPO) roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
- B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 053100 "Steel Decking."
- C. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
 - 4. Section 079513 "Expansion Joint Cover Assemblies" for manufactured roof expansionjoint assemblies.
 - 5. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

- 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
- 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
- 5. Review structural loading limitations of roof deck during and after roofing.
- 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
- 7. Review governing regulations and requirements for insurance and certificates if applicable.
- 8. Review temporary protection requirements for roofing system during and after installation.
- 9. Review roof observation and repair procedures after roofing installation.
- B. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
 - 1. Sheet roofing, of color required.
 - 2. Walkway pads or rolls, of color required.
 - 3. 4-by-4-inch square of overlay board.

BID AND PERMIT SET

4. 12-inch length of metal termination bars.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed, FM Global approved for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. In continuous business under same name for past 5 years.
 - 2. Completed at least 3 successful installations of specified materials and systems on projects of similar scope.
 - 3. Contractor shall provide all personnel trained in application of materials and systems and shall maintain supervision as specified elsewhere.
 - 4. Installer Field Supervision: Require Installer to maintain a full-time supervisor / foreman on the job site during times that single ply roofing systems installation is in progress, and who is experienced in installation of the specified roofing systems.

DLR GROUP PROJECT NO. 74-18109-00

BEAVERTON, OREGON

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BID AND PERMIT SET

1.9 DELIVERY, STORAGE, AND HANDLING

- Deliver roofing materials to Project site in original containers with seals unbroken and labeled A. with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- Store liquid materials in their original undamaged containers in a clean, dry, protected location B. and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - Discard and legally dispose of liquid material that cannot be applied within its stated shelf 1. life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Provide tarps or plastic sheeting required to protect opened roofs and flashings and to prevent the entrance of moisture or rain water into the existing structure until new materials have been applied and roof is in a watertight condition.
- Have necessary waterproof canvas or plastic sheeting readily available in case of emergency. C.
- D. Roofing materials shall not be applied when water in any form (i.e., rain, dew, ice, frost, snow, etc.) is present on the deck.
- Provide necessary protection over newly installed membrane during the course of construction at E. all roof access points and at high traffic areas.
- F. Measures to protect the newly installed membrane shall be employed during the entire duration of the work from staining and damage.

1.11 WARRANTY

- Special Warranty: Manufacturer agrees to repair or replace components of roofing system that A. fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories and other components of roofing system.

BID AND PERMIT SET

- 2. Warranty Period: 20 years from date of Substantial Completion.
- 3. Warranty Period: 25 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide Firestone Building Products UltraPly TPO membrane, or comparable products from the following:
 - 1. Carlisle SynTec Incorporated.
 - 2. Johns Manville.
- B. Source Limitations: Obtain components including roof insulation, fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail-Resistance Rating: MH.

BID AND PERMIT SET

- D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
- F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible fleece-backed TPO sheet.
 - 1. Thickness: 80 mils, nominal.
 - 2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
 - 3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
BID AND PERMIT SET

- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide DensDeck manufactured by Georgia Pacific, or comparable product by but not limited to one of the following:
 - a. USG.
 - b. Certainteed.
 - c. National Gypsum.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.6 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
 - 1. Basis-of-Design Product: Firestone V-Force Vapor Barrier Membrane; Firestone Building Products.

BID AND PERMIT SET

2.7 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope as indicated in drawings unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - 3. Full-spread spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch factory primed.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide DensDeck manufactured by Georgia Pacific, or comparable product by but not limited to one of the following:
 - a. USG.
 - b. Certainteed.
 - c. National Gypsum.

2.9 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roofdrain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weather tightness of transition and to not void warranty for existing roofing system.

3.4 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

BID AND PERMIT SET

2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install selfadhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 2. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature

BID AND PERMIT SET

- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. Adhere cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
- I. Install slip sheet over cover board and immediately beneath roofing.

3.7 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

BID AND PERMIT SET

- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

BID AND PERMIT SET

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Manufactured through-wall flashing with counterflashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed wall sheet metal fabrications.
 - 5. Formed equipment support flashing.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 3. Section 079513 "Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

BID AND PERMIT SET

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Include details of roof-penetration flashing.
 - 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 10. Include details of special conditions.
 - 11. Include details of connections to adjoining work.
 - 12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
 - 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.6 INFORMATIONAL SUBMITTALS

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

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

BID AND PERMIT SET

- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: Zinc-tin alloy stainless steel.
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

BID AND PERMIT SET

- B. Flexible Flashing at Openings: 100 percent solids, low VOC, liquid-applied flashing for opening perimeters. Basis-of-Design Product: R-Guard Fast Flash by Prosoco. Use with manufacturer's companion joint sealant.
- C. Self-Adhering, High-Temperature Sheet Flashing: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
 - 3. Basis-of-Design Product: Grace Ultra, self-adhering butyl underlayment; www.gcpat.com.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Zinc-Coated (Galvanized), Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

BID AND PERMIT SET

- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- G. Do not use graphite pencils to mark metal surfaces.

BID AND PERMIT SET

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
 - 1. Zinc-Tin Alloy Stainless Steel: 0.028 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 12foot- (3.6-m-) long sections. Furnish with 6-inch wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Standing seam with 45-degree slope at all faces of coping visible from below.
 - 2. Fabricate from the Following Materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.
- B. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
 - 2. Fabricate from the Following Materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
- C. Base Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.
- D. Counterflashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

BID AND PERMIT SET

2.8 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings,

separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

- 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
- 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
- 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
- 5. Torch cutting of sheet metal flashing and trim is not permitted.
- 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressuretreated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

BID AND PERMIT SET

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Loosely lock front edge of scupper with conductor head.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

BID AND PERMIT SET

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

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. Roof hatches.
 - 2. Roof hatch safety rails.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 055213 "Pipe and Tube Railings" for safety railing systems not attached to roofhatch curbs.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 4. Section 230548 "Vibration and Seismic Controls for HVAC" for special curbs designed to accommodate seismic and vibration controls.
 - 5. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.
 - 6. Section 237413 "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leak proof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Subject to compliance with requirements, provide Bilco Model NB for ship's ladder access, with Bil-Guard 2.0 Safety Rail.
- B. Type and Size: Single-leaf lid, 30 by 54 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Aluminum sheet.
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: Mill.
- E. Construction:
 - 1. Insulation: Manufacturer's standard.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 5. Fabricate curbs to minimum height of 12 inches above final roofing surface unless otherwise indicated.

BID AND PERMIT SET

- 6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Manufacturer: Bilco Bil-Guard.
 - 2. Height: 42 inches above finished roof deck.
 - 3. Posts and Rails: Fiberglass reinforced polymer.
 - 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
 - 5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 - 6. Fasteners: Manufacturer's standard, finished to match railing system.
 - 7. Finish: Manufacturer's standard.

2.3 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof-Hatch Installation:
 - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 2. Attach safety railing system to roof-hatch curb.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.
- D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

BID AND PERMIT SET

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
 - 4. Putty pad sealant.
 - 5. Delegated design.
- B. Related Requirements:
 - 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Deferred Submittal Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular firestopping system condition, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."

BID AND PERMIT SET

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 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. A/D Fire Protection Systems Inc.
 - b. GCP (formerly Grace Construction Products).
 - c. Hilti, Inc.
 - d. Johns Manville.
 - e. Nelson Firestop Products.
 - f. NUCO Inc.
 - g. Passive Fire Protection Partners.
 - h. RectorSeal Corporation.
 - i. Specified Technologies Inc.
 - j. 3M Fire Protection Products.
 - k. Tremco, Inc.; Tremco Fire Protection Systems Group.
- B. USGCorporation Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

BID AND PERMIT SET

- F. Putty Pad Sealant: Intumescent putty sheet providing fire resistance at electrical boxes and other penetrations.
 - 1. Approved Products:
 - a. CP-617 Firestop Putty Pad by Hilti; www.hilti.com.
 - b. Nelson FSP Firestop Moldable Putty Pads by Nelson Firestop Products; www.nelsonfirestop.com.
 - c. TREMstop MP by Tremco; www.tremco.com.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

BID AND PERMIT SET

- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, 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: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning Penetration Firestopping Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial

Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."
- D. Firestop Systems with No Penetrating Items : Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, C-BJ, F-A- or W-L- 0001-0999.
- E. Firestop Systems for Metallic Pipes, Conduit, or Tubing Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, F-A-, F-C-, W-J-, or W-L- 1001-1999.
- F. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing : Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, F-A-, F-C- or W-L- 2001-2999.
- G. Firestop Systems for Electrical Cables : Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, C-BJ-, F-A-, F-C-, or W-L- 3001-3999.
- H. Firestop Systems for Cable Trays: Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, C-BJ-, or W-L- 4001-4999.
- I. Firestop Systems for Insulated Pipes: Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, C-BJ-, F-A-, F-C- 5001-5999.
- J. Firestop Systems for Miscellaneous Electrical Penetrants: Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, or F-A-6001-6999.
- K. Firestop Systems for Miscellaneous Mechanical Penetrations: Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-7001-7999.
- L. Firestop Systems for Groupings of Penetrations: Comply with the following:
 - 1. Available UL-Classified Systems: C-AJ-, C-BJ-, F-A-, or W-L-8001-8999.

BID AND PERMIT SET

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

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. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
 - 4. Delegated design.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
 - 2. Section 079513 "Expansion Joint Cover Assemblies" for fire-resistive architectural joint systems.
 - 3. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Deferred Submittal Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular firestopping system condition, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."

BID AND PERMIT SET

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
 - 1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, 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: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or

BID AND PERMIT SET

self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

- 1. The words "Warning Joint Firestopping Do Not Disturb. Notify Building Management of Any Damage."
- 2. Contractor's name, address, and phone number.
- 3. Designation of applicable testing agency.
- 4. Date of installation.
- 5. Manufacturer's name.
- 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Immersible joint sealants.
 - 5. Silyl-terminated polyether joint sealants.
 - 6. Mildew-resistant joint sealants.
 - 7. Butyl joint sealants.
 - 8. Latex joint sealants.
 - 9. Low expanding foam sealant.
- B. Related Requirements:
 - 1. Section 07 84 13 "Penetration Firestopping" for fire-resistant joint sealants.
 - 2. Section 09 29 00 "Gypsum Board" for acoustical sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-13-mm- wide joints formed between two 6-inch-150-mm- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
BID AND PERMIT SET

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Pre-installation Conference: Conduct conference at Project site.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 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 jointsealant 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.

1.7 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.

BID AND PERMIT SET

- 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 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.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, non-sag, plus 100 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Basis-of-Design Product: 790 Silicone by Dow Corning; www.dowcorning.com
 - 2. Applications:
 - a. Non-porous dissimilar materials.
 - b. Joints: 3/8 inch wide or less.
 - 3. Location: Exterior non-paintable surfaces.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Basis-of-Design Product: 795 Silicone by Dow Corning; www.dowcorning.com
 - 2. Applications:
 - a. Similar materials.

BID AND PERMIT SET

b. Joints: 3/8 inch wide or more.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: 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.
 - 1. Application: Porous exterior substrates.
- C. Silicone, Nonstaining, S, NS, 25, NT: 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: 758 Silicone Weather Barrier Sealant by Dow Corning; www.dowcorning.com.
 - 2. Application: Sealing weather barrier materials and adjacent surfaces where low movement is anticipated.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, non-sag, plus 100 percent and minus 50 percent movement capability, traffic- and non-traffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses NT, M, A, O and I (Class 2).
 - 1. Manufacturers: Subject to compliance with requirements, provide Vulkem 921 or comparable products from, but not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Sika Corporation.
 - 2. Location: Exterior paintable surfaces and exterior and interior horizontal concrete joints.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Location: At joints in ceramic tile walls and floor, around equipment and around plumbing fixtures.

BID AND PERMIT SET

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
- B. Location: At interior frames/walls.

2.7 LOW EXPANDING FOAM SEALANTS

- A. Low expanding, one-component, polyurethane foam sealant, curing to a semi-rigid, closed cell urethane foam.
- B. Acceptable products:
 - 1. Hilti CF812 WD (Low Pressure polyurethane).
 - 2. Dow GREAT STUFF.

C. Locations:

- 1. Apply between top of precast concrete panels and metal framing.
- 2. Miscellaneous openings and voids in exterior walls.

2.8 SECURITY SEALANT

- A. Flexible polyurethane security sealant. Apply as base installation and in all open wall panel joints in Seclusion Room.
- B. Acceptable products: Dynaflex by Pecora Corp or accepted substitute.

2.9 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type O (open-cell material), Type B (bi-cellular 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.

BID AND PERMIT SET

2.10 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: Non-staining, 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. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.

BID AND PERMIT SET

- 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.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

BID AND PERMIT SET

- F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

BID AND PERMIT SET

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

3.5 CLEANING

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

3.6 **PROTECTION**

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

END OF SECTION 079200

BID AND PERMIT SET

SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

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 expansion control systems.
 - 2. Exterior expansion control systems.
 - 3. Delegated design.

B. Related Requirements:

- 1. Section 016116 "Delegated Design Requirements."
- 2. Section 033000 "Cast-In-Place Concrete."
- 3. Section 054000 "Cold-Formed Metal Framing."
- 4. Section 072500 "Weather Barriers" for flexible flashing at horizontal roof-to-roof seismic joints.
- 5. Section 076200 "Sheet Metal Flashing and Trim."
- 6. Section 092216 "Non-Structural Metal Framing."
- 7. Section 092900 "Gypsum Board."

1.3 REFERENCES

A. Fire Rated Assemblies shall meet requirements of Underwriter's Laboratories, in accordance with ANSI/UL No. 263, ASTM E 119 and ASTM E 814, including hose stream test at full rated period. Underwriter's Laboratories shall classify assemblies. Fire rating shall be not less than the fire rating of adjacent construction.

1.4 SUBMITTALS

- A. Manufacturer's specifications, technical data, installation instructions, and detail drawings for each Fire Barrier System.
- B. Certificates or other documentation confirming UL approved or equivalent compliance with fire resistance rating of fire barrier assemblies.
- C. Samples: Provide samples of each system indicated; 12 inches in length.

EXPANSION JOINT COVER ASSEMBLIES

BID AND PERMIT SET

- D. Shop Drawings: Provide standard and project specific details with requirements of each system indicated, including joint transitions and interface with the work of other trades.
 - 1. Shop drawings shall clearly illustrate the following:
 - a. Material and finish of seals and covers.
 - b. Attachment and interface to Work specified in other Sections.
 - c. Joinery and joint and seal transitions, including secondary seals, water- and weatherproofing and condensation control.
 - d. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - e. Fastener or anchorage type, size, spacing, material and finish.
 - f. Fire rating and continuity of rating at transitions and terminations.
 - g. Relative layout to walls, ceilings, beams, columns, and slabs.
 - h. Dimensional provisions for building movement in all directions.
 - i. Dimensional provisions for thermal expansion.
 - j. Locations of and details of embeds where required. Include size, type, spacing in a dimensioned plan, section or elevation.
 - k. Material isolation and separation required at dissimilar metals and materials.
 - 2. Provide isometric details or three-dimensional drawings illustrating terminations, corners and transitions and as required and requested by Architect.
- E. Delegated-Design Submittal: For expansion joint cover assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Qualification Data:
 - 1. For professional engineer.
- G. Product Schedule.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- B. Engineer Qualifications: Qualified professional engineer responsible for delegated design.
- C. Manufacturer Qualifications: Furnish all fire barrier systems from a single manufacturer with a minimum of five (5) years of experience in the design, engineering and fabrication of Fire Barrier Systems.
- D. Installer Qualifications: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

BID AND PERMIT SET

- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects and conformance to design intent, and to set quality standards for fabrication and installation.
 - 1. Provide and install expansion joint cover assemblies to wall assembly mockups as indicated.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY AND STORAGE

- A. Deliver fire barrier systems to jobsite in new, clean, unopened cartons or crates of sufficient size and strength to protect materials during transit.
- B. Store components in original containers in a clean, dry location. Inspect materials upon arrival, monitor for adverse environmental impacts.

1.7 SEQUENCING

- A. Submittals shall be completed and submitted within a reasonable amount of time after award of subcontract.
- B. Subcontract for the work of this section shall be planned to allow sufficient time for manufacturer's production and delivery scheduling.

1.8 WARRANTY

A. Manufacturer's limited warranty against material and manufacturing defects for a period of not less than three (3) years when installed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Balco, a CSW Industries Company; www.balcousa.com.
- B. Construction Specialties, Inc.; www.c-sgroup.com.
- C. EMSEAL, a Sika Company; www.emseal.com.
- D. InPro Corp.; www.inprocorp.com.

2.2 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems tested per UL 2079 or ASTM E 1966.
- B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Component Importance Factor is 1.5.
- C. Joint systems shall permit limited movement of joint without disengagement.
 - 1. X-axis joint movement (horizontal): As indicated.
 - 2. Y-axis joint movement (vertical): As indicated.
 - 3. Z-axis joint movement (lateral, where applicable): As indicated.

2.4 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Ceramic blanket insulation encapsulated with stainless steel foil and stainless-steel shear screen.
- B. Floor-to-Floor, Basis-of-Design Product: SNB Series by MM Systems; www.mm-usa.com.
- C. Ceiling-to-Ceiling, Basis-of-Design Product: Model FWF-600 by Construction Specialties; www.c-sgroup.com.
 - 1. Color: As selected by Architect.
 - 2. Attachment: Epoxy; do not mechanically fasten.
- D. Ceiling-to-Ceiling, Basis-of-Design Product: Model FCF-600 by Construction Specialties; www.c-sgroup.com.
 - 1. Color: As selected by Architect.

2.5 EXTERIOR EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Manufacturer: Emseal; www.emseal.com.
 - 1. Wall-to-Wall, Basis-of-Design Products:
 - a. Model Seismic Colorseal by Emseal.
 - 1) Color: As selected by Architect.

2.6 MATERIALS

ACMA

- Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet A. and plate.
- B. Stainless Steel: ASTM A 240 or ASTM A 666, Type 304 for plates, sheet, and strips.
- C. Galvanized Steel: 24 gauge.
- Stainless Steel Foil: 304 0.2 mils. D.
- E. Shear Screen: Stainless steel mesh.
- F. Fire Barrier Insulation: Ceramic blanket.
- G. Elastomeric Seals: ASTM E 1783; non-slumping single component smoke resistant silicone sealant.
- H. Compression Seals: ASTM E 1612.
- I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107.

2.7 SYSTEM ACCESSORIES

- A. Provide the manufacturer's standard accessories, including the following:
 - 1. Chase Covers.
 - 2. Drainage fittings.

2.8 GENERAL FINISH REQUIREMENTS

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for A. recommendations for applying and designating finishes.

2.9 **ALUMINUM FINISHES**

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

2.10 STAINLESS-STEEL FINISHES

Bright, Cold-Rolled, Unpolished Finish: No. 2B. A.

2.11 FABRICATION

- A. Factory fabricate and assemble systems for each application to the maximum extent possible. Field modifications shall be performed only as follows:
 - 1. Fire blanket shall only be field-cut, spliced and transitioned according to manufacturer recommendations.
 - 2. Mounting flanges shall only be field-cut and spliced according to manufacturer instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that structural gap and block-out dimensions are in conformance with manufacturer's submittal data.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces or sides of slabs, as required, before installing compression seals.
- E. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not over-pressurize.
- F. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements. Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

BID AND PERMIT SET

- H. Vapor Barrier: Where indicated or required, install to manufacturer's instructions. Provide drainage fittings where required.
- I. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings.

END OF SECTION 079513

BID AND PERMIT SET

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work including:
 - 1. Non-fire-rated doors and frames.
 - 2. Fire-rated doors and frames.
 - 3. Interior frames for wood doors.
 - 4. Interior acoustical frames for acoustical wood door assemblies.
 - 5. Interior borrowed lites.
 - 6. Interior acoustical borrowed lites.
- B. Related Requirements:
 - 1. Section 081416 "Flush Wood Doors" for acoustical wood doors.
 - 2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

BID AND PERMIT SET

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
 - 2. Acoustical Borrowed Lites:
 - a. Manufacturer test reports from a qualified independent testing agency demonstrating proposed products of this Section comply of specified sound ratings.
 - b. Material certificates in lieu of laboratory test reports when permitted by Architect signed by the manufacturer certifying that each acoustical borrowed lite complies with the project requirements.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Verification:
 - 1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
 - 2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

BID AND PERMIT SET

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
 - 1. Provide compliance with the air infiltration test procedure for exterior swing doors per AAMA/WDMA/CSA101/I.S.2/A440, NFRC 400, or ASTM E 283 at 1.57 psf (75Pa)..
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Door and Frame Product and Manufacturer:
 - 1. Provide Curries 747 T metal doors with metal frames designed for Curries 747 T doors. No substitutions allowed.
- B. Acoustical Hollow Metal Door Frame and Borrowed Lite Frame Manufacturers:
 - 1. Basis-of-Design Manufacturer: IAC Acoustics, a Division of Sound Seal; www.iacacoustics.com.
 - 2. Other Acceptable Manufacturers, contingent on products meeting the specifications:
 - a. Krieger Specialty Products; www.kriegerproducts.com.
 - b. Noise Barriers, LLC.; www.noisebarriers.com.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.70 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- C. Air Infiltration: Provide compliance with the air infiltration test procedure for exterior swing doors per AAMA/WDMA/CSA101/I.S.2/A440, NFRC 400, or ASTM E 283 at 1.57 psf (75Pa).
 - 1. Maximum Air Infiltration:
 - a. Exterior swing doors: 0.30 cfm per square foot of door area.
- D. Acoustical Door and Borrowed Lite Frame Assemblies:
 - 1. Sound Rating: Provide acoustical assemblies that have been fabricated as sound-retardant units, tested according to ASTM E 90 and have the following certified Sound Transmission Class (STC) rating as determined according to ASTM E 413.
 - a. Door Assembly STC Rating: Minimum 52.
 - b. Borrowed Lite Assembly STC Rating: Minimum 53.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 1. Physical Performance: Level A (1,000,000 cycles) according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16-gauge, 0.053 inch (1.3 mm).
 - d. Edge Construction: Model 2, Seamless.
 - 3. Core: Manufacturer's standard.
 - 4. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 16-gauge, 0.053 inch (1.3 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.

BID AND PERMIT SET

- c. Construction: Full profile welded.
- 5. Exposed Finish: Prime Factory.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum Duty Doors and Frames: SDI A250.8, Level 4.
 - 1. Physical Performance: Level A (1,000,000 cycles) according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 14 gauge, 0.067-inch (1.7-mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 14 gauge, 0.067-inch (1.7-mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 - c. Provide with stucco flange at exterior side.
 - d. Fully grout exterior frames.
 - 4. Exposed Finish: Prime Factory.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Post installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

BID AND PERMIT SET

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 ACOUSTICAL HOLLOW METAL BORROWED LITES

- A. Frames: Fabricated from not less than 11-gauge (3.13-mm) cold-rolled, galvannealed steel with an A60 coating weight, reinforced and filled with sound-absorbing acoustic fill. Inside and outside corners shall be mitered and interlocked to hairline measurements, made square, continuously welded, and ground smooth, flush and invisible.
- B. Glass Panes:
 - 1. Acoustic Rating: STC 53 minimum.
 - 2. Glass Type: 1/4-inch (6-mm) thick, clear, laminated safety glass.
 - 3. Glass Unit Assembly: 1/4-inch (6-mm) interior, 1/4-inch (6-mm) exterior, double pane unit.
 - 4. Overall unit thickness: 8 inches (203 mm).
- C. Acoustic Seals For Glazing: Vibration-isolating resilient gaskets, U-shaped and continuous Santoprene UV grade 65-75 durometer, black. Self-contained, sound absorptive interior perimeter of not less than 22-gauge (0.76-mm) steel shall be perforated and pre-finished black. Desiccant material shall be incorporated into multiple glazed units.
- D. Glazing Stops: Provide stops that are 1-inch (25-mm) high minimum, and readily removable, fabricated from not less than 16-gauge (2-mm) rolled steel sections predrilled and aligned with frame to form tight square acoustical joints. Fasten stop with concealed fasteners.
- E. Assembly: The assembly of the acoustic window units including frames, stops, glazing, acoustic seals, sound-absorbing material and concealed fasteners shall take place at the factory to insure required noise reduction is achieved. Glazing shall not need to be removed to facilitate fastening or anchoring at the project site.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) on center. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.

BID AND PERMIT SET

- 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - 6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.

BID AND PERMIT SET

- 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- 8. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45 or 90degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollowmetal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
- G. Acoustical Borrowed Lites:
 - 1. General: Fabricate units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practical, fit and assemble units in the manufacturer's plant. Identify work that is not permanently factory-assembled before shipment to ensure proper assembly at the Project site. Weld exposed joints continuously; grind, fill dress and make smooth flush and invisible.

2.9 FABRICATION, STEEL ACOUSTICAL DOOR FRAMES

A. Source Limitations: Obtain steel acoustical door frames, sound-control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.

BID AND PERMIT SET

- B. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.
 - 1. Weld frames according to NAAMM-HMMA 820.
 - 2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075inch (1.90-mm) nominal thickness or thicker as required to provide STC rating indicated.
 - 3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
 - 4. Head Reinforcement: Metallic-coated steel channel or angle stiffener, 0.108-inch (2.74-mm) nominal thickness.
 - 5. Jamb Anchors:
 - a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch (1.21-mm) nominal-thickness uncoated steel unless otherwise indicated.
 - 6. Floor Anchors: Not less than 0.079-inch (2.01-mm) nominal-thickness metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 7. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch (0.6 mm) thick.
 - 8. Acoustic Door Seals:
 - a. Basis-of-Design Product: Gasket System S or T by Eggers Industries.
 - b. Pemko 2008STC x Q380 raised threshold.
 - c. Pemko S44 gasketing (S); Pemko S773 gasketing (T).
 - d. Pemko 312_R perimeter gasketing (S); Pemko S44 gasketing (T).
 - e. Required undercut: 3/8-inch (9.5mm).

2.10 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat.

2.11 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

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. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

- g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 6. In-Place Metal Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
- 7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollowmetal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) on center and not more than 2 inches (51 mm) on center from each corner.

E. Acoustical Borrowed Lites:

- 1. Install work in accordance with reviewed shop drawings and manufacturer's written installation instructions, using only factory-trained personnel as required by the manufacturer.
 - a. Install windows and shim accordingly to allow for a plumb and square installation without excessive clearances.
 - b. During installation, solidly pack acoustic insulation around frames that are installed in stud and gypsum-wallboard partitions.
 - c. Seal exterior joint prior to painting.
 - d. Install sound control window assemblies during finish phase of construction to protect units from damage.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

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. Solid-core doors with wood-veneer faces.
 - 2. Acoustical wood doors.
 - 3. Factory finishing flush wood doors.
 - 4. Door vision panels, wood and metal frames.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for steel door frames for wood doors.
 - 2. Section 087100 "Door Hardware".
 - 3. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.

BID AND PERMIT SET

C. Samples for Verification:

- 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.
- 2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Provide Samples for each color, texture, and pattern of plastic laminate required.
 - c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
- 3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on butt side of door with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels 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. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by 84-inch (1067by 2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) 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 Exterior Doors: Five years from date of Substantial Completion.
- 4. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide Eggers 5-Ply SCL or comparable products from, but not limited to, the following:
 - 1. Graham-Maiman, division of Masonite Architectural.
 - 2. Marshfield-Algoma, division of Masonite Architectural.
 - 3. VT Industries Inc.
 - 4. Vancouver Architectural Doors.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards.
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species: White Oak.
 - 3. Cut: Rift cut.

BID AND PERMIT SET

- 4. Match between Veneer Leaves: Slip match.
- 5. Assembly of Veneer Leaves on Door Faces: Balance match.
- 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- 8. Exposed Vertical and Top Edges: Same species as faces edge Type A.
- 9. Core: Structural composite lumber.
- 10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
- 11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- 12. STC Rating:
 - a. Standard Wood Doors: STC 33 minimum.
 - b. Acoustical Wood Doors: STC 52 minimum.
- 13. Finish: Basis-of-design, No. 01 "Clear" by Eggers.

B. ACOUSTICAL DOOR SEALS

- 1. Basis-of-Design Product: Gasket System S or T by Eggers Industries.
 - a. Pemko 2008STC x Q380 raised threshold.
 - b. Pemko S44 gasketing (S); Pemko S773 gasketing (T).
 - c. Pemko 312_R perimeter gasketing (S); Pemko S44 gasketing (T).
 - d. Required undercut: 3/8-inch (9.5mm).

2.4 DOOR LITE FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Flush rectangular beads.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Lite Openings in Security Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.

BID AND PERMIT SET

- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. 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."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish.
 - 3. 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.

BID AND PERMIT SET

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware"
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering, unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 2. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) 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 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 083113 - ACCESS DOORS AND FRAMES

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 access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 077200 "Roof Accessories" for roof hatches.
 - 2. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ED-2002 as manufactured by Acudor Products, Inc.; www.acudor.com, or a comparable product by another manufacture, including but not limited to, the following:
 - a. Babcock-Davis; A Cierra Products Co.; www.babcockdavis.com.
 - b. Elmdor Stoneman; Div. of Acorn Engineering Co.; www.elmdorstoneman.com.
 - c. Karp Associates, Inc.; www.karpinc.com.
 - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: 18 inches by 18 inches, unless noted otherwise.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
 - 6. Frame Material: Same material and thickness as door.
 - 7. Latch and Lock: As indicated in schedule.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges:
 - 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. Acudor Products, Inc.
 - b. Babcock-Davis; A Cierra Products Co.
 - c. Elmdor Stoneman; Div. of Acorn Engineering Co.
 - d. Karp Associates, Inc.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: 18 inches by 18 inches, unless noted otherwise.
 - 5. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 6. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
 - 7. Frame Material: Same material, thickness, and finish as door.
 - 8. Latch and Lock: Self-latching door hardware, as indicated in schedule.
- B. Fire-Rated, Flush Access Doors with Concealed Flanges:
 - 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. Acudor Products, Inc.
BID AND PERMIT SET

- b. Babcock-Davis; A Cierra Products Co.
- c. Elmdor Stoneman; Div. of Acorn Engineering Co.
- d. Karp Associates, Inc.
- 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
- 3. Locations: Wall and ceiling.
- 4. Door Size: 12x12 minimum.
- 5. Fire-Resistance Rating: Not less than that of adjacent construction.
- 6. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
- 7. Frame Material: Same material, thickness, and finish as door.
- 8. Latch and Lock: Self-closing, self-latching door hardware, as indicated in schedule.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- D. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- E. Frame Anchors: Same material as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinccoated expanded-metal lath and exposed casing bead welded to perimeter of frames.

BID AND PERMIT SET

- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.
 - 3. Provide Olympus National lock sets 100-200 series
- E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

ACCESS DOORS AND FRAMES

SECTION 083313 - COILING COUNTER 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. Counter doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats
 - 2. Bottom bar
 - 3. Guides.
 - 4. Brackets.
 - 5. Hood.
 - 6. Locking device(s).

BID AND PERMIT SET

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.

2.2 COUNTER DOOR ASSEMBLY

- A. Manufacturers: Subject to compliance with requirements, provide Overhead Door Corp. Counter Door Model 652 or comparable products from, but not limited to, the following:
 - 1. Clopay Building Products.
 - 2. Cornell Cookson, LLC.
 - 3. Wayne Dalton.
- B. Door Curtain Material: Stainless steel.
- C. Door Curtain Slats: No. F-158, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2inch (13-mm) deep, clear anodized aluminum with stainless steel angle bottom bar with lift handles and vinyl astragal.
- D. Bottom Bar: Manufacturer's standard continuous tubular shape, fabricated of extruded aluminum to match door.
- E. Curtain Jamb Guides: Extruded aluminum with exposed finish matching curtain slats.
- F. Hood: Match curtain material and finish.
 - 1. Mounting: As shown on Drawings.
- G. Sill Configuration: No sill.

BID AND PERMIT SET

- H. Locking Devices: Equip door with cylindrical locking device in bottom bar with Schlage Everest Core per BSD standards assembly. BSD will provide keying.
- I. Manual Door Operator: Manual push up.
- J. Door Finish: Clear anodized.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.5 LOCKING DEVICES

- A. Locking Devices: Equip door with locking device assembly.
 - 1. Cremone-type, both jamb sides locking bars, operable from inside with cylinder to receive Schlage Everest core to meet BSD hardware standards. Keying provided by BSD.

2.6 CURTAIN ACCESSORIES

A. Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

2.7 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

BID AND PERMIT SET

- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structuralquality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

BID AND PERMIT SET

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

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

END OF SECTION 083313

SECTION 083323 - OVERHEAD COILING 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. Motor operated service door.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
 - 2. Section 083313 "Coiling Counter Doors" for counter doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Show locations of controls, locking devices, and other accessories.
- C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats.
 - 2. Bottom bar.
 - 3. Guides.
 - 4. Brackets.
 - 5. Hood.
 - 6. Locking device(s).

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

2.3 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, provide Cornell ESD-10 or comparable product from, but not limited to, the following:
 - a. Overhead Door Corp.
 - b. Wayne Dalton.
 - c. Clopay Building Products.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.

C. Door Curtain Material:

- 1. Door Curtain Slats: Flat profile, perforated metal, interlocking roll formed slats with endlocks riveted to ends of alternate slats.
- 2. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from aluminum extrusions and finished to match door.
- D. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- E. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: As shown on Drawings.
- F. Electric Door Operator: Manufacturer's standard with backup manual chain operator.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand design loads, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Aluminum Door Curtain Slats: ASTM B209 (ASTM B209M) sheet or ASTM B221 (ASTM B221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm); and as required.
 - 2. Perforated Slats: Of perforation size and spacing as selected by Architect from manufacturer's standard perforation patterns.
 - 3. Door Curtain Finish: Clear anodized aluminum.
- B. Curtain Jamb Guides: Manufacturer's standard galvanized steel angles or channels, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form aluminum sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.6 LOCKING DEVICES

A. Chain Lock Keeper: Suitable for padlock.

BID AND PERMIT SET

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 ELECTRIC DOOR OPERATOR

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
 - 3. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
 - 4. Operator Location: Top of hood, as indicated on Drawings.
 - 5. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.44 m) or lower.
 - 6. Motor Exposure: Interior.
 - 7. Motor Electrical Characteristics:
 - a. Horsepower: As required for size of door.
 - b. Voltage: Coordinate with electric service provided.
- B. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- C. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

BID AND PERMIT SET

- D. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- E. Control Station: Three-button control station in fixed location with momentary-contact pushbutton controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with generalpurpose NEMA ICS 6, Type 1 enclosure.
 - 2. Provide keyed switch (Schlage 653 keyed to District master) to disengage power when the door is locked. BSD will provide keying for switch.
- F. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).
- G. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.8 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. 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.

BID AND PERMIT SET

- C. Aluminum Finishes:
 - 1. Mill Finish: Manufacturer's standard.
 - 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

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

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior storefront framing.
 - 2. Exterior manual-swing entrance doors and door-frame units.
- B. Related Sections:
 - 1. Section 084115 "Interior Aluminum-Framed Entrances and Storefronts" for interior aluminum storefronts and entrance doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminumframed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

BID AND PERMIT SET

- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- d. Water penetration through fixed glazing and framing areas.
- e. Failure of operating components.
- 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.

BID AND PERMIT SET

- D. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).
- E. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
 - 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a staticair-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a staticair-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 8.00 lbf/sq. ft. (300 Pa).
- H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI7 Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI7.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.

- 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
- 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 35 as determined according to NFRC 500.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metalsurface temperature of 180 deg F (82 deg C).
 - b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
 - c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.2 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Kawneer VG 451T for storefront and Kawneer Insulpour 500T for entrance doors or comparable product by, but not limited to, one of the following:
 - 1. EFCO.
 - 2. TRACO.
 - 3. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated.
 - 4. Finish: High-performance organic finish.
 - 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, thermally broken extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or, that incorporate concealed tie rods.
 - 2. Door Design: Wide stile and top rail, 6-inch (150-mm) nominal width; 12-inch bottom rail.
 - 3. Glazing Stops and Gaskets: snap-on, extruded-aluminum stops and preformed gaskets.

2.5 OPERABLE VENT UNIT

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Kawneer GlassVent for operable vent unit or comparable product.
 - 1. Operable Vent Unit: Woven aluminum mesh, 14/18 grid insect screens.

2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.

BID AND PERMIT SET

- 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
 - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 - 2. Exterior Hinges: Nonferrous.
 - 3. Quantities:
 - a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
 - b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide four hinges per leaf.
- E. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- F. Cylinders: BHMA A156.5, Grade 1.
 - 1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".
- G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing. Comply with BSD standard detail of the strike with spacer located on the Drawings. Do not cut the blade stop to install the strike.
- H. Operating Trim: BHMA A156.6.
- I. Removable Mullions: BHMA A156.3, extruded aluminum.
 - 1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic

BID AND PERMIT SET

protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

- J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- K. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- M. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- O. Silencers: BHMA A156.16, Grade 1.
- P. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).
- Q. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.7 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding stainless steel, galvanized or aluminum fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.

BID AND PERMIT SET

- 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Two colors; white and dark bronze, as selected by Architect from manufacturer's full range.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for 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. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

BID AND PERMIT SET

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weatherstripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).

3. Alignment:

- a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
- b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
- c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
- 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water Penetration Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 503 and shall not evidence water penetration, defined as any water appearing on the interior surfaces of framing or glass other than condensation.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Should the tested units not pass the test, the Contractor is required to:
 - 1. Correct the failed unit.
 - 2. Re-test the failed unit at Contractor's expense until the unit passes the test.
 - 3. Successfully test an additional unit at Contractor's expense.
 - 4. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 084115 - INTERIOR ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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 aluminum storefront system, including punched openings.
 - 2. Manual-swing entrance doors and door-frame units.
 - 3. Delegated design.
- B. Related Requirements:
 - 1. Section 016116 "Delegated Design Requirements".
 - 2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for exterior storefront and swing entrance doors.
 - 3. Section 087100 "Door Hardware" for door hardware for aluminum-framed entrances.
 - 4. Section 088000 "Glazing".
 - 5. Division 23 "Heating Ventilating and Air Conditioning" for coordination of automatic vent actuators with smoke extraction system.
 - 6. Division 28 "Electronic Safety and Security" for coordination of automatic vent actuators with fire alarm system.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For interior aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

BID AND PERMIT SET

- 2. Include full-size isometric details of each vertical-to-horizontal intersection of interior aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent construction.
- C. Delegated-Design Submittal: For interior aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Qualification Data: For Installer and professional engineer.
- G. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- H. Source quality-control reports.
- I. Sample Warranties: For special warranties.
- J. Maintenance Data: For interior aluminum-framed entrances and storefronts to include in maintenance manuals.
- K. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by

dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

- 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.6 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of interior aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

BID AND PERMIT SET

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 016116 "Delegated Design Requirements," to design interior aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of interior aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Interior aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Design Pressures: Horizontal Deflection: For wall assemblies, limited to L/240 of the wall height based on horizontal loading of 10 lbf/sq. ft.
- D. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: As indicated on Drawings.
 - 2. Test Performance: Complying with criteria for passing based on building occupancy type.
- E. Seismic Performance: Interior aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type at design displacement.
 - 2. Vertical Interstory Movement: As indicated.
- F. The Basis-of-Design Product's performance criteria, product properties and attributes, including materials and methods used in fabrication of and/ or the manufacturing process of individual components or for entire system, as indicated in manufacturers' current published product literature at the date of the Contract Documents, shall establish the minimum performance requirement for the Project, regardless of inclusion in this Section.

BID AND PERMIT SET

2.2 MANUFACTURERS

- A. Source Limitations: Obtain all components of interior aluminum-framed entrance and storefront system, including framing, entrances and accessories, from single manufacturer.
- B. Basis-of-Design Manufacturer: Kawneer; www.kawneer.com.
- C. Other Acceptable Manufacturers:
 - 1. Arcadia, Inc.; www.arcadiainc.com.
 - 2. Efco Corp.; www.efcocorp.com.
 - 3. Wausau; www.wausauwindow.com.

2.3 PRODUCTS

- A. Interior Aluminum Storefront System and Borrowed lites:
 - 1. Basis-of-Design Product: Trifab VersaGlaze 451 by Kawneer.
 - 2. Profile: Non-thermally broken; $1-3/4 \ge 4-1/2$ inches.
 - 3. Glazing Alignment: Center.
 - 4. Finish: Fluoropolymer paint finish, two colors; white and red as selected by Architect from manufacturer's full color range.
 - 5. Glass Type: Standard, monolithic interior single lites; coordinate with Section 088000 "Glazing".
- B. Interior Entrance Doors:
 - 1. Basis-of-Design Product: 500 Standard Entrances by Kawneer.
 - 2. Acoustic Performance, STC: 42 minimum.
 - 3. Stiles and Top Rail: Non-thermal, 6-inch-face.
 - 4. Bottom Rail: 12 inches.
 - 5. Finish: Fluoropolymer paint finish, two colors; white and red as selected by Architect from manufacturer's full color range.
 - 6. Glass Type: Match storefront system.
 - 7. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

2.4 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Non-thermally broken. Refer to systems for specific requirements.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center.
 - 4. Finish: Fluoropolymer paint finish, two colors; white and red as selected by Architect from manufacturer's full color range..
 - 5. Fabrication Method: Field-fabricated stick system.

- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: Comply with Section 088000 "Glazing."
- D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system

components with which it comes in contact; recommended by structural-sealant, weathersealsealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

BID AND PERMIT SET

- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using screw-spline system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge for sound.
 - 2. At doors, provide automatic door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish frames after assembly.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Two colors; white and red, as selected by Architect from manufacturer's full range.

BID AND PERMIT SET

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for 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. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.

BID AND PERMIT SET

- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weatherstripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install interior aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 ENTRANCE DOOR HARDWARE SETS

A. Refer to Section 087100 "Door Hardware."

END OF SECTION 084115

SECTION 084523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

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 aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
 - 1. Skylight assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- C. Samples: In manufacturer's standard size.
 - 1. For each type of fiberglass-sandwich panel.
 - 2. For each type of exposed finish for framing members.
- D. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
BID AND PERMIT SET

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - c. Water leakage.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
 - 1. Defects include, but are not limited to, the following:
 - a. Fiberbloom.
 - b. Delamination of coating, if any, from exterior face sheet.
 - c. Color change exceeding requirements.
 - d. Delamination of panel face sheets from panel cores.

BID AND PERMIT SET

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fiberglass-sandwich-panel assemblies.
- B. Structural Loads: As indicated on Drawings.
- C. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
 - 1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.29 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a SHGC of no greater than 0.23 as determined according to NFRC 200.
 - 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.01 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kalwall S-lines or comparable product by, but not limited to one of the following:
 - a. Major Industries Inc.

BID AND PERMIT SET

2.3 FIBERGLASS-SANDWICH PANELS

- A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.
 - 1. Core Insulation: Fill panel cores with aerogel.
- B. Panel Thickness: 2-3/4 inches (70 mm).
- C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).
 - 1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.
 - 2. I-Beam Construction: Thermally broken, extruded aluminum.
 - 3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm).
- D. Exterior Face Sheet:
 - 1. Thickness: 0.070 inch (1.78 mm).
 - 2. Color: White.
 - 3. Protective Weathering Surface: Manufacturer's standard.
- E. Interior Face Sheet:
 - 1. Thickness: 0.045 inch (1.14 mm).
 - 2. Color: White.
- F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.
- G. Panel Strength:
 - 1. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after five minutes.
 - 2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334-N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.
- H. Panel Performance:
 - 1. Self-Ignition Temperature: 650 deg F (343 deg C) or more according to ASTM D 1929.
 - 2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
 - 3. Roof-Covering Classification: Class A according to ASTM E 108 or UL 790.
 - 4. Interior Finish Classification: Class B based on testing according to ASTM E 84.

BID AND PERMIT SET

- 5. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.
 - a. Outdoor Weathering Conditions: Sixty months in southern Florida.
- 6. Impact Resistance: No fracture or tear at impact of 70 ft. x lbf (95 J) by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) freefalling ball according to UL 972 test procedure.
- 7. Haze Factor: Greater than 90 percent when tested according to ASTM D 1003.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken, extruded aluminum.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429 (/B 429M).
 - 4. Structural Profiles: ASTM B 308 (/B 308M).
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193 (/A 193M), 300 series stainlesssteel screws.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 (/A 123M) or ASTM A 153 (/A 153M) requirements.
- F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.
- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch (1.02 mm) thick, finished to match framing.
- I. Framing Gaskets: Manufacturer's standard.

BID AND PERMIT SET

- J. Frame-System Sealants: As recommended in writing by manufacturer.
- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Frame System Fabrication:
 - 1. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
 - 2. Fabricate sill closures with weep holes and for installation as continuous component.
 - 3. Reinforce components as required to receive fastener threads.
- B. Panel Fabrication: Factory assemble and seal panels.
 - 1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
 - a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).
 - 2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
 - 3. Fabricate panel to allow condensation within panel to escape.
 - 4. Reinforce panel corners.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

BID AND PERMIT SET

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m), but no greater than 1/2 inch (13 mm) over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

BID AND PERMIT SET

- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 084523

BID AND PERMIT SET

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
 - 3. Electrified door hardware.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames".
 - 2. Section 081416 "Flush Wood Doors"
 - 3. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
 - 4. Section 083313 "Coiling Counter Doors" for lock cylinders provided as part of coiling counter doors.
 - 5. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
 - 6. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.
 - 7. Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.
 - 8. Section 281300 "Access Control" for access control devices installed at door openings and provided as part of a security system.
 - 9. Section 281600 "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion-detection system.

1.3 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, surge protection and interfaces required for proper operation; provide wiring

BID AND PERMIT SET

between hardware and control components and to building power connection in accordance with requirements described in Divisions 26 and 28

- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems. Do not install power supplies above ceiling. Install in MDF or IDF rooms, wall-mounted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For electrified door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.

BID AND PERMIT SET

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

1.5 INFORMATIONAL SUBMITTALS

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

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 WARRANTY

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

BID AND PERMIT SET

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

BID AND PERMIT SET

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

2.3 SCHEDULED DOOR HARDWARE

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 - 1. Door hardware is scheduled on Drawings and in Section 087100.01 "Door Hardware Sets".

2.4 PARTS LIST

- A. Refer to Section 087100.01 "Door Hardware Sets".
 - 1. Substitutions must be submitted in advance.

2.5 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Contractor shall provide one extra key blank for each lock. Owner will cut keys. Incorporate decisions made in keying conference.
 - a. Coordinate keying with owner's requirements.
 - b. Contractor shall provide lock cores. Owner will pin and install cores.

2.6 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not

BID AND PERMIT SET

permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

- 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
- 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
- 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
- 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
- D. Door Labels:
 - 1. Provide permanent labels for all doors indicating door number per schedule. Labels to be permanently affixed to butt and of door leaf near top hinge.

2.7 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

BID AND PERMIT SET

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

DLR GROUP PROJECT NO. 74-18109-00

ACMA BEAVERTON SCHOOL DISTRICT BEAVERTON, OREGON

BID AND PERMIT SET

- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Boxed Power Supplies: Locate power supplies wall-mounted in MDF or IDF rooms. Do not install above ceilings. Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
 - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

BID AND PERMIT SET

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.9 DOOR HARDWARE SCHEDULE

A. As indicated on Drawings and in Section 087100.01 "Door Hardware Sets".

END OF SECTION 087100

BID AND PERMIT SET

SECTION 087100A – DOOR HARDWARE SCHEDULE

HW SET: 01

FOR	USE OI	N DOOR #(S):			
001		004			
EAC	H OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	GATE LOCK MOUNT	K-BXRHO	600	KEE
		BOX-CYLINDRICAL			
			BALANCE OF HARDWARE BY GATE		
			MANUFACTURER		

CHAIN LINK GATE. PIVOTS AND STRIKE PREP BY GATE MANUFACTURER.

HW SET: 02

FOR	USE OI	N DOOR #(S):			
002		003			
EACH	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PAD LOCK KEEPER	0524PL	Ζ	CRO
1	EA	CANE BOLT	524 P21	Ζ	CRO
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	PADLOCK L/CYL-FSIC	KS43F3200	606	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	GATE LOCK MOUNT	K-BXRHO	600	KEE
		BOX-CYLINDRICAL			

BALANCE OF HARDWARE BY GATE MANUFACTURER

CHAIN LINK GATE. PIVOTS AND STRIKE PREP BY GATE MANUFACTURER. PROVIDE MOUNTING PLATES FOR SPECIFIED HARDWARE.

BID AND PERMIT SET

FOR	USE OI	N DOOR #(S):			
100					
EACH	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-L-06	626	VON
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM

BID AND PERMIT SET

HW SET: 04

FOR	USE ON	N DOOR #(S):			
100A					
EACH	I OPEN	VING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	<u>MFR</u>
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-QEL-XP99-DT-CON	626	VON
		HARDWARE			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
2	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE
			BOLLARDS		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	POWER SUPPLY	PS902 900-4RL 900-BBK CONTROLS 4		VON
			DOOR LEAVES		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			PROVIDE FACTORY POINT TO POINT		
			WIRING DIAGRAMS		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			PROVIDE RISER DIAGRAMS		

120VAC TO POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

FOR	USE OI	N DOOR #(S):			
100B					
EACH	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-QEL-XP99-NL-CON	626	VON
		HARDWARE	-		
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
		OPERATOR			
1	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	WEATHER RING	8310-801	PLA	LCN
1	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
2	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE
			BOLLARDS		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
			PROVIDE FACTORY POINT TO POINT		
			WIRING DIAGRAMS		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			PROVIDE RISER DIAGRAMS		

BID AND PERMIT SET

120VAC TO SHARED POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG. EXTERIOR ADA ACTUATOR INSTALLS ON BOLLARD.

HW SET: 06

FOR U	USE ON	N DOOR #(S):			
100C					
EACH	I OPEN	ING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	ELEC PANIC	RX-QEL-XP99-DT-CON	626	VON
		HARDWARE			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
2	EA	WALL STOP	WS406/407CVX INSTALL ONE ON	630	IVE
			BOLLARD		
1	EA	MULLION SEAL	5110BL	BLK	PEM
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			PROVIDE FACTORY POINT TO POINT		
			WIRING DIAGRAMS		

PROVIDE RISER DIAGRAMS

120VAC TO SHARED POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

HW SET: 07

FOR	USE OI	N DOOR #(S):			
100D					
EACH	H OPEN	VING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-QEL-XP99-NL-CON	626	VON
		HARDWARE			
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
		OPERATOR			
1	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
1	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
2	EA	WALL STOP	WS406/407CVX INSTALL ONE ON	630	IVE
			BOLLARD		
1	EA	MULLION SEAL	5110BL	BLK	PEM
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
			PROVIDE FACTORY POINT TO POINT		
			WIRING DIAGRAMS		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			PROVIDE RISER DIAGRAMS		

120VAC TO SHARED POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

HW SET: 08

FOR	USE OI	N DOOR #(S):			
100E		120 132	E		
EACI	H OPEN	VING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-XP99-EO PROVIDE BLADE STOP	626	VON
			SHIM FOR STRIKE		
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

EXIT ONLY. NO OUTSIDE TRIM.

FOR	USE C	ON DOOR #(S):			
102					
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>	r	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM	ND96TD RHO LLL	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE CON	630	VON
1	EA	SURF. AUTO	4631 WMS	689	LCN
		OPERATOR			
2	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
2	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	MOTION SENSOR	PROVIDED BY DIVISION 28	WHT	SCE
			PERIMETER SEALS BY FRAME		
			MANUFACTURER		
			POWER SUPPLY - WORK OF		
			DIVISION 28		

BID AND PERMIT SET

HW SET: 10

FOR	USE O	N DOOR #(S):			
102A	1				
EAC	H OPE	NING TO HAVE:			
QTY	- -	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	INSTITUTION LOCK	ND82TD RHO LLL	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1	EA	SURF. AUTO	4631 WMS	689	LCN
		OPERATOR			
2	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
2	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
	SET	SEALS	S88D	DKB	PEM
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	MOTION SENSOR	PROVIDED BY DIVISION 28	WHT	SCE
			POWER SUPPLY - WORK OF		
			DIVISION 28		

FOR	USE OI	N DOOR #(S):					
103		105 1	08	108A	110	118	
EACI	H OPEN	NING TO HAVE:					
<u>QTY</u>		DESCRIPTION		CATALOG NUMBER		FINISH	MFR
3	EA	HINGE		5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL ENTRANCE	, ,	ND92TD RHO		626	SCH
		LOCK					
1	EA	FSIC CORE		23-030 EV29 T		626	SCH
1	EA	WALL STOP		WS406/407CCV		630	IVE
1	SET	SEALS		S88D		DKB	PEM

ACMA BEAVERTON SCHOOL DISTRICT

BEAVERTON, OREGON

BID AND PERMIT SET

HW SET: 12

FOR U	USE OI	N DOOR #(S):					
103A		107	114B	115B	122A	131A	
132A		133A	151A	205E			
EACH	H OPEN	NING TO HAVE:					
QTY		DESCRIPTION		CATALOG NUMBER		FINISH	MFR
3	EA	HINGE		5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	VANDL STOREROO	DM	ND96TD RHO		626	SCH
		LOCK					
1	EA	FSIC CORE		23-030 EV29 T		626	SCH
1	EA	WALL STOP		WS406/407CVX		630	IVE
3	EA	SILENCER		SR64		GRY	IVE

HW SET: 13

FOR	USE O	N DOOR #(S):			
109					
EAC	H OPE	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	INSTITUTION LOCK	ND82TD RHO LLL	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1	EA	LOCK PROTECTOR	341D	630	HAG
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	MOTION SENSOR	PROVIDED BY DIVISION 28	WHT	SCE
			POWER SUPPLY - WORK OF		

DIVISION 28

ACCESS CONTROLLED BOTH SIDES OF DOOR. COORDINATE WITH SECURITY.

BID AND PERMIT SET

114E

132D

149B 205D

214

245

HW SET:	<u>14</u>			
FOR USE O	ON DOOR #(S):			
104	112	114	114A	114C
115A	123	132	132B	132C
133B	142	144	146	149
201	205	205A	205B	205C
207	209	210A	211	212
216	217	242	243	244

249

EACH OPENING TO HAVE:

247

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL ENTRANCE	ND92TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 15

246

FOR	USE C	ON DOOR #(S):			
114D)				
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>	-	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

ACMA

BEAVERTON SCHOOL DISTRICT BEAVERTON, OREGON

BID AND PERMIT SET

HW SET: 16

FOR	USE ON	N DOOR #(S):			
115		151			
EACH	H OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-99-L-2SI-06	626	VON
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYL THUMBTURN	XB11-979	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM

HW SET: 17

FOR USE ON DOOR #(S):

121A EACH OPENING TO HAVE: **OTY** DESCRIPTION CATALOG NUMBER FINISH MFR 6 EA HINGE 5BB1HW 4.5 X 4.5 NRP 652 IVE 2 EA SURFACE BOLT IVE SB360 12" SNB 604 VANDL STOREROOM ND96TD RHO SCH 1 EA 626 LOCK FSIC CORE 23-030 EV29 T SCH 1 EA 626 2 EA WALL STOP/HOLDER WS40 INSTALL AT TOP OF DOOR 626 IVE 1 EA ASTRAGAL 355CS PUSH SIDE INACTIVE LEAF AL PEM EA THRESHOLD 151A MSES10 AL PEM 1 SILENCER SR64 GRY 4 EA IVE

BID AND PERMIT SET

HW SET: 18

FOR	USE OI	N DOOR #(S):					
124		124A 12	25	127	129		
EACH	H OPEN	NING TO HAVE:					
<u>QTY</u>		DESCRIPTION		CATALOG NUMBER		FINISH	MFR
1	EA	VANDL ENTRANCE		ND92TD RHO 14-028 3-3	/4" BACKSET	626	SCH
		LOCK					
1	EA	FSIC CORE		23-030 EV29 T		626	SCH
1	EA	WALL STOP		WS406/407CCV		630	IVE
				BALANCE OF HARDWA	ARE BY		
				DOOR/FRAME MANUFA	ACTURER		
STC	ACCEN	DIV CAMILET HING	TEC	SEALS DOOD DOTTON	IDV DOOD AN		

STC ASSEMBLY. CAM LIFT HINGES, SEALS, DOOR BOTTOM BY DOOR AND FRAME MANUFACTURER.

HW SET: 19 FOR USE ON DOOR #(S):

FOR U	USE OF	N DOOR $\#(S)$:			
126A					
EACH	I OPEN	ING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-2SI-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	RIM CYL THUMBTURN	XB11-979	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	\$88D	DKB	PEM

FOR	USE OI	N DOOR #(S):			
126B		126C 134	1		
EACI	H OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	SURFACE BOLT	SB360 12" SNB	604	IVE
1	EA	VANDL STOREROOM	ND96TD RHO XQ07-351	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
2	EA	WALL STOP/HOLDER	WS40 INSTALL AT TOP OF DOOR	626	IVE
1	EA	ASTRAGAL	355CS	AL	PEM
1	EA	THRESHOLD	151A MSES10	AL	PEM
4	EA	SILENCER	SR64	GRY	IVE

BID AND PERMIT SET

HW SET: 21

FOR	USE O	N DOOR #(S):			
130A					
EACI	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-QEL-XP99-NL-CON	626	VON
		HARDWARE			
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
		OPERATOR			
1	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
1	EA	WEATHER RING	8310-801	PLA	LCN
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK		VON
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			PROVIDE FACTORY POINT TO POINT	•	
			WIRING DIAGRAMS		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			PROVIDE RISER DIAGRAMS		

120VAC TO POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

HW SET: 22

FOR	USE OI	N DOOR #(S):			
130B					
EACH	I OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	DUMMY PUSH BAR	330	626	VON
1	EA	DUMMY PUSH BAR	330-DT-990	626	VON
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
		OPERATOR			
1	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
2	EA	WALL STOP	WS406/407CVX	630	IVE
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

120VAC TO DOOR OPERATOR.

HW SET: 23

FOR USE ON DOOR #(S): 133 EACH OPENING TO HAVE: QTY DESCRIPTION CATALOG NUMBER FINISH MFR EA MORTISE CYLINDER 20-061 ICX 626 SCH 1 1 EA FSIC CORE 23-030 EV29 T 626 SCH BALANCE OF HARDWARE BY DOOR MANUFACTURER

COORDINATE CYLINDER TYPE, LENGTH, AND CAM REQUIREMENTS WITH DOOR MANUFACTURER.

BID AND PERMIT SET

HW SET: 24

FOR	USE O	N DOOR #(S):			
133C					
EAC	H OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM	ND96TD RHO LLL	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE CON	630	VON
1	EA	LOCK PROTECTOR	341D	630	HAG
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	MOTION SENSOR	PROVIDED BY DIVISION 28	WHT	SCE
			POWER SUPPLY - WORK OF		
			DIVISION 28		
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		

WEATHERSTRIP BY DOOR/FRAME MANUFACTURER

FOR U	USE ON	N DOOR #(S):					
136		138 143	3	145	147		
EACH	I OPEN	ING TO HAVE:					
QTY		DESCRIPTION		CATALOG NUMBER		FINISH	MFR
3	EA	HINGE		5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE		LD-99-L-2SI-06		626	VON
1	EA	RIM CYL THUMBTUR	RN	XB11-979		626	SCH
1	EA	RIM CYLINDER		20-057 ICX		626	SCH
1	EA	FSIC CORE		23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER		4111 EDA TBWMS		689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP		WS406/407CVX		630	IVE
3	EA	SILENCER		SR64		GRY	IVE

BID AND PERMIT SET

HW SET: 26

FOR USE ON DOOR #(S):									
136A	136A								
EACH OPENING TO HAVE:									
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR				
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE				
1	EA	PASSAGE SET	ND10S RHO	626	SCH				
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	EA	WALL STOP	WS406/407CVX	630	IVE				
1	SET	SEALS	S88D	DKB	PEM				

HW SET: 27 FOR USE ON DOOR #(S):

FUK	USE OF	N DOOR #(S):				
136B		138A	147A	E101		
EACH	H OPEN	IING TO HAVE:				
<u>QTY</u>		DESCRIPTION		CATALOG NUMBER	FINISH	<u>MFR</u>
4	EA	HINGE		5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWAR	E	LD-XP99-NL PROVIDE BLADE STOP	626	VON
				SHIM		
1	EA	RIM CYLINDER		20-057 ICX	626	SCH
1	EA	FSIC CORE		23-030 EV29 T	626	SCH
1	EA	RIM CYL THUMBT	'URN	XB11-979	626	SCH
1	EA	SURFACE CLOSER		4111 EDA TBWMS PROVIDE BSD	689	LCN
				DISTRICT STD MOUNTING PLATE		
1	EA	WALL STOP		WS406/407CVX	630	IVE
1	EA	RAIN DRIP		346C	AL	PEM
1	EA	DOOR SWEEP		315CN	AL	PEM
				WEATHERSTRIP BY DOOR/FRAME		
				MANUFACTURER		
				THERMAL BREAK THRESHOLD BY		
				DOOR/FRAME MANUFACTURER		

BID AND PERMIT SET

HW SET: 28

FOR	USE OI	N DOOR #(S):					
140A							
EACH	H OPEN	NING TO HAVE:					
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR		
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE		
1	EA	POWER TRANSFER	EPT10 CON	689	VON		
1	EA	REMOVABLE	KR4954 STAB	689	VON		
		MULLION					
1	EA	ELEC PANIC	RX-QEL-XP99-DT-CON	626	VON		
		HARDWARE					
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON		
1	EA	FSIC CORE	23-030 EV29 T	626	SCH		
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH		
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN		
			DISTRICT STD MOUNTING PLATE				
2	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE		
			BOLLARDS				
1	EA	RAIN DRIP	346C	AL	PEM		
1	EA	MULLION SEAL	5110BL	BLK	PEM		
2	EA	DOOR SWEEP	315CN	AL	PEM		
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH		
			SUPPLY				
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH		
			ELECTRIFIED HARDWARE				
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK		VON		
			WEATHERSTRIP BY DOOR/FRAME				
			MANUFACTURER				
			PROVIDE RISER DIAGRAMS				
			PROVIDE FACTORY POINT TO POINT				
			WIRING DIAGRAMS				
			BOLLARD(S) PROVIDED BY				
			CONTRACTOR				
			THERMAL BREAK THRESHOLD BY				
			DOOR/FRAME MANUFACTURER				

120VAC TO POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

FOR	USE O	N DOOR #(S):			
140B					
EACH	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-OEL-XP99-NL-CON	626	VON
		HARDWARE			
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
-			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
-		OPERATOR		007	2011
1	EA	ACTUATOR, WALL	8310-853T	630	LCN
-		MOUNT		000	2011
1	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
1	EA	WEATHER RING	8310-801	PLA	LCN
2	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE
_			BOLLARDS		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
	1.1		ELECTRIFIED HARDWARE		5011
1	FA	WIRF HARNESS	CON-6W FROM INCOMING POWER		SCH
1	LIX		SLIPPI V		ben
			SUILI		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			PROVIDE FACTORY POINT TO POINT	•	
			WIRING DIAGRAMS		
			BOLLARD(S) PROVIDED RV		
			CONTRACTOR		
			PROVIDE RISER DIAGRAMS		
			THERMAL BREAK THRESHOLD BV		
			$\frac{11}{1000} \text{ DOOR / ER AME MANUEACTUREP}$		
			DOOR/FRAME MANUFACTURER		

BID AND PERMIT SET

120VAC TO SHARED POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

HW SET: 30

FOR	USE C	ON DOOR #(S):			
1400	2				
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>	-	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	DUMMY PUSH BAR	330-DT-990	626	VON
1	EA	DUMMY PUSH BAR	330	626	VON
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	SURF. AUTO	4642 WMS	689	LCN
		OPERATOR			
1	EA	ACTUATOR, JAMB	8310-818T	630	LCN
		MOUNT			
1	EA	FLUSH MOUNT BOX	8310-819F	689	LCN
2	EA	WALL STOP	WS406/407CVX INSTALL ONE ON	630	IVE
			BOLLARD		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

120VAC TO DOOR OPERATOR.

FOR	USE O	N DOOR #(S):			
140D					
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	DUMMY PUSH BAR	330	626	VON
1	EA	DUMMY PUSH BAR	330-DT-990	626	VON
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
2	EA	WALL STOP	WS406/407CVX INSTALL ONE ON	630	IVE
			BOLLARD		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

BID AND PERMIT SET

FOR	FOR USE ON DOOR #(S):								
131B	131B								
EACI	EACH OPENING TO HAVE:								
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR				
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE				
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH				
		LOCK							
1	EA	FSIC CORE	23-030 EV29 T	626	SCH				
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	SET	SEALS	S88D	DKB	PEM				
BID AND PERMIT SET

HW SET: 33

FOR	USE C	ON DOOR #(S):			
151E	3				
EAC	H OPE	NING TO HAVE:			
QTY	r	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	ELEC PANIC	RX-QEL-XP99-NL-CON	626	VON
		HARDWARE			
2	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
2	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE
			BOLLARDS		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
1	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK		VON
			PROVIDE RISER DIAGRAMS		
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR		
			PROVIDE FACTORY POINT TO POINT	-	
			WIRING DIAGRAMS		

120VAC TO POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

BID AND PERMIT SET

HW SET: 34

FO	R USE C	ON DOOR #(S):			
201	А				
EA	CH OPE	NING TO HAVE:			
QT	Y	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	GASKETING	303AS	AL	PEM
1	EA	MORTISED AUTO	434ARL	AL	PEM
		DOOR BOTTOM			
LIC	GHT CO	NTROLLED			
ну	V SET:	35			
FO	R USE C	N DOOR #(S):			
203	;				
EA	CH OPE	NING TO HAVE:			
QT	Y	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL ENTRANCE	ND92TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

1	LA	I SIC CORE	23-030 E V 29 I	020	SCII
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	GASKETING	303AS	AL	PEM
1	EA	MORTISED AUTO	434ARL	AL	PEM
		DOOR BOTTOM			

LIGHT CONTROLLED

BID AND PERMIT SET

FOR	USE C	ON DOOR #(S):			
143A	1	145A			
EAC	H OPE	NING TO HAVE:			
QTY	r	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-XP99-NL PROVIDE BLADE STOP	626	VON
			SHIM		
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYL THUMBTURN	XB11-979	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	WALL STOP	WS406/407CVX INSTALL ON	630	IVE
			BOLLARD		
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
			BOLLARD(S) PROVIDED BY		
			CONTRACTOR (WHERE BOLLARDS		
			OCCUR)		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		

ACMA BEAVERTON SCHOOL DISTRICT

BEAVERTON, OREGON

BID AND PERMIT SET

HW SET: 37

FOR	USE OI	N DOOR #(S):						
206		221						
EACH	EACH OPENING TO HAVE:							
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR			
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE			
1	EA	REMOVABLE	KR4954 STAB	689	VON			
		MULLION						
1	EA	PANIC HARDWARE	LD-99-L-NL-06	626	VON			
1	EA	PANIC HARDWARE	LD-99-EO	626	VON			
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON			
		KIT	PROVIDE BSD DISTRICT STD					
			SPACER.					
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH			
2	EA	FSIC CORE	23-030 EV29 T	626	SCH			
1	EA	RIM CYLINDER	20-057 ICX	626	SCH			
2	EA	SURFACE CLOSER	4011 TBWMS	689	LCN			
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE			
2	EA	FIRE/LIFE WALL MAG	SEM7850	689	LCN			
4	EA	SILENCER	SR64	GRY	IVE			
CON	CONNECT WALL MAGNETS TO ACCESS CONTROL FOR A SECTIONED AREA LOCK DOWN.							

FOR	USE OI	N DOOR #(S):			
218		220			
EACH	H OPEN	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL CLASSROOM	ND94TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

BID AND PERMIT SET

HW SET: 39

FOR U	USE ON	N DOOR #(S):				
251						
EACH	I OPEN	ING TO HAVE:				
QTY		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR	
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE	
1	EA	PANIC HARDWARE	LD-99-L-BE-06	626	VON	
1	EA	MAG LOCK	M62 X 24VDC	628	SEC	
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE	
1	EA	WALL STOP	WS406/407CVX DEPENDING ON	630	IVE	
			CONDITIONS WALL STOP MAY			
			NEED TO ALIGN WITH MAG LOCK			
3	EA	SILENCER	SR64	GRY	IVE	
CONN	CONNECT MAG LOCK TO ACCESS CONTROL. AHJ APPROVAL FOR USE OF MAG LOCK ON					

EGRESS DOOR IS REQUIRED.

HW SET: 40

FOR	USE OI	N DOOR #(S):			
C100		C101 C200			
EACH	H OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS40 INSTALL AT TOP OF DOOR	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

FOR	FOR USE ON DOOR #(S):								
E100		E101A	E101B	E102	E200	E201			
EACH	H OPEN	NING TO HAVE:							
<u>QTY</u>		DESCRIPTION	<u>(</u>	CATALOG NUMBER		<u>FINISH</u>	MFR		
3	EA	HINGE	-	5BB1HW 4.5 X 4.5 NH	RP	652	IVE		
1	EA	VANDL STOREROO	DM]	ND96TD RHO		626	SCH		
		LOCK							
1	EA	FSIC CORE	4	23-030 EV29 T		626	SCH		
1	EA	SURFACE CLOSER	4	4011 TBWMS		689	LCN		
1	EA	KICK PLATE	8	8400 10" X 2" LDW B	-CS	630	IVE		
1	EA	WALL STOP	1	WS406/407CVX		630	IVE		
1	SET	SEALS	:	S88D		DKB	PEM		

BID AND PERMIT SET

FOR	USE O	N DOOR #(S):			
M10	0				
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>	-	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-XP99-EO	626	VON
1	EA	PANIC HARDWARE	LD-XP99-NL	626	VON
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	DOOR SWEEP	315CN	AL	PEM
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

BID AND PERMIT SET

HW SET: 43

FOR	USE O	N DOOR #(S):			
M101	l				
EAC	H OPE	NING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	LOCK PROTECTOR	341D	630	HAG
1	EA	SURFACE CLOSER	4111 EDA TBWMS PROVIDE BSD	689	LCN
			DISTRICT STD MOUNTING PLATE		
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	RAIN DRIP	346C	AL	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
			THERMAL BREAK THRESHOLD BY		
			DOOR/FRAME MANUFACTURER		
			WEATHERSTRIP BY DOOR/FRAME		
			MANUFACTURER		

FOI	R USE C	DN DOOR #(S):			
M1	02				
EA	CH OPE	ENING TO HAVE:			
QT	<u>Y</u>	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

BID AND PERMIT SET

HW	SET: 4	<u>45</u>			
FOR	USE O	N DOOR #(S):			
P100					
EAC	H OPE	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED	KR9954 STAB	689	VON
		REMOVABLE			
		MULLION			
1	EA	ELEC FIRE EXIT	RX-QEL-99-L-F-06-CON	626	VON
		HARDWARE			
1	EA	FIRE EXIT HARDWARE	99-EO-F	626	VON
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	SURF. AUTO	4631 WMS	689	LCN
		OPERATOR			
2	EA	ACTUATOR, WALL	8310-853T	630	LCN
_		MOUNT			
2	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	\$88D	DKB	PEM
1	EA	MULLION SEAL	5110BL	BLK	PEM
2	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
•			ELECTRIFIED HARDWARE		aau
2	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY	(2)	aar
1	EA	KEY SWITCH	653-04 L2 36-079 ENABLES/DISABLES	630	SCE
			ADA OPERATOR AND ELECTRIFIED		
			PANIC DEVICE		NON
1	ΕA	POWER SUPPLY	PS902 900-2KS 900-BBK		VON
			PROVIDE EACTORY PONT TO PONT		
			PROVIDE FACTORY POINT TO POINT		
			WIKING DIAGRAMS		

BID AND PERMIT SET

120VAC TO POWER SUPPLY AND DOOR OPERATOR. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG. NFPA 80 6.1.3.4 POWER-OPERATED FIRE DOORS. POWER-OPERATED FIRE DOORS SHALL BE EQUIPPED WITH A RELEASING DEVICE THAT SHALL AUTOMATICALLY DISCONNECT THE POWER OPERATOR AT THE TIME OF FIRE, ALLOWING A SELF-CLOSING OR AUTOMATIC DEVICE TO CLOSE AND LATCH THE DOOR REGARDLESS OF POWER FAILURE OR MANUAL OPERATION.

HW SFT. 46

BID AND PERMIT SET

)L/1. ¬	r <mark>o</mark>			
FOR	USE O	N DOOR #(S):			
P101					
EACH	I OPEN	NING TO HAVE:			
QTY		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED	KR9954 STAB	689	VON
		REMOVABLE			
		MULLION			
1	EA	FIRE EXIT HARDWARE	99-EO-F	626	VON
1	EA	ELEC FIRE EXIT	RX-QEL-99-L-F-06-CON	626	VON
		HARDWARE			
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	SURF. AUTO	4631 WMS	689	LCN
		OPERATOR			
2	EA	FLUSH MOUNT BOX	8310-867F	689	LCN
2	EA	ACTUATOR, WALL	8310-853T	630	LCN
		MOUNT			
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7850	689	LCN
1	EA	MULLION SEAL	5110BL	BLK	PEM
1	SET	SEALS	S88D	DKB	PEM
2	EA	WIRE HARNESS	CON-6W FROM INCOMING POWER		SCH
			SUPPLY		
2	EA	WIRE HARNESS	CON-26P POWER TRANSFER TO		SCH
			ELECTRIFIED HARDWARE		
1	EA	KEY SWITCH	653-04 L2 36-079	630	SCE
			PROVIDE RISER DIAGRAMS		
			PROVIDE FACTORY POINT TO POINT		
			WIRING DIAGRAMS		

120VAC TO SHARED POWER SUPPLY (SHARED WITH P100) AND DOOR OPERATOR. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG. NFPA 80 6.1.3.4 POWER-OPERATED FIRE DOORS. POWER-OPERATED FIRE DOORS SHALL BE EQUIPPED WITH A RELEASING DEVICE THAT SHALL AUTOMATICALLY DISCONNECT THE POWER OPERATOR AT THE TIME OF FIRE, ALLOWING A SELF-CLOSING OR AUTOMATIC DEVICE TO CLOSE AND LATCH THE DOOR REGARDLESS OF POWER FAILURE OR MANUAL OPERATION. CONNECT WALL MAGNETS TO FIRE ALARM.

DLR GROUP PROJECT NO. 74-18109-00

BID AND PERMIT SET

HW SET: 47

FOR U	JSE ON	N DOOR #(S):				
PAC-2	100	PAC-101	PAC-105	PAC-106		
EACH	I OPEN	ING TO HAVE:				
QTY		DESCRIPTION	CATALO	<u>G NUMBER</u>	FINISH	MFR
1	EA	FSIC CORE	23-030 EV	29 T ADVISE QUANTITY	626	SCH
			REQ'D			
			BALANC	E OF EXISTING HARDWARE	<u>i</u>	

TO REMAIN

FIELD CONFIRM EXISTING HARDWARE IS SERVICEABLE AND COMPLETE. ADVISE OF ANY FAULTY OR MISSING HARDWARE. CONFIRM EXISTING CYLINDER(S) ARE INTERCHANGEABLE CORE TYPE.

HW SET: 48

FOR USE ON DOOR #(S):							
PAC-103	PAC-104						
EACH OPEN	NING TO HAVE:						
<u>QTY</u>	DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR			
1 EA	FSIC CORE	23-030 EV29 T	626	SCH			
		BALANCE OF EXISTING HARDWARE					
		TO REMAIN					

FIELD CONFIRM EXISTING HARDWARE IS SERVICEABLE AND COMPLETE. ADVISE OF ANY FAULTY OR MISSING HARDWARE. CONFIRM EXISTING CYLINDER IS INTERCHANGEABLE CORE TYPE.

FOR USE ON DOOR #(S):								
UR1	00	UR102 U	R103	UR200	UR201			
EAC	EACH OPENING TO HAVE:							
QTY	- -	DESCRIPTION	CATA	ALOG NUMBER		FINISH	MFR	
3	EA	HINGE	5BB1	HW 4.5 X 4.5 NRP		652	IVE	
1	EA	PRIVACY WITH	LV94	96T 06A L583-363		626	SCH	
		OCCUPIED INDICAT	OR					
1	EA	FSIC CORE	23-03	0 EV29 T		626	SCH	
1	EA	SURFACE CLOSER	4011	TBWMS		689	LCN	
1	EA	KICK PLATE	8400	10" X 2" LDW B-C	S	630	IVE	
1	EA	WALL STOP/HOLDE	R WS40	INSTALL AT TO	P OF DOOR	626	IVE	
1	SET	SEALS	S88D			DKB	PEM	

BID AND PERMIT SET

HW SET: 50

FOR USE ON DOOR #(S):						
UR1()1					
EAC	H OPEN	NING TO HAVE:				
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	MFR	
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE	
1	EA	PRIVACY WITH	LV9496T 06A L583-363	626	SCH	
		OCCUPIED INDICATOR				
1	EA	FSIC CORE	23-030 EV29 T	626	SCH	
1	EA	WALL STOP/HOLDER	WS40 INSTALL AT TOP OF DOOR	626	IVE	
1	SET	SEALS	S88D	DKB	PEM	

FOR	USE ON	N DOOR #(S):			
122		122B 126			
EACH	H OPEN	ING TO HAVE:			
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	FINISH	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE	KR4954 STAB	689	VON
		MULLION			
1	EA	PANIC HARDWARE	LD-99-L-2SI-06	626	VON
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	MULLION STORAGE	MT54 REINFORCEMENT REQUIRED.	689	VON
		KIT	PROVIDE BSD DISTRICT STD		
			SPACER.		
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	RIM CYL THUMBTURN	N XB11-979	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
2	EA	WALL STOP/HOLDER	WS40 INSTALL AT TOP OF DOOR	626	IVE
1	EA	MULLION SEAL	5110BL	BLK	PEM
1	SET	SEALS	S88D	DKB	PEM

BID AND PERMIT SET

HW SET: 52

FOR USE ON DOOR #(S):							
234		236 238					
EACH	H OPEN	NING TO HAVE:					
<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR		
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE		
1	EA	VANDL ENTRANCE	ND92TD RHO	626	SCH		
		LOCK					
1	EA	FSIC CORE	23-030 EV29 T	626	SCH		
1	EA	WALL STOP	WS406/407CCV	630	IVE		
1	EA	THRESHOLD	196A X 195A X 192A X 228A X 191A X	AL	PEM		
			WELD X NO HOLES (SEE NOTE				
			BELOW)				
3	EA	SILENCER	SR64	GRY	IVE		

CUSTOM THRESHOLD USED AS PLACE HOLDER. COORDINATE ARCHITECTURAL DETAILS OF GYM FLOOR WITH THRESHOLD.

HW SET: 53

FOR USE ON DOOR #(S):							
251A	251A						
EACH	I OPEN	ING TO HAVE:					
QTY		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR		
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE		
1	EA	PANIC HARDWARE	LD-99-EO	626	VON		
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE		
1	EA	WALL STOP	WS406/407CVX	630	IVE		
3	EA	SILENCER	SR64	GRY	IVE		
EXIT	EXIT ONLY. NO PULL SIDE TRIM.						

HW SET: 54

FOR USE ON DOOR #(S):

149A	1				
EAC	H OPEI	NING TO HAVE:			
QTY	- -	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM	ND96TD RHO	626	SCH
		LOCK			
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	THRESHOLD	568A-223	А	ZER

END OF SECTION 087100A

BID AND PERMIT SET

SECTION 087100B – DOOR HARDWARE INDEX

001 01 002 02 003 02 004 01 100 03 100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14	DOOR NUMBER	HW SET
002 02 003 02 004 01 100 03 100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114E 14 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14	001	01
003 02 004 01 100 03 100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51	002	02
004 01 100 03 100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 16 114E 14 114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51	003	02
100 03 100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 16 114A 14 114B 12 114C 14 114B 12 114C 14 114B 12 114C 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18	004	01
100A 04 100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 16 114A 14 114B 12 114C 14 114B 12 114C 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100	03
100B 05 100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 16 114E 14 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100A	04
100C 06 100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 109 13 110 11 112 14 114 14 114 14 115 16 114E 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100B	05
100D 07 100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 16 114C 14 114B 12 114C 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100C	06
100E 08 102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 108A 11 109 13 110 11 112 14 114 14 114 14 114B 12 114C 14 114B 12 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100D	07
102 09 102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114B 12 114C 14 114B 12 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	100E	08
102A 10 103 11 103A 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 115 14 114B 12 114C 14 114B 12 114C 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	102	09
103 11 $103A$ 12 104 14 105 11 107 12 108 11 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 115 16 $115A$ 14 115 16 $115A$ 14 120 08 $121A$ 17 122 51 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	102A	10
103A 12 104 14 105 11 107 12 108 11 $108A$ 11 109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	103	11
104 14 105 11 107 12 108 11 108 11 108 11 109 13 110 11 112 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 114 14 115 16 115 16 115 16 115 12 118 11 120 08 $121A$ 17 122 51 123 14 124 18 125 18 126 51 126 51 126 51 126 20	103A	12
105 11 107 12 108 11 $108A$ 11 109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	104	14
107 12 108 11 $108A$ 11 109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $122A$ 12 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	105	11
108 11 $108A$ 11 109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $123A$ 12 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	107	12
108A 11 109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 $114B$ 12 $114C$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $122A$ 12 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	108	11
109 13 110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114D$ 15 $114E$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $122A$ 12 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	108A	11
110 11 112 14 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114D$ 15 $114E$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $122A$ 12 123 14 124 18 125 18 126 51 $126A$ 19 $126B$ 20	109	13
11214 114 14 114 14 $114A$ 14 $114B$ 12 $114C$ 14 $114D$ 15 $114E$ 14 115 16 $115A$ 14 $115B$ 12 118 11 120 08 $121A$ 17 122 51 $122A$ 12 123 14 124 18 125 18 126 51 $126B$ 20	110	11
114 14 114A 14 114B 12 114C 14 114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	112	14
114A 14 114B 12 114C 14 114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	114	14
114B 12 114C 14 114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 123 14 124 18 125 18 126 51 126A 19 126B 20	114A	14
114C 14 114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 122A 12 123 14 124 18 125 18 126 51 126A 19 126B 20	114B	12
114D 15 114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 122A 12 123 14 124 18 125 18 126 51 126A 19 126B 20	114C	14
114E 14 115 16 115A 14 115B 12 118 11 120 08 121A 17 122 51 122A 12 123 14 124 18 125 18 126 51 126A 19 126B 20	114D	15
11516115A14115B121181112008121A1712251122A12122B5112314124181251812651126A19126B20	114E	14
115A 14 115B 12 118 11 120 08 121A 17 122 51 122A 12 123 14 124 18 125 18 126 51 126A 19 126B 20	115	16
115B 12 118 11 120 08 121A 17 122 51 122A 12 122B 51 123 14 124 18 125 18 126 51 126A 19 126B 20	115A	14
118 11 120 08 121A 17 122 51 122A 12 122B 51 123 14 124 18 125 18 126 51 126A 19 126B 20	115B	12
120 08 121A 17 122 51 122A 12 122B 51 123 14 124 18 125 18 126 51 126A 19 126B 20	118	11
121A 17 122 51 122A 12 122B 51 123 14 124 18 125 18 126 51 126A 19 126B 20	120	08
122 51 122A 12 122B 51 123 14 124 18 125 18 126 51 126A 19 126B 20	121A	17
122A 12 122B 51 123 14 124 18 124A 18 125 18 126 51 126A 19 126B 20	122	51
122B 51 123 14 124 18 124A 18 125 18 126 51 126A 19 126B 20	122A	12
123 14 124 18 124A 18 125 18 126 51 126A 19 126B 20	122B	51
124 18 124A 18 125 18 126 51 126A 19 126B 20	123	14
124A 18 125 18 126 51 126A 19 126B 20	124	18
125 18 126 51 126A 19 126B 20	124A	18
126 51 126A 19 126B 20	125	18
126A 19 126B 20	126	51
126B 20	126A	19
.200	126B	20

DOOR NUMBER	HW SET
126C	20
127	18
129	18
130A	21
130B	22
131A	12
131B	32
132	14
132A	12
132B	14
132C	14
132D	14
132F	08
133	23
133A	12
133R	14
1330	24
134	20
136	25
136A	26
136R	20
138	27
138	23
130A	28
140A	20
1400	30
1400	31
1400	1/
142	25
143 1/3Δ	20
144	14
145	25
145	20
145	14
140	25
147	20
147.5	21 1 /
149	14
149A	0+ 1/
1490	16
151	10
151A	1Z 22
201	33 14
201	14
201A	34

DOOR NUMBER	HW SET
203	35
205	14
205A	14
205B	14
205C	14
205D	14
205E	12
206	37
207	14
209	14
210A	14
211	14
212	14
214	14
216	14
217	14
218	38
220	38
221	37
234	52
236	52
238	52
242	14
243	14
244	14
245	14
246	14
247	14
249	14
251	39
251A	53
C100	40
C101	40
C200	40
E100	41
E101	27
E101A	41
E101B	41
E102	41
E200	41
E201	41
M100	42
M101	43
M102	44

BID AND PERMIT SET

DOOR NUMBER	HW SET
P100	45
P101	46
PAC-100	47
PAC-101	47
PAC-103	48
PAC-104	48
PAC-105	47
PAC-106	47
UR100	49
UR101	50
UR102	49
UR103	49
UR200	49
UR201	49

BID AND PERMIT SET

SECTION 088000 - 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. Glass for windows, doors, storefront framing, glazed curtain walls, skylights.
 - 2. Tempered monolithic glass mirrors (MR-5).
 - 3. Large format "glassless" mirrors (MR-4).
 - 4. Channel-framed interior borrowed lites.
 - 5. Glazing sealants and accessories.
 - 6. Mirror hanging hardware.
 - 7. Delegated design.
- B. Related Requirements:
 - 1. Section 016116 "Delegated Design Requirements."
 - 2. Section 102800 "Toilet and Custodial Accessories."

1.3 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 according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

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

BID AND PERMIT SET

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 glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, "glassless" mirrors, glass coating components, edge sealer, and quality-control provisions.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Samples: For each type of the following:
 - 1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
 - 2. Mirror Trim: 12 inches (300 mm) long.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass, each type of mirror and mirror mastic.
- C. Product Test Reports: For tinted glass, insulating 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.

BID AND PERMIT SET

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.10 DELIVERY, STORAGE, AND HANDLING

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

1.11 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 (4.4 deg C).

1.12 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

BID AND PERMIT SET

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 Insulating Glass: Manufacturer agrees to replace insulatingglass 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 the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Vitro Architectural Glass or comparable products by, but not limited to, one of the following:
 - 1. AGC Glass Company North America, Inc.
 - 2. Pilkington North America, Inc.
 - 3. Saint-Gobain Corporation.
 - 4. Sunguard by Guardian.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

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

the following: 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 016116 "Delegated Design Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. 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 laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, according to 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. GANA 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 or manufacturer. 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 IGCC.

BID AND PERMIT SET

- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- 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 is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- D. Fully Tempered Float Glass: ASTM C 1048, 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.
- E. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with primary and secondary sealants.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 SILVERED FLAT GLASS MIRRORS, MR-5

A. Mirrors, General: ASTM C1503.

BID AND PERMIT SET

- B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.
 - 1. Size: 96 x 48 inches.
 - 2. Nominal Thickness: 1/4-inch (6-mm).
 - 3. Orientation: Horizontal.
 - 4. Location: Group restrooms.

2.7 LARGE FORMAT "GLASSLESS" MIRRORS, MR-4 AND MR-5

- A. Basis-of-Design Product: Wall Mounted Mirrorlite Glassless Mirrors by Dance Equipment International.
 - 1. Mirror MR-4: No. DW-K019W96 by Dance Equipment International.
 - a. Size: 72 x 96 inches.
 - b. Orientation: Vertical.
 - c. Location: Dance rooms.

2.8 CHANNEL-FRAMED INTERIOR BORROWED LITES

- A. Glazing Channels: Shallow extruded aluminum U-channels by C.R. Laurence Co., Inc. Width and depth to accept 1/4-inch thick clear glazing.
- B. Color: As selected by Architect from manufacturer's standard finishes.

2.9 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.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

BID AND PERMIT SET

D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.10 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 C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.11 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of 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: 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 glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- G. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

BID AND PERMIT SET

2.12 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 (67 deg C), ambient; 180 deg F (100 deg C), 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.

2.13 MIRROR HARDWARE

- A. Wall Mounting Bracket: Provide manufacturer's standard angle brackets.
- B. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - 3. Finish: Clear bright anodized.
- C. Aluminum J-Channels and Cleat: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
 - 2. Top Trim: Formed with front leg with a height matching bottom trim and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
 - 3. Finish: Clear bright anodized.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

BID AND PERMIT SET

E. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.14 FABRICATION OF MIRRORS

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment:
 - 1. Edge Finish: Flat, polished.
 - 2. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 3. Perform edge treatment and sealing in factory immediately after cutting to final sizes.

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.
- C. Mirror Mastic: Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

BID AND PERMIT SET

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 (1270 mm).
 - 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 (3-mm) 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 according to 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 by gasket manufacturer.

BID AND PERMIT SET

3.4 INSTALLATION, MIRRORS

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Laminated Glazing Reference Manual," "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
 - 2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
 - 4. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.5 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.

BID AND PERMIT SET

- 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.

3.6 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 between glass 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 glass lites 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 glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites 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 glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.7 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 come into 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.

BID AND PERMIT SET

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.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Glass Type CTG: Uncoated Ultra-clear fully tempered float glass.
 - 1. Minimum Thickness: 0.25 inches.
- B. Glass Type TRTG: Translucent fully tempered float glass: Uncoated clear, acid etched on #2 surface.
 - 1. Minimum Thickness: 0.25 inches.

3.9 INSULATING GLASS SCHEDULE

- A. Glass Type ICG: Low-E-coated, clear insulating glass.
 - 1. Basis-of-Design Product: Solarban 70XL (2) + Clear by Vitro.
 - 2. Overall Unit Thickness: 1 inch (25 mm).
 - 3. Minimum Thickness of Each Glass Lite: 0.25 inches.
 - 4. Outdoor Lite: Float glass.
 - 5. Interspace Content: Air.
 - 6. Indoor Lite: float glass.
 - 7. Low-E Coating: Pyrolytic on second surface.
 - 8. U-Factor: 0.28 maximum.
 - 9. Visible Light Transmittance: 64 percent minimum.
 - 10. Solar Heat Gain Coefficient: 0.27 maximum.
- B. Type ICTG High Impact Resistant Sealed Insulating Glass Units: Vision glass, double glazed.
 - 1. Outboard Lite: Fully tempered float glass, 0.25 inches thick.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #3 surface.
 - 2. Inboard Lite: Annealed Laminated, .030 PVB interlayer, 0.25 inches thick.
 - a. Tint: Clear
 - 3. Total Thickness: 1 inch.
 - 4. Total Visible Light Transmittance: 64% percent, nominal.
 - 5. Total Solar Heat Gain Coefficient: 0.27 percent, nominal.
- C. Glass Type TTIG: Low-E coated, tinted insulating glass.
 - 1. Basis-of-Design Product: As selected by Architect.

BID AND PERMIT SET

- 2. Overall Unit Thickness: 1 inch (25 mm).
- 3. Minimum Thickness of Each Glass Lite: 0.25 inches.
- 4. Outdoor Lite: Tinted heat-strengthened float glass.
- 5. Tint Color: Crystal Gray.
- 6. Interspace Content: Air.
- 7. Indoor Lite: Heat-strengthened float glass.
- 8. Low-E Coating: Pyrolytic on second surface.
- 9. Winter Nighttime U-Factor: 0.29 maximum.
- 10. Summer Daytime U-Factor: 0.28 maximum.
- 11. Visible Light Transmittance: 34 percent minimum.
- 12. Solar Heat Gain Coefficient: 0.28 maximum.
- D. Decorative Glass Type GL-2: Laminated glass with decorative interlayer.
 - 1. Basis-of-Design Product: No. CS-TTW7-1030-1030 Clearshade IGU by Panelite.
 - 2. Construction: Two plies of clear fully tempered float glass.
 - 3. Thickness of Each Glass Ply: 0.25 inches minimum.
 - 4. Construction: Laminate glass with encapsulated high performance honeycomb insert to comply with performance requirements.
- E. Decorative Glass: Laminated glass with decorative interlayer.
 - 1. Basis-of-Design Product: 3Form.
 - 2. Construction: Two plies of clear fully tempered float glass.
 - 3. Thickness of Each Glass Ply: 0.125 inches minimum.
 - 4. Construction: Laminate glass with PVB interlayer or cast-in-place and cured, transparent, resin interlayer to comply with interlayer manufacturer's written instructions.
 - 5. Interlayer Color and Pattern: As selected by Architect from manufacturer's full range.

END OF SECTION 088000

BID AND PERMIT SET

SECTION 088813 - FIRE-RESISTANT 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. Fire-protection-rated glazing.

1.3 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 according to ASTM C 1036.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches (300 mm) square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and glass testing agency.
- B. Product Certificates: For each type of glass and glazing product, from manufacturer.

BID AND PERMIT SET

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

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

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

- A. Manufacturer's Special Warranty on Double Glazing Units with Clear Gel Fill: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of double glazing units with clear gel fill is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is the leakage of gel fill from units, air bubbles within units, or obstruction of vision by contamination or deterioration of gel.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following:

BID AND PERMIT SET

defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

2.4 GLASS PRODUCTS

- A. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise 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.
- B. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.
- B. Double Glazing Units with Clear Gel Fill: Double glazing units made from two lites of uncoated, fully tempered, ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent gel; and complying with 16 CFR 1201, Category II.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide the following products by the following:
 - a. FRTG1: Fireglass 20 by Technical Glass Products.
 - b. FRTG2: FireLite Plus, Premium Grade by Technical Glass Products.

BID AND PERMIT SET

2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. Tremco Incorporated.
 - 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- C. 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 C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

BID AND PERMIT SET

2.8 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. 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.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

BID AND PERMIT SET

- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 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 (3-mm) 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.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.
- J. 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 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 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 right before each glazing unit is installed.
- F. 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.
- G. 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.
BID AND PERMIT SET

- B. Insert soft compression gasket between glass 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 glass lites 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.
- D. Install gaskets so they protrude past face of glazing stops.

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 come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces in each area of Project 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 FIRE-RESISTANCE-RATED GLAZING SCHEDULE

- A. Glass Type FRTG1: 20-minute fire-resistance-rated glazing with 450 deg F (250 deg C) temperature-rise limitation; double glazing units with clear gel fill; 1/4 inch thickness.
- B. Glass Type FRTG2: 20-minute to 180-minute fire-resistance-rated glazing with 450 deg F (250 deg C) temperature-rise limitation; double glazing units with clear gel fill; 5/16 inch thickness.

END OF SECTION 088813

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

BID AND PERMIT SET

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
 - 2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa) acting inward or outward.
 - 3. Wind Loads: Determine loads based on pressures indicated below:

- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project if dictated in structural design
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- F. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade shall pass enhanced-protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Non-Drainable-Blade Louver:
 - 1. Basis of Design Product: Subject to compliance with performance requirements, provide Ruskin ELC6375DXD Drainable Combination Louver or comparable product by one the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Air Flow Company, Inc.
 - c. Airolite Company, LLC (The).
 - d. All-Lite Architectural Products.
 - e. American Warming and Ventilating
 - f. Arrow United Industries; a division of Mestek, Inc.
 - g. Construction Specialties, Inc.
 - h. Dowco Products Group; Safe Air of Illinois.
 - i. Greenheck Fan Corporation.
 - j. Industrial Louvers, Inc.
 - k. Louvers & Dampers; a division of Mestek, Inc.
 - 1. Nailor Industries Inc.
 - m. NCA Manufacturing, Inc.
 - n. Nystrom, Inc.
 - o. Pottorff.
 - p. Reliable Products, Inc.
 - q. United Enertech.

BID AND PERMIT SET

- 2. Louver Depth: < 5 inches, unless shown or otherwise noted on Drawings.
- 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) for blades and 0.080 inch (2.03 mm) for frames.
- 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.5 sq. ft. (0.79 sq. m for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver, or as called for in Drawings.
 - b. Point of Beginning Water Penetration: Not less than 0.01 oz/sq. ft. at 1250 fms free area velocity.

2.4 BLANK-OFF PANELS

- A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
 - 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
 - 2. Panel Finish: Same finish type applied to louvers, but black color.
 - 3. Attach blank-off panels with sheet metal screws.

2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.6 FABRICATION

A. Factory-assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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 gypsum board shaft wall assemblies.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for other exterior and interior load-bearing and non-load-bearing wall stud and furring.
 - 2. Section 079200 "Joint Sealants" for acoustical sealant.
 - 3. Section 078413 "Penetration Firestopping" for fire rated sealants.
 - 4. Section 092216 "Non-Structural Metal Framing."
 - 5. Section 092900 "Gypsum Board."
 - 6. Wall Types on the drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

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 support them on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.

GYPSUM BOARD SHAFT WALL ASSEMBLIES

BID AND PERMIT SET

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 E 119 by an independent testing agency.
 - 1. Fire-Rated Construction, where indicated on drawings:
 - a. One-hour fire-rated shafts.
 - b. Two-hour fire-wall, using shaftwall assembly construction.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. STC Rating: As indicated in Wall Types on drawings.
- C. Gypsum Shaftliner Board:
 - 1. Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch (25.4 mm) thick, with double beveled long edges.
 - a. American Gypsum; Shaft Liner.
 - b. CertainTeed Corp.; ProRoc Shaftliner.
 - c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
 - d. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
 - e. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
 - f. PABCO Gypsum; Pabcore Shaftliner Type X.
 - g. Temple-Inland Inc.; Fire-Rated SilentGuard Gypsum Shaftliner System.
 - h. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
 - 1. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

BID AND PERMIT SET

- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 - 1. Depth: As indicated Minimum Base-Metal Thickness: As indicated
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm long and matching studs in depth.
- G. Minimum Base-Metal Thickness: As indicated Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - b. Metal-Lite, Inc.; The System.
- H. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches (76 mm), matching studs in depth, and not less than 0.033 inch (0.84 mm) thick.
- I. Finish Panels: As indicated Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

BID AND PERMIT SET

- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch (0.84-mmminimum thickness of base metal (uncoated).
- F. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 1/2- or 5/8-inch (13- or 16-mmpanels.
 - 2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

BID AND PERMIT SET

- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches (102 mm, install gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) on center with screws fastened to shaft wall framing.
 - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) on center and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 **PROTECTION**

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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 092116.23

BID AND PERMIT SET

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.
- B. Related Requirements:
 - 1. Section 092900 "Gypsum Board" for board materials applied to metal framing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
 - 4. Fire-rated and non-fire-rated deflection head tracks.
 - 5. Metal blocking for supporting wall-mounted items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate nonload-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft. (480 Pa)

BID AND PERMIT SET

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 hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
 - 1. Steel Studs and Tracks, minimum 22 gauge (0.027 inch).
- C. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch (38-mm) vertical movement.
 - 2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Basis-of-Design Products:
 - 1) Non-Fire-Rated deflection head: Vertitrack; Steel Network.
 - 2) Fire-rated deflection head: BlazeFrame DSL2; Clark Dietrich.
- D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: 1-1/2 inches (38 mm).
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
 - 2. Depth: 7/8 inch (22.2 mm).
- F. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: 2-1/2 inches (64 mm).
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 - 2. Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
 - b. Depth: 1-5/8 inches (41 mm) See "Embossed Steel Studs and Tracks" Article in the Evaluations for information about embossed steel studs and tracks.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Basis-of-Design Product: Drywall Grid System; Armstrong Ceiling & Wall Solutions.
- G. Putty Pad Sealant: At acoustic rated partitions and fire-rated partitions in order to provide noise transmission resistance and fire resistance at electrical boxes and other penetrations. Refer to Section 078413 "Penetration Firestopping".

2.4 AUXILIARY MATERIALS

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

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 Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Putty Pad Sealant: Acoustically seal with putty pads, electrical boxes in walls and ceilings in which resilient sound isolation clips are used.

BID AND PERMIT SET

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: As required by horizontal deflection performance requirements unless otherwise indicated.
 - 2. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Install two studs at each jamb unless otherwise indicated.
 - 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 4. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 5. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 6. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- D. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) on center.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches (1219 mm) on center.
 - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) on center.

NON-STRUCTURAL METAL FRAMING

BID AND PERMIT SET

- 3. Furring Channels (Furring Members): 16 inches (406 mm).
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support Grid suspension systems are suitable for use with gypsum board. They might be acceptable for gypsum veneer plaster; consult gypsum veneer plaster and grid suspension system manufacturers.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

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. Tile backing panels.
- B. Related Requirements:
 - 1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
 - 3. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 DELIVERY, STORAGE AND HANDLING

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

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 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 E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.
 - 5. National Gypsum Company.
 - 6. PABCO Gypsum.
 - 7. Temple-Inland.
 - 8. USG Corporation.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch (12.7 mm).
 - 2. Long Edges: Tapered.
- E. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 - 1. Core: As indicated on Drawings5/8 inch (15.9 mm), Type X.
 - 2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.

BID AND PERMIT SET

- 3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 2requirements.
- 4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2requirements.
- 5. Long Edges: Tapered.
- 6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- 7. Basis-of-Design Product: DensArmor Plus, Georgia-Pacific.
- F. Type C gypsum board has fire-resistive capability greater than that of Type X. Design designations of independent testing agencies indicated on Drawings generally determine product requirements for Type C gypsum board. Type C gypsum board from different manufacturers cannot be intermixed because the ratings apply only to assemblies identical in materials and construction to those tested.
- G. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
 - 1. Thickness: 1/2 inch (12.7 mm
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- H. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
 - 1. Core: As indicated on Drawings.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc
 - 2. Shapes:
 - a. Cornerbead.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C 665, 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.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

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 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4-to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

BID AND PERMIT SET

- 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 C 919 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 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings
 - 2. Type X: As indicated on Drawings
 - 3. Ceiling Type: Ceiling surfaces
 - 4. Abuse-Resistant Type: In Gymnasium
 - 5. Impact-Resistant Type: As indicated on drawings.
 - 6. Mold-Resistant Type: Minimum 3' in all directions centered on plumbing fixtures. Required both sides of walls containing fixtures.
 - 7. Glass-Mat Interior Type: 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, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm)

minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

- 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- 4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile
- C. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners
 - 2. L-Bead: Use where indicated or recommended by manufacturer.
 - 3. J-trim: Use at exposed edges of boards and where boards abut caulked joints with dissimilar materials.

BID AND PERMIT SET

3.6 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. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- C. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - 3. Level 3: Mechanical, electrical rooms, custodial closets, and storage rooms
 - 4. Level 4: Classrooms
 - 5. Level 5: Corridors, gymnasiums, cafeteria/Commons, offices, high traffic/public areas.
- D. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- F. Clean gypsum board of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

3.7 **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. Provide Vapor retarder (minimum: 4 mil) behind gypsum board on all shower walls, behind slop sinks, in dishwash rooms, and exterior walls of walk-in coolers
- D. 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.

DLR GROUP PROJECT NO. 74-18109-00

BID AND PERMIT SET

END OF SECTION 092900

SECTION 093000-TILING

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. Unglazed ceramic floor tile.
 - 2. Glazed wall tile.
 - 3. Trim pieces.
 - 4. Crack isolation membrane.
 - 5. Metal edge strips.
 - 6. Mortar and grout.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

DLR GROUP PROJECT NO. 74-18109-00

ACMA BEAVERTON SCHOOL DISTRICT BEAVERTON, OREGON

BID AND PERMIT SET

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Full-size units of each type of trim and accessory.
 - 3. Metal edge strips of each profile in 6-inch (150-mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

BID AND PERMIT SET

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by

BID AND PERMIT SET

TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

- A. Tile Type TL-1: Unglazed ceramic tile.
 - 1. Products: Basis-of-Design products from Daltile, Keystones.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: 2 by 2 inches.
 - 4. Thickness: 1/4 inch.
 - 5. Finish: Matte
 - 6. Dynamic Coefficient of Friction: Not less than 0.42.
 - 7. Tile Color, Glaze, and Pattern: As indicated in Color and Material Schedule on drawings, or if not indicated, as selected by Architect from full range of industry colors.
 - 8. Grout Color: As selected by Architect from manufacturer's full range.
- B. Tile Type TL-2, TL-3, and TL-4: Glazed wall tile.
 - 1. Products: Basis-of-Design products from Roca Tile, Color Collection.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: 4.25 x 4.25 inches
 - 4. Face Size Variation: Rectified.
 - 5. Thickness: 5/16 inch
 - 6. Face: Solid with square edges.
 - 7. Dynamic Coefficient of Friction: N/A.
 - 8. Tile Color, Glaze, and Pattern: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.
 - 9. Grout Color: As selected by Architect from manufacturer's full range.
- C. Tile Type TLB-1, Glazed Wall Tile Base.
 - 1. Products: Basis-of-Design products from Roca Tile, Color Collection.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: 4.25 x 4.25 inches cove base.
 - 4. Thickness: 5/16 inch.
 - 5. Face: Solid with square edges.
 - 6. Tile Color, Glaze, and Pattern: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.
 - 7. Grout Color: As selected by Architect from manufacturer's full range.

2.4 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
- C. Crack Isolation Membrane and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both a crack isolation membrane and tile-setting adhesive in a two-step process.

2.5 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1 and as specified below.
 - 1. Latex additive (water emulsion) described below, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
 - a. Latex Additive: Manufacturer's standard.
- B. Latex-Portland Cement Mortar: ANSI A118.4, composition as follows:
 - 1. Latex additive (water emulsion) of type described below, combined at job site with prepackaged dry mortar mix supplied or specified by latex additive manufacturer.
 - a. Latex Type: Manufacturer's standard.
 - b. Latex-Portland Cement Mortar shall be quality similar to Custom Building Products ProLite Tile and Stone Mortar.

2.6 GROUT MATERIALS

- A. Chemical-Resistant Epoxy Grout: ANSI A118.3. Manufacturer standard colors:
- B. Quality of epoxy grout used on this Project shall be similar to Custom Building Products CEG-Lite.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, designed specifically for flooring applications; exposed-edge material.
 - 1. Outside Corners and same height floor material transition (SCHL-1): Schluter Systems anodized aluminum Schiene.
 - a. Schiene to be used at wall tile at flash coved base areas only.
 - 2. Outside Corners (SCHL-2): Schluter Systems anodized aluminum Rondec.
 - a. Rondec to be used at outside corners of wall tile.
 - 3. Floor Reducing (SCHL-3): Schluter Systems anodized aluminum RENO-U.
 - a. RENO-U to be used at floor tile edge adjacent to concrete floor.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.9 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 07 Section "Joint Sealants," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

BID AND PERMIT SET

- D. Products: Subject to compliance with requirements, provide one of the following:
 - 1. One-Part Mildew-Resistant Silicone Sealant:
 - a. "Dow Corning 786"; Dow Corning Corp.
 - b. "Sanitary 1700"; GE Silicones.
 - c. "898 Sanitary Silicone Sealant"; Pecora Corp.
 - d. "Rhodorsil 6B White"; Rhone-Poulenc Inc.
 - e. "Tremsil 600 White"; Tremco Corp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/8 inch (3.2 mm).
 - 2. Floor Tile: 1/8 inch (3.2 mm).
- G. Lay out tile wainscots to dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Metal Edge Strips: Install at locations indicated.

BID AND PERMIT SET

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 **PROTECTION**

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Floor Tile, Typical: Install tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfloor construction, and grout types:
 - a. Crack Isolation Mat: TCNA F125-Partial Coverage.
 - b. Latex Modified Portland Cement Mortar: ANSI A108.4
 - c. Bond Coat: Latex-portland cement mortar, ANSI A108.4 or ANSI A108.5.
 - 1) Concrete Subfloors, Typical: TCNA F115-13 on medium bed.
 - 2) Grout: Water-cleanable epoxy grout.
BID AND PERMIT SET

- B. Interior Wall Installations, Wood or Metal Studs or Furring:
 - 1. Tile Installation TCNA W244C 13; thinset mortar on cementitious backer units.
 - a. Thinset Mortar: Latex Portland Cement Mortar: ANSI A108.4.
 - b. Grout: Water-cleanable epoxy grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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. Acoustical ceiling panels.
 - 2. Exposed suspension systems for interior ceilings.
 - 3. Wood slat ceiling grille (WS-1).
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.
- C. Related Requirements:
 - 1. Section 062023 "Interior Finish Carpentry" for wood grille (WS-1).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, provide 6-inch (150-mm) sample size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

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

ACOUSTICAL PANEL CEILINGS

BID AND PERMIT SET

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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc. or comparable product by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Chicago Metallic Corporation.
 - 3. United States Gypsum Company.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

BID AND PERMIT SET

- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS (ACT-1 and ACT-1B)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide School Zone Fine Fissured, 1714 as manufactured by Armstrong World Industries, Inc., no substitutions.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type XII, mineral-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured), Fine.
- D. Colors:
 - 1. ACT-1: White.
 - 2. ACT-1B: Black.
- E. Light Reflectance (LR): 0.81
- F. Noise Reduction Coefficient (NRC): 0.70
- G. Ceiling Attenuation Class (CAC): Not less than 35.
- H. Edge/Joint Detail: Square Lay-in.
- I. Thickness: 5/8 inch.
- J. Modular Size: 24 by 48 inches.
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL PANELS (ACT-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Clean Room VL 870 as manufactured by Armstrong World Industries, Inc., no substitutions.

BID AND PERMIT SET

- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with factory-applied latex paint on DuraBrite acoustically transparent membranes.
 - 2. Pattern: E (lightly textured).
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.80.
- F. Ceiling Attenuation Class (CAC): Not less than 40.
- G. Noise Reduction Coefficient (NRC): N/A.
- H. Edge/Joint Detail: Square Lay-in.
- I. Thickness: 5/8 inch.
- J. Modular Size: 24 by 48 inches
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 ACOUSTICAL PANELS (ACT-3)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Invisacoustics 1212FP as manufactured by Armstrong World Industries, Inc., or comparable product by another manufacturer.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type XII, mineral-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured), Fine.
 - 3. Installation: Mechanically fastened to hat channel furring.
- D. Color: White.
- E. Light Reflectance (LR): N/A.

BID AND PERMIT SET

- F. Noise Reduction Coefficient (NRC): 0.75
- G. Ceiling Attenuation Class (CAC): N/A.
- H. Edge/Joint Detail: Square Lay-in.
- I. Thickness: 3/4 inch.
- J. Modular Size: 24 by 48 inches.
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.6 ACOUSTICAL PANELS (ACT-4)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Optima 3153 as manufactured by Armstrong World Industries, Inc., or comparable product by another manufacturer.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type XII, mineral-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured), Fine.
- D. Color: White.
- E. Light Reflectance (LR): 0.90
- F. Noise Reduction Coefficient (NRC): 0.95.
- G. Ceiling Attenuation Class (CAC): N/A.
- H. Edge/Joint Detail: Square Lay-in.
- I. Thickness: 1 inch.
- J. Modular Size: 24 by 48 inches.
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

BID AND PERMIT SET

- 2.7 ACOUSTICAL PANELS (ACT-5)
 - A. Basis-of-Design Product: Subject to compliance with requirements, provide 24-inch by 24-inch (600- by 600-mm), convex lay-in Pyramidal Ceiling Diffusers as manufactured by Wenger, or an approved substitution.
 - B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
 - C. Classification: Provide panels as follows:
 - 1. Type and Form: Type XII, mineral-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured), Fine.
 - D. Color: White.
 - E. Light Reflectance (LR): 0.81
 - F. Noise Reduction Coefficient (NRC): 0.70
 - G. Ceiling Attenuation Class (CAC): Not less than 35.
 - H. Edge/Joint Detail: Square Lay-in.
 - I. Thickness: 5/8 inch.
 - J. Modular Size: 24 by 24 inches.
 - K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.8 ACOUSTICAL PANELS (ACT-6)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Soundscapes Blades, Product No. 3921 by Armstrong Ceiling & Wall Solutions.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type XII, mineral-fiber base with DuraBrite acoustically-transparent membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured), Fine.

BID AND PERMIT SET

- D. Shape: Vertical blade.
- E. Color: White.
- F. Light Reflectance (LR): 0.90
- G. Edge: Square.

2.9 SUSPENDED WOOD GRILLE CEILING

- A. Interior Wood Grille for Walls and Ceilings (WS-1):
 - 1. Basis-of-Design Product: As specified in Section 062023 "Interior Finish Carpentry."
 - a. Dimensions and Spacing: As detailed on Drawing A10.10.
 - b. Finish: Manufacturer's clear finish.
 - 2. Metal Suspension System: As specified in this Section.
 - 3. Sound-Attenuation Boards: Provide behind ceiling grille slats.
 - a. Composition: Rigid, resin-bonded fibrous glass board with damage-resistant, black core with black mat facing.
 - 1) Thickness: 2 inches.
 - 2) Color: Black.
 - 3) Flame Spread: 25 per ASTM E84.
 - 4) Smoke Developed: 50 per ASTM E84.
 - b. Basis-of-Design Product: SelectSound Black Acoustic Board by Owens Corning; or approved equal.
 - c. Reveal Scrim: Manufacturer's standard black scrim.
 - 4. Ceiling Grille Access Panels: As detailed on Drawing A10.10.

2.10 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
 - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

BID AND PERMIT SET

- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Seismic Clips: seismic clips designed and spaced to secure acoustical panels in place.
 - 1. Hemmed aluminum-capped angle molding with prefinished exposed flanges, 7/8-inch width. Basis of Design Seismic clip: BERC2 retaining clip.

2.11 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Prelude XL as manufactured by Armstrong World Industries, Inc., or a comparable product:
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
 - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16 inch wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Cold-rolled steel.
 - 5. Cap Finish: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.

2.12 ACCESSORIES

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

BID AND PERMIT SET

- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch-(1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Three way clips: GC3W Grip clip 3-Way for ACT-1 & ACT-5 grid only

2.13 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - a. Moldings for seismic constraint; Basis of Design Product: BERC2 retaining clip, part of the Seismic RX system by Armstrong World Industries, Inc.
 - 2. Where indicated on drawings for lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - a. Armstrong Shadow Molding
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's

BID AND PERMIT SET

designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

- 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- C. Seismic Restraint Wall Moldings: Hemmed aluminum-capped angle molding with prefinished exposed flanges, 7/8-inch width. Basis of Design Seismic clip: BERC2 retaining clip.
- 2.14 METAL EDGE MOLDINGS AND TRIM (Perimeter Termination not adjacent to walls)
 - A. Basis-of-Design Product: Subject to compliance with requirements, provide Axiom Classic as manufactured by Armstrong World Industries, Inc., or a comparable product by one of the following:
 - B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.15 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

BID AND PERMIT SET

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Compliance of seismic design.

BID AND PERMIT SET

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096466 - ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes athletic flooring.
- B. Related Sections:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete slab-on-grade subfloor to receive athletic flooring.

1.3 REFERENCES

- A. DIN Performance Standard 18032 Part 2
- B. EN Performance Standard 14904 World Standard
- C. MFMA PUR Performance Uniformity Requirements
- D. FIBA International Basketball Association
- E. MFMA Maple Flooring Manufacturers Association

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for athletic flooring.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include the following:
 - 1. Expansion provisions and trim details.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.

BID AND PERMIT SET

- C. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:
 - 1. Floor finish.
 - 2. Game-line and marker paint.
- D. Samples for Verification: For each type of athletic flooring and accessory required; approximately 24 inches long and of same thickness and material indicated for the Work.
 - 1. Include sample sets showing the full range of normal color and texture variations expected in flooring.
 - 2. Include Sample sets showing finishes and game-line and marker paint colors applied to flooring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for athletic flooring system.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For athletic flooring and finish systems to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who has completed athletic flooring installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.
 - 1. Installer responsibilities include installation and field finishing of athletic flooring components and accessories, and application of game lines and markers.
- B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
 - 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
- C. Performance Testing
 - 1. Flooring system shall have been independently tested to the International Standards: DIN 18032, Part 2, EN 14904 or MFMA PUR.
 - 2. FIBA International Standards.
 - 3. Independent DIN testing laboratory must be recognized by the MFMA and test to all the required standards of the DIN testing methodologies.
 - 4. Independent DIN testing laboratory shall have Scientific Body Membership in the International Association of Sports Surface Sciences (ISSS).

BID AND PERMIT SET

- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
 - 2. Prepare finished mockup of floor area as shown on Drawings to set quality standards for sanding and application of field finishes and game lines and markers.
 - 3. Acoustical consultant will test mockup to determine if installation will meet design intent for acoustic performance.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver assembly materials in unopened cartons or bundles.
- B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.9 FIELD CONDITIONS

- A. Conditioning period begins not less than seven days before athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive athletic flooring during the conditioning period.
 - 2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
 - a. Do not install wood athletic flooring until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
 - b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install athletic flooring after other finishing operations, including painting, have been completed.

BID AND PERMIT SET

1.10 COORDINATION

A. Coordinate layout and installation of athletic flooring systems with floor inserts for gymnasium equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Robbins Pro Tap Sprung Floor system manufactured by Robbins Sports Surfaces or comparable product by one of the following:
 - 1. Action Floor Systems, LLC.
 - 2. Connor Floor; Subsidiary of Connor Sport Court International.
 - 3. Horner Flooring Company, Inc.
 - 4. Monarch Flooring.
 - 5. Mondo.
 - 6. Aacer Flooring, LLC.
 - 7. WD Flooring, LLC.

2.2 FLOATING WOOD FLOORS (RF-5 AND WF-2)

- A. Description, RF-5:
 - 1. Basis-of-Design Product: Robbins, Pro Tap Vinyl floor system.
 - 2. Type: Floating floor system including:
 - a. 6-mil (0.15-mm) polyethylene vapor retarder over concrete substrate.
 - b. 7/16-inch (11-mm) thick, 50 durometer resilient pads and damping strips.
 - c. Manufacturer's standard wood sleepers.
 - d. Two layers of 15/32-inch (12-mm) thick plywood subfloor.
 - 3. Covered with Marley Vinyl Finish flooring.
 - 4. Total System Thickness: 2-9/16 inches (65 mm).
- B. Description, WF-2:
 - 1. Basis-of-Design Product: Robbins, Pro Tap Wood floor system.
 - 2. Type: Floating floor system including:
 - a. 6-mil (0.15-mm) polyethylene vapor retarder over concrete substrate.
 - b. 7/16-inch (11-mm) thick, 50 durometer resilient pads and damping strips.
 - c. Manufacturer's standard wood sleepers.
 - d. One layer of 15/32-inch (12-mm) thick plywood subfloor.
 - 3. Covered with 1-1/2 inches wide by 25/32-inch (19.8-mm) thick hard Maple wood strip flooring.
 - 4. Total System Thickness: 2-13/16 inches (71.4 mm).

BID AND PERMIT SET

- 2.3 FASTENERS
 - A. Flooring: 2-inch barbed cleats.
 - B. Subfloor: 1-inch coated staples.

2.4 FINISHES

- A. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.
 - 1. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
 - 2. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.
 - 3. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - a. Colors: As indicated on Drawings.
 - 4. VOC Content: Products shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.

2.5 ACCESSORIES

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils (0.15 mm) thick.
- B. Resilient Wall Base: Heavy-duty, molded, vented, rubber or vinyl cove base; 4- by 3- by 48- inches (100- by 75- by 1200-mm); with premolded outside corners.
 - 1. Color: Black.
- C. Perimeter Edge Transition Strip: Flat, extruded aluminum threshold; clear anodized finish.
- D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by athletic flooring manufacturer.
- E. Adhesives: Manufacturer's standard for application indicated that has a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of athletic flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and, perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1) Proceed with installation only after substrates have maximum moisturevapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform plastic sheet test, ASTM D 4263. Proceed with installation only after testing indicates absence of moisture in substrates.
 - 1) Proceed with installation only if there is no evidence of condensation or clouding in 24 hours.
 - c. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.3 INSTALLATION

- A. General: Comply with athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
- B. Pattern: Lay flooring parallel with long dimension of space to be floored unless otherwise indicated.
- C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - 1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
- D. Vapor Retarder: Cover entire slab area beneath wood flooring. Install with joints lapped a minimum of 6 inches (150 mm) and sealed.
- E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.

3.4 SANDING AND FINISHING

- A. Allow installed flooring to acclimate to ambient conditions before sanding.
- B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
- C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
- D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide no fewer than four coats total and no fewer than two finish coats.
 - 1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
 - 2. Game-Line and Marker Paint: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
 - a. Mask flooring at game lines and markers and, apply paint to produce lines and markers with sharp edges.
 - b. Where game lines cross, break minor game line at intersection; do not overlap lines.
 - c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
 - d. Apply finish coats after game-line and marker paint is fully cured.

BID AND PERMIT SET

3.5 FIELD QUALITY CONTROL

A. Project acoustical consultant will perform field tests on flooring system to document compliance with performance criteria.

3.6 **PROTECTION**

- A. Protect athletic flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
 - 1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.
 - 2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096466

BID AND PERMIT SET

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
 - 2. Resilient stair accessories (RST-1).
 - 3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 4 inches (300 mm) long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
 - 2. Smoke Density: Less than 450 per ASTM E 662.

BID AND PERMIT SET

- B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient base.
- C. Provide 5-year unconditional warranty for installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than [95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE (RB-1 and RB-2)

- A. Products: Basis-of-Design products from Johnsonite, Inc. Traditional Rubber Base or comparable product by one of the following:
 - 1. Roppe Corporation, USA.
 - 2. VPI Corporation.
- B. Product Standard: ASTM F 1861
 - 1. Group: I (solid, homogeneous).
 - 2. Meet or exceed ASTM E 84/NFPA 225 Class A flame spread index, less than 450 smoke density.
 - 3. Style:
 - a. Cove on carpeted floors.
 - b. Cove on resilient and concrete floors.

BID AND PERMIT SET

- C. Thickness: 1/8 inch (3mm).
- D. Height:
 - 1. RB-1, RB-2: 4 inches (102 mm).
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated in Color and Material Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.

2.2 RESILIENT STAIR ACCESSORIES (RST-1)

- A. Resilient Stair Tread with Integrated Riser:
 - 1. Manufacturers: Provide basis of design product from Johnsonite or, provide comparable products by one of the following:
 - a. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
 - b. Roppe Corporation, USA.
 - c. VPI, LLC; Floor Products Division.
- B. Resilient Stair Treads Standard: ASTM F 2169.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
 - 2. Surface Design: Hammered finish on treads with smooth riser surface.
- C. Nosing Style: Square with visually impaired grit tape insert.
- D. Nosing Height: 2 inches (51 mm).
- E. Thickness: 1/4 inch (6 mm) and tapered to back edge.
- F. Size: Lengths and depths to fit each stair tread in one piece.
- G. Color: No. 148 Paprika, hammered, by Johnsonite.

2.3 RESILIENT MOLDINGS

A. Resilient edge and transition strips for transition from resilient flooring to other finishes. Manufacturer standard profiles in color to match flooring materials.

BID AND PERMIT SET

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.

- 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

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

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

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. Vinyl sheet flooring.
- 2. Rubber sheet flooring.
- 3. Dance vinyl sheet flooring.
- 4. Kitchen slip-resistant flooring.
- B. Related Requirements:
 - 1. Section 096466 "Athletic Flooring" for RF-5.
 - 2. Section 096513 "Resilient Base and Accessories" for resilient base, stair accessories, transition strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring.
 - 4. Seam locations for sheet flooring.
- C. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.
 - 2. Provide trained technical representative from manufacturer for additional training prior to installation.
 - 3. Provide 5-year unconditional warranty for installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient sheet flooring during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

BID AND PERMIT SET

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL SHEET FLOORING WITH BACKING (RF-3)

- A. Products: Provide Acczent Flourish, No. 206, Stability CG, or comparable products from
 - 1. Armstrong World Industries.
 - 2. Forbo Flooring Systems.
- B. Product Standard: ASTM F 1303-2.
 - 1. Type (Binder Content): Type II, Grade 1, minimum binder content of 34 percent.
 - 2. Wear-Layer Thickness: 0.050 in.
 - 3. Overall Thickness: 0.080 in.
 - 4. Interlayer Material: Filled Vinyl Chips.
 - 5. Backing: Class A, Polyester.
- C. Wearing Surface: Smooth, UV-cured polyurethane coating.
- D. Sheet Width: As standard with manufacturer.
- E. Seamless-Installation Method: Heat welded.
- F. Colors and Patterns: As indicated in Color and Material Schedule in drawings or, if not indicated, as selected by Architect from full range of industry colors.

BID AND PERMIT SET

2.3 HOMOGENOUS VINYL SHEET FLOORING (RF-4)

- A. Products: Provide Reliance 25, No. D2517, Vault by Altro, or comparable products from:
 - 1. Armstrong World Industries.
 - 2. Forbo Flooring Systems.
- B. Product Standard: ASTM F 1913.
 - 1. Type (Binder Content): Type II, minimum binder content of 34 percent.
 - 2. Wear-Layer Thickness: 0.098 inch (2.5 mm).
 - 3. Overall Thickness: 0.098-inch (2.5-mm).
 - 4. Interlayer Material: None.
- C. Wearing Surface: Smooth.
- D. Sheet Width: As standard with manufacturer.
- E. Seamless-Installation Method: Heat welded.
- F. Base: Integral self-cove base, 4 inches (102 mm) high.
- G. Colors and Patterns: As indicated in Color and Material Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.

2.4 HOMOGENOUS VINYL SHEET FLOORING (RF-5)

- A. Products: Provide Robbins Dance Vinyl as specified in Section 096466 "Athletic Flooring".
- B. Wearing Surface: Smooth.
- C. Sheet Width: As standard with manufacturer.
- D. Seamless-Installation Method: Heat welded.
- E. Colors and Patterns: As indicated in Color and Material Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

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

- C. Seamless-Installation Accessories:
 - 1. Cold welding Compound: At all location except where indicated to be heat-welded Manufacturer's product for cold welding seams.
 - a. Colors: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
 - 2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
 - 3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

BID AND PERMIT SET

- 4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

BID AND PERMIT SET

- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Cold Welded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
 - 2. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

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. Rubber floor tile (RF-2 and RF-7).
 - 2. Alternate No. 4:
 - a. Base Bid: Vinyl composition tile (VCT), RF-1.
 - b. Alternate No. 4: Vinyl luxury tile (VLT).
 - 3. Acoustic underlayment.
- B. Related Sections:
 - 1. Section 012300 "Alternates" for Alternate No. 4.
 - 2. Section 093013 "Ceramic Tiling" for transition strips.
 - 3. Section 096513 "Resilient Base Accessories" for transition strips.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: Refer to Color & Material Schedule and Room Finish Schedule for locations.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Provide 3% extra back stock of each product installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.

BID AND PERMIT SET

- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.
- C. Low-Emitting Materials: Flooring system shall comply 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."

2.2 VINYL COMPOSITION TILE (VCT-1 and VCT-2), BASE BID

- A. Basis-of-Design Product: Provide Standard Excelon VCT by Armstrong World Industries, or comparable product by one of the following:
 - 1. Tarkett VCT, by Tarkett (formerly Johnsonite).
- B. Tile Standard: ASTM F1066, Class 2, through pattern.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As indicated on Color and Material Schedule on Drawings.

2.3 VINYL LUXURY TILE (VLT-1 and VLT-2), ALTERNATE NO. 4

- A. Basis-of-Design Products: Provide Shaw Contract VLT or, comparable products by one of the following:
 - 1. Johnsonite.
 - 2. Mannington.
- B. Construction: Luxury Vinyl Plank with Micro Bevel Edges.

BID AND PERMIT SET

- C. Wear Layer Thickness: 0.020 inch.
- D. Overall Thickness: 0.098 mil (2.5 mm).
- E. Size: 6 inches by 42 inches, Plank.
- F. Installation Method: direct glue.
- G. Colors and Patterns: As indicated on Color and Material Schedule on drawings.
- H. Install luxury vinyl tile over acoustic underlayment.

2.4 RUBBER FLOOR TILE (RF-2)

- A. Basis-o-Design Product: Provide Rubber Tile, Minerality Line by Johnsonite, Inc., or comparable products from one of the following:
 - 1. Nora Flooring.
 - 2. Mondo.
- B. Tile Standard: ASTM F 1344, Class I-B, homogeneous rubber tile, through mottled.
- C. Hardness: ASTM D2240, Shore type "A", 82 achieved, greater than or equal to 70 is required.
- D. Wearing Surface: Smooth texture.
- E. Thickness: 1/8 inch (3 mm).
- F. Size: 12 inches by 24 inches (300 mm by 600 mm).
- G. Installation Method: direct glue.
- H. Colors and Pattern: As indicated on Color and Material Schedule on the drawings.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content:
 - a. Rubber Floor Adhesives: 60 g/L or less.

BID AND PERMIT SET

- b. Encore "E-Grip" one-component urethane adhesive.
 - 1) Sealant (Floor Polish): Apply 2-3 coats of finish as recommended by manufacturer.
- 2. Adhesives shall comply 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."
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: As selected by Architect from manufacturer's full range to match with floor tile.
- D. Acoustic Underlayment:
 - 1. Base Bid: Provide the following at vinyl composite tile (VCT):
 - a. Basis-of-Design Product: TBD.
 - 2. Alternate No. 4: Provide the following at vinyl luxury tile (VLT):
 - a. Basis-of-Design Product: Sonus LV270, by Regupol America, LLC.
 - b. Material: Sheet acoustic underlayment made of recycled material, 1/8-inch (3 mm) thick.
 - c. Weight: 0.35 pounds per square foot.
 - d. Hardness: 54-64 Shore A Durometer.
 - e. Adhesive: Hard set acrylic adhesive; Trueset adhesive by Regupol.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with corridor entry door of room.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

BID AND PERMIT SET

- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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 modular carpet tile (CPT-1 and CPT-2).
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with 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. Carpet tile type, color, and dye lot.
 - 2. Type of subfloor.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Pile direction.
 - 7. Type, color, and location of edge, transition, and other accessory strips.
 - 8. 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. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

BID AND PERMIT SET

E. 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. (8.3 sq. m).

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups at locations and in sizes shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

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

TILE CARPETING

BID AND PERMIT SET

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 weather-tight, 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

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

- A. Basis-of-Design Product: First Step II Tile by Mohawk Group.
- B. Other Approved Products:
 - 1. Recoarse II by Mannington Commercial.
 - 2. Traverse by Mannington Commercial.
- C. Fiber Content: Nylon.
- D. Product Construction: Tufted construction.

TILE CARPETING

BID AND PERMIT SET

- E. Pile Characteristic: Large nap design.
- F. Pile Thickness: 0.203 inches.
- G. Primary Backing/Back-Coating: Manufacturer's standard.
- H. Tile Size: 24 by 24 inches (609.6 by 609.6 mm)
- I. Color: As indicated on Color and Material Schedule on the drawings.
- J. Installation Method: As indicated.

2.2 CARPET TILE (CPT-2)

- A. Products: Basis-of-Design products from Shaw Contract, Places Collection, Sea Edge Tile, Style 5T173 or, comparable by one of the following:
 - 1. Interface.
 - 2. Mannington Mills, Inc.
- B. Pattern and Color:
 - 1. Skyline Red, 40 percent of carpet tile area.
 - 2. Skyline Silver, 60 percent of carpet tile area.
- C. Fiber Content: Eco Solution q® nylon.
- D. Product Construction: Multi-level patterned loop.
- E. Pile Thickness: 0.086 inches (2.18 mm).
- F. Surface Pile Weight: 17 oz./sq. yd. (576.4 gms/sqm).
- G. Pile Density: 7116 oz/sq. yd. (0.264 g/cm^3)
- H. Primary Backing/Back-Coating: Manufacturer's standard synthetic materials.
- I. Backing System: ecoworx® tile.
- J. Size: 24 inches by 24 inches.
- K. Installation Method: Monolithic.
- L. Performance Characteristics:
 - 1. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
 - 2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 - 3. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
 - 4. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.

BID AND PERMIT SET

- 5. Dimensional Stability: Less than 10% according to AATCC 134.
- 6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
- 7. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
- 8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.3 INSTALLATION ACCESSORIES

A. 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. Transitions to be mechanically fastened.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine carpet tile for type, color, pattern, and potential defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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: None (will be used as loose carpet squares/area rugs in classrooms)
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Install pattern parallel to walls and borders.

3.3 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove yarns that protrude from carpet tile surface.
 - 2. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- 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.

BID AND PERMIT SET

END OF SECTION 096813

SECTION 097212 - FIBERGLASS REINFORCED PLASTIC SHEET WALL COVERING

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. Furnish all labor, material, equipment, and services required and incidental to the installation of fiberglass reinforced sheet wall covering as detailed.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

- A. Submit the following in accordance with Division 01 Section "Submittal Procedures."
- B. Material samples for review and color selection of each type of panel, trim, and fastener.

1.5 QUALITY ASSURANCE

A. Applicator shall be experienced in manufacturer's installation procedures and be approved by the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver finish materials to job site only when satisfactory conditions for storage can be provided. Maintain materials in manufacturer's labeled and unbroken packages.

1.7 PROJECT CONDITIONS

A. Acclimate plastic sheet at least 24 hours in temperature and humidity conditions of final environment before beginning Work of this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Marlite; www.marlite.com.
- B. Other Approved Manufacturer: Kemlite Co.; www.cranecomposites.com/kemlite.
- C. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 01 Section "Product Requirements."

2.2 MATERIALS

- A. FRP-1, Fiberglass Reinforced Plastic Panels:
 - 1. Fiberglass reinforced plastic sheet, 3/32-inch (0.093-inch) thick.
 - 2. Fire Hazard Classification: As tested per ASTM E84, IBC Class C flame-spread index 76-200, smoke-developed 450 or less per ASTM E84.
 - 3. Product: Induro FRP.
 - 4. Color: As selected by Architect.
 - 5. Finish: As selected by Architect.
- B. FRP-2, Fiberglass Reinforced Plastic Panels:
 - 1. Fiberglass reinforced plastic sheet, 3/32-inch (0.093-inch) thick.
 - 2. Fire Hazard Classification: As tested per ASTM E84, IBC Class C flame-spread index 76-200, smoke-developed 450 or less per ASTM E84.
 - 3. Product: Standard FRP.
 - 4. Color: As selected by Architect.
 - 5. Finish: Pebbled Surface.
- C. Adhesive: Low VOC as recommended by plastic sheet manufacturer for laminating over gypsum board substrate. Marlite FRP Solvent-free Adhesive, C-551.
- D. Sealant: silicone sealant, white color.
- E. Moldings:
 - 1. Material: PVC in matching color.
 - 2. Manufacturer: Marlite.
 - 3. Types:
 - a. Edges: M370.
 - b. Inside Corner: M350.
 - c. Outside Corner: M360.
 - d. Panel-to-Panel: M365.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify that substrate surfaces are smooth, level, clean, and free of irregularities that may be detrimental to proper application.
 - 2. Commencement of installation denotes acceptance of substrate.
 - 3. Do not begin installation until the work of other trades, including painting, has been completed and the temperature of the rooms has been maintained within humidity and temperature requirements by adhesive manufacturer for at least 48 hours before commencing Work.

3.2 INSTALLATION

- A. Apply adhesive in accordance with the recommendations of the adhesive manufacturer.
- B. Handle and install wall covering in conformance with manufacturer's installation bulletin.
- C. Install wall covering to provide a proper symmetrical pattern in each area, with joints straight and true, and all panel edges concealed with appropriate molding for finished appearance; joints sealed with silicone sealant.

3.3 CLEANING

A. Carefully clean all surfaces after application using recommended methods. Any stains or defects apparent after cleaning will require replacement of material.

END OF SECTION 097212

SECTION 097300 – GRAPHIC WALL COVERINGS

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. Custom graphic polyester fabric wall covering (GRAPH-1 thru GRAPH-4).
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for priming wall surfaces.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
- B. Shop Drawings: Show location and extent of each graphic wall covering type. Indicate pattern placement, veneer matching, seams and termination points.
- C. Samples for Verification: For each type of graphic wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- (914-mm-) long in size.
 - 1. Graphic Wall Covering Sample: From same production run to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
- D. Product Schedule: For graphic wall coverings. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For graphic wall coverings to include in maintenance manuals.
- 1.6 FIELD CONDITIONS
 - A. Environmental Limitations: Do not deliver or install graphic wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is

complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

- B. Lighting: Do not install graphic wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by graphic wall covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Photo Tex Group, Inc.; www.phototexgroup.com.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical graphic wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: 25 or less.

Smoke-Developed Index: 50 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265.

2.3 CUSTOM GRAPHIC WALL COVERING (GRPH-1 TO GRPH-4)

- A. Description:
 - 1. Basis-of-Design Product: PhotoTex polyester fabric of type selected by Architect to meet graphic design intent.
 - 2. Material: Removable, self-adhesive, translucent or opaque polyester fabric as selected by Architect to meet graphic design intent.
 - 3. Thickness with backing: 0.012 inch (0.305 mm).
 - 4. Weight of backers: 2.95 oz. per sq yd. (100 gsm).
 - 5. Weight of the materials is 7.1 oz. per sq. yd. (240 gsm).
 - 6. Total thickness: 0.01 inch (280 mic).
 - 7. Graphic inks: Solvent, eco-solvent, aqueous, UV or latex inks as selected by Architect to meet graphic design intent.
 - 8. Print Side: Inkjet coating with adhesive on back side 0.006 inch (152 mic).
 - 9. Back Side: Paper backer that peels off 0.006 inch (152 mic).

GRAPHIC WALL COVERINGS

BID AND PERMIT SET

- 10. Sizes: Manufacturer's standard sheet or roll sizes to meet graphic design intent.
- B. Provide mildew-resistant products in rolls from same production run and complying with the following:

2.4 ACCESSORIES

- A. Adhesive: Mildew-resistant, non-staining, strippable adhesive, for use with specific graphic wall covering and substrate application indicated and as recommended in writing by graphic wall covering manufacturer.
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and graphic wall covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and graphic wall covering manufacturer.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

BID AND PERMIT SET

3.3 GRAPHIC WALL COVERING INSTALLATION

- A. Comply with graphic wall covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut graphic wall covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install graphic wall covering without lifted or curling edges and without visible shrinkage.
- E. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- G. Fully bond graphic wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by graphic wall covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097300

BID AND PERMIT SET

SECTION 098433 – SOUND ABSORBING WALL UNITS

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 shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
 - 1. Fabric covered fixed sound-absorptive panels, wall mounted (SAW-1 and SAW-2).
 - 2. Tunable acoustical panels (TAP-1 and TAP-2).
 - 3. Acoustic panel, non-covered; installed above wood ceiling and behind Commons wood wall.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
 - 1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products, prepared on Samples of size indicated below:
 - 1. Fabric: Size as required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.

BID AND PERMIT SET

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by sound-absorbing wall units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.
- B. Warranty: Special warranty.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

BID AND PERMIT SET

1.9 **PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

- A. General Requirements for Sound-Absorbing Wall Units: Units shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Sound-Absorbing Wall Unit (SAW-1 and SAW-2): Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following:

- a. Kinetics Noise Control, Inc. (Basis-of-Design); www.kineticsnoise.com.
- b. MBI Products Company, Inc.; www.mbiproducts.com.
- c. Sound Concepts; www.soundconceptscan.com.
- d. Wall Technology, Inc.; an Owens Corning company; www2.owenscorning.com.
- 2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
- 3. Core: Manufacturer's standard 24 pounds per cubic foot density mineral board, perforated for sound absorption.
- 4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
- 5. Edge Profile: Square edges.
- 6. Corner Detail in Elevation: Square with continuous edge profile indicated.
- 7. Facing Material: High-impact panel, shall have 1/8-inch (3-mm) thick high-density fiberglass facing.
- 8. Fabric Facing Color:
 - a. SAW-1: Maharam Tek-Wall 1002, Color 013, Heritage, as indicated on Color and Material Schedule.
 - b. SAW-2: Color selected from manufacturer's standard colors.
- 9. Nominal Overall Panel Thickness:
 - a. SAW-1: 1 inch (25.4 mm).
 - b. SAW-2: 2 inches (50.8 mm).
- 10. Panel Width: As indicated on Drawings; not more than 60 inches (1524 mm).
- 11. Panel Height: As indicated on Drawings; not more than 120 inches (3048 mm).
- 12. Basis-of-Design Product: Hi-Tack Tackable Wall Panels; by Kinetics Noise Control.
- C. Tunable Acoustical Panels (TAP-1 and TAP-2): Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. Basis-of-Design Product: Tunable Acoustical Panels by Wenger Corp.
 - a. Panel Size:
 - 1) TAP-1: 48 by 48 inches (1219 by 1219 mm).
 - 2) TAP-2: 48 by 96 inches (1219 by 2438 mm)
 - b. Fabric Covering: Manufacturer's standard.
 - c. Color: As selected by Architect.

2.2 MATERIALS

- A. General:
 - 1. Minimum Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 15 percent by weight.
 - 2. Regional Materials: Sound-absorbing wall units shall be manufactured within 500 miles of Project site.
- B. Core Materials: Manufacturer's standard.
- C. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations indicated on Drawings.
- D. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
 - 1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
 - 1. Glass-Fiber Board and Mineral-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.
- B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - 1. Square Corners: Tailor corners.
 - 2. Radius and Other Non-square Corners: Attach facing material so there are no seams or gathering of material.
 - 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.

BID AND PERMIT SET

5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align and level fabric pattern and grain among adjacent units.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates. Provide labor, materials, tools and other equipment, services and supervision required to complete exterior painting work as indicated on Finish Schedules, Drawings and Specifications. Utilize exterior paint systems for exterior substrates.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing".
 - 2. Section 052100 "Steel Joist Framing".
 - 3. Section 053100 "Steel Decking".
 - 4. Section 055000 "Metal Fabrications".
 - 5. Section 081113 "Hollow Metal Doors and Frames".
 - 6. Section 087100 "Door Hardware" for preparation prior to finishing of existing doors and frames to remain.
 - 7. Section 096466 "Athletic Flooring" for wood floor transparent finish.
 - 8. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

- A. Gloss Level 1: Matte or Flat Finish: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: Eggshell Finish: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: Satin Finish: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: Semi-Gloss Finish: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: Gloss Finish: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: High Gloss Finish: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C834 Latex Sealing Compounds.

EXTERIOR PAINTING

- 2. ASTM D16 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- 3. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Architectural Painting Specification Manual by the Master Painters Institute (MPI), including Evaluation, Systems, Preparation and Approved Product List (MPI Manual).
- C. Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

1.4 SYSTEM DESCRIPTION

- A. Painting and finishing shall include all coating systems materials, including primers, emulsions (except asphalt based), enamels, stains, sealers and fillers and other applied materials, whether used as prime, intermediate or finish coats.
- B. Materials to Finish:
 - 1. Unless otherwise indicated in documents, all Work receives painting and finishing. Consult Drawings, Schedules, and other Specification Sections for complete requirements. Where materials required to be finished are not indicated in the Finish Schedule or Drawings, refer to the MPI Manual for the appropriate finish; provide premium grade finish.
 - 2. Existing construction receives painting and finishing as indicated. Consult Drawings, Schedules, and other Specification Sections for complete requirements. Where materials required to be finished are not indicated in the Finish Schedule or Drawings, refer to the MPI Manual for the appropriate finish; provide premium grade finish.
- C. Materials Not to Finish:
 - 1. Finished metal surfaces of anodized aluminum, polyvinylidene fluoride (PVDF), stainless steel, chromium plate, copper, bronze and similar finished metals will not require finish painting, except as indicated otherwise.
 - 2. Glass and plastic, except as noted otherwise.
 - 3. Materials having complete factory finish or that require installer finishing, except as indicated otherwise. Shop priming of ferrous metal items and shop-fabricated components is included under various Sections.
 - 4. Walls and ceilings in concealed and generally inaccessible areas, above suspended ceilings, furred areas, pipe spaces, duct shafts, and the like.
 - 5. Acoustical ceiling tile and their suspension systems, unless indicated otherwise.
 - 6. Concrete floors, except as indicated to be painted.
 - 7. CMU walls, except as indicated on Drawings to be painted.
 - 8. Moving parts of operating units, moving parts of mechanical and electrical units, linkages, sensing devices, motor and fan shafts, and the like.
 - 9. Code-required labels such as Underwriter's Laboratories, Factory Mutual, and Warnock-Hershey or any equipment identification, performance rating, name or nomenclature plates, and the like.

BID AND PERMIT SET

1.5 ACTION SUBMITTALS

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

1.6 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: 5 percent, but not less than 1 gal. of each material and color applied.

1.7 QUALITY ASSURANCE

- A. Quality Standard:
 - 1. Work of this Section shall conform to not less than the minimum standards for material and Work including inspection and warranty requirements set forth in the MPI Manual.
 - 2. Work of this Section shall be of the grade and finish system in Accordance with the MPI as indicated in Painting and Finishing Schedule in Part 3 of this Section.
- B. Qualifications:
 - 1. Product Manufacturers: As listed in PART 2 of this Section. No substitutions.
- C. Regulatory Requirements:
 - 1. Comply with applicable federal, state, and local requirements and publications pertaining to environmental protection and the protection of the health and safety of workers, visitors to the site, and persons occupying the Project Site.
 - 2. Where conflict among requirements or with this specification exists, the most stringent shall govern.

BID AND PERMIT SET

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 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. Perform no exterior painting work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided. Where required, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
- C. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3° C) above the dew point; or to damp or wet surfaces.
- D. Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
 - a. 15 percent for wood.
 - b. 12 percent for plaster and gypsum board.
- E. Conduct all moisture tests using a properly calibrated electronic Moisture Meter.

1.10 SPECIAL PROJECT WARRANTY

A. Warranty: Furnish a two (2)-year Maintenance Bond. The Maintenance Bond shall warrant that all painting work has been performed in accordance with accepted industry quality standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Sherwin Williams Company (Basis of Design).
- B. The following manufacturers will be considered for substitution subject to compliance with procedures specified in Section 012500 Product Requirements, and the properties specified for each product in the PART 3 EXTERIOR PAINTING SCHEDULE.
 - 1. Benjamin Moore.
 - 2. PPG.

2.2 PAINT, GENERAL

- A. Materials:
 - 1. All materials used on this job (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) shall be from a single source manufacturer for each system used.
 - 2. Other materials such as linseed oil, shellac, thinners, solvents, etc., shall be the highest quality product, compatible with paint materials being used as required.
 - 3. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

2.3 EQUIPMENT

- A. Painting and Decorating Equipment: To best trade standards for type of product and application.
- B. Spray Painting Equipment: Of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.4 MIXING AND TINTING

- A. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- B. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- D. If required, thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

2.5 FINISH AND COLORS

A. Refer to Color and Material Schedule and Drawings for identification and location of colors.

2.6 GLOSS AND SHEEN RATINGS:

A. As indicated in Part 3 of these Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Portland Cement Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations 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.
- 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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

BID AND PERMIT SET

- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 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.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 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 undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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.
- E. Exterior Mechanical and Electrical Equipment:
 - 1. General: Exterior painting and finishing of mechanical and electrical items includes all exposed items whether factory-finished or not.
 - 2. Additional painting and finishing of mechanical and electrical items is indicated in Divisions 23 and 26.

BID AND PERMIT SET

3.4 FIELD QUALITY CONTROL

- A. Tolerances: Final application shall match color and texture of approved samples and shall be smooth, uniform in appearance, color, texture, sheen, and shall be free of runs, sags, holidays, lap marks, air bubbles, pin holes, and other detrimental effects in accordance with requirements of the MPI and this Specification.
- B. Inspection and Testing:
 - 1. Provide and pay for inspection and testing of the Work of this Section in accordance with the warranty provisions of the MPI.
 - 2. Inspection Agency's Duties:
 - a. Provide qualified personnel at Project Site. Cooperate with Architect and Contractor in performance of services.
 - b. Perform required inspection, sampling, and testing of Products and applications and ascertain compliance with requirements of MPI.
 - c. After each inspection and test, submit 1 copy of written report within 5 calendar days to Architect and Contractor. Include in each report the Project title, date of report, date and time of inspection, weather conditions during visit, name of inspector, identification of Product and substrate, location in Project, type of inspection or test, results of tests, and whether results indicate conformity with Contract Documents.
 - d. Promptly notify Architect and Contractor in writing of observed irregularities or non-conformity of workmanship or Projects. When requested by Architect, provide interpretation of test results, evaluation of analysis of cause (in event of test failure), and recommendations for remedial action.
 - 3. Inspection Agency's Limitations:
 - a. Inspection Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Inspection Agency many not approve or accept any portion of the Work for Owner or Architect.
 - c. Inspection Agency may not assume duties of Contractor or Applicator.
 - d. Inspection Agency has no authority to stop the Work.
 - 4. Applicator's Duties:
 - a. Pay inspection fees associated with inspection and warranty requirements set forth in MPI.
 - b. Notify inspection agency not less than 10 full working days prior to beginning Work of this Section.
 - c. Notify inspection agency not less than 2 full working days prior to expected time for operations requiring inspection or testing services.
 - d. Allow full access to the Work. Cooperate with inspection and testing personnel in performance of their duties of inspecting and testing of Work.
 - e. Provide incidental labor and facilities to provide access to Work to be inspected or tested. Repair destructive testing sites.
 - f. Correct deficiencies noted by Inspection Agency.

3.5 CLEANING AND PROTECTION

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

- A. Structural Steel and Metal Fabrications (including steel doors and frames).
 - 1. Two Coats (over alkyd primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W Kem Kromik Universal Metal Primer.
 - b. Finish: S-W Pro Industrial Direct-to-Metal Acrylic, Semi-Gloss.
- B. Galvanized-Metal Substrates: (including metal deck and hollow metal frames).
 - 1. Surface Preparation: Clean with water-based cleaner, degreaser.
 - 2. Two Coats (over acrylic primer).
 - 3. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W Pro Industrial Pro-Cry Universal Acrylic Primer.
 - b. Finish: S-W Pro Industrial Direct-to-Metal Acrylic, Semi-Gloss.
- C. Aluminum:
 - 1. Two Coats (over wash primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W DTM Wash Primer.
 - b. Finish: S-W Pro Industrial, Direct-to-Metal Acrylic, Semi-Gloss.
- D. Dressed Lumber: to be Painted (including fascia boards, wood doors, frames and window trim)
 - 1. Two, 100 percent Acrylic Coats (over alkyd primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W Exterior Oil-Based Wood Primer.
 - b. Finish: S-W Solo 100 percent Acrylic Interior/Exterior, Semi-Gloss.

BID AND PERMIT SET

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates. All labor, materials, tools and other equipment, services and supervision required to complete all interior painting and decorating work as indicated on Finish Schedules and to the full extent of the Drawings and Specifications. Interior paint systems will be utilized for interior substrates.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for preparation prior to finishing of existing doors and frames to remain.
 - 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 3. Color and Material Schedule on drawings for paint colors (PT-1 thru PT-6).

1.2 DEFINITIONS

- A. Gloss Level 1: Matte or Flat Finish: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: Eggshell Finish: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: Satin Finish: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: Semi-Gloss Finish: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: Gloss Finish: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: High Gloss Finish: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C834 Latex Sealing Compounds.
 - 2. ASTM D16 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 3. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-base Materials.
- B. Architectural Painting Specification Manual by the Master Painters Institute (MPI), including Evaluation, Systems, Preparation and Approved Product List (MPI Manual).
- C. Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

1.4 SYSTEM DESCRIPTION

- A. Painting and finishing shall include all coating systems materials, including primers, emulsions (except asphalt based), enamels, stains, sealers and fillers and other applied materials, whether used as prime, intermediate or finish coats.
 - 1. Materials to Paint:
 - a. Unless otherwise indicated in documents, Work receives painting and finishing. Consult Drawings, Schedules, and other specification Sections for complete requirements. Where materials required to be finished are not indicated in the Finish Schedule or Drawings, refer to the MPI Manual for the appropriate finish; provide premium grade finish.
 - b. Paint all exposed structure, fire protection piping, ductwork, exposed conduits at open to structure ceilings.
 - c. At "cloud ceilings", paint exposed structure and other mechanical and electrical items to minimum 5 feet beyond (behind) edge of suspended cloud ceiling.
 - 2. Materials Not to Paint:
 - a. Finished metal surfaces of anodized aluminum, polyvinylidene fluoride (PVDF), stainless steel, chromium plate, copper, bronze, and similar finished metals will not require finish painting, except as indicated otherwise.
 - b. Glass and plastic, except as noted otherwise.
 - c. Materials having complete factory finish or that require installer finishing, except as indicated otherwise. Shop priming of ferrous metal items and shop-fabricated components is included under various Sections.
 - d. Walls and ceilings in concealed and generally inaccessible areas, above suspended ceilings, furred areas, pipe spaces, duct shafts, and the like.
 - e. Acoustical ceiling tile and their suspension systems, unless indicated otherwise.
 - f. Concrete floors, except as indicated to be painted.
 - g. CMU except where indicated to be painted.
 - h. Moving parts of operating units, moving parts of mechanical and electrical units, linkages, sensing devices, motor and fan shafts, and the like.
 - i. Code-required labels such as Underwriter's Laboratories, Factory Mutual, and Warnock-Hershey or any equipment identification, performance rating, name or nomenclature plates, and the like.

1.5 ACTION SUBMITTALS

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

BID AND PERMIT SET

- B. Samples for Verification: For each type of paint system and in 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.
- C. 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.

1.6 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: 5 percent, but not less than 1 gal. of each material and color applied.

1.7 QUALITY ASSURANCE

- A. Quality Standard:
 - 1. Work of this Section shall conform to not less than the minimum standards for material and Work including inspection and warranty requirements set forth in the MPI Manual.
 - 2. Work of this Section shall be of the grade and finish system in accordance with the MPI as indicated in Painting and Finishing Schedule in Part 3 of this Section.
- B. Qualifications:
 - 1. Product Manufacturers: As listed in MPI and Color and Material Schedule in Drawings. No substitutions.
 - 2. Applicator: Company specializing in and regularly engaged in performing Work of this Section with not less than three (3) years experience. Maintain regular work force of qualified journey-level personnel, trained, skilled, and experienced in performing required Work and constant competent supervision. Apprentices may be employed working under qualified journeymen's directions in accordance with trade regulations.
- C. Regulatory Requirements:
 - 1. Comply with applicable federal, state, and local requirements and publications pertaining to environmental protection and the protection of the health and safety of workers, visitors to the site, and persons occupying the Project Site.
 - 2. Where conflict among requirements or with this specification exists, the most stringent shall govern.

BID AND PERMIT SET

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 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. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during and after paint application. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- C. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- D. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- E. Perform no painting or decorating work unless a minimum lighting level of 323 Lux (30-foot candles) is provided on surfaces to be painted or decorated.
- F. Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
 - 1. 15 percent for wood.
 - 2. 12 percent for plaster and gypsum board.
- G. Conduct moisture tests using a properly calibrated electronic moisture meter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. As listed in the Interior Painting Schedule.
 - 1. Benjamin Moore (Basis-of-Design colors).
 - 2. Miller Paint.
 - 3. Rodda Paint Company.
 - 4. Sherwin Williams (Basis-of-Design products).

BID AND PERMIT SET

- B. The following manufacturers will be considered for substitution subject to compliance with procedures specified in Section 012500 "Substitution Procedures," and the properties specified for each product in the PART 3 Interior Painting Schedule.
 - 1. PPG.

2.2 PAINT, GENERAL

- A. Materials:
 - 1. Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project. All such material shall be from a single source manufacturer for each system used.
 - 2. Other materials such as linseed oil, shellac, thinners, solvents, etc shall be the highest quality product of an MPI listed manufacturer and shall be compatible with paint materials being used as required.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.

2.3 EQUIPMENT

- A. Painting and Decorating Equipment: To best trade standards for type of product and application.
- B. Spray Painting Equipment: Of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.4 MIXING AND TINTING

A. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

BID AND PERMIT SET

- B. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- D. If required, thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

2.5 FINISH AND COLORS

- A. Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements.
- B. Refer to Color and Material Schedule and Drawings for identification and location of colors, PT-1 though PT-6.
- C. Except as noted herein or indicated in the Color and Material Schedule, interior walls and ceiling surfaces shall be painted in accordance with the following criteria over appropriate prime / sealer coat:
 - 1. All areas (except as noted): washable latex with GL3 (eggshell) finish.
 - 2. Laundry facilities / rooms, public wash / shower / bathrooms: washable latex with G5 (semi-gloss) finish.
 - 3. Public change / wash / shower rooms with institutional facility bathing and shower rooms: G5 (semi-gloss) finish for wet surfaces.
 - 4. Public and institutional facility "clean" or "sanitary" areas such as food preparation and laboratory areas: G5 (semi-gloss) finish for dry surfaces.
- D. Access doors, prime coated butts, and other prime coated hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces (i.e. same color, texture and sheen), unless otherwise noted or where pre-finished.
- E. Plywood service panels (e.g. electrical, telephone, and cable vision panels) including edges shall be back-primed and painted to match painted wall mounted on.
- F. The inside of light valances shall be painted gloss white.
- G. The inside of all duct work behind louvers, grills and diffusers for a minimum of 18" (460 mm) or beyond sight-line, whichever is greater, shall be painted using flat black (non-reflecting) paint.

2.6 GLOSS AND SHEEN RATINGS

A. As indicated in Part 3 of these Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Portland Cement Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations 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. Carefully clean and replace all such items upon completion of painting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes).
 - 2. 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. Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage with drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

BID AND PERMIT SET

- E. Substrate defects shall be made good and sanded by others ready for painting particularly after the first coat of paint. Start of finish painting of defective surfaces (e.g. gypsum board) shall indicate acceptance of substrate and any costs of making good defects shall be borne by the painter including re-painting of entire defective surface (no touch-up painting).
- F. 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.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.
 - 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.

3.4 FIELD QUALITY CONTROL

A. Tolerances: Final application shall match color and texture of approved samples and shall be smooth, uniform in appearance, color, texture, sheen, and shall be free of runs, sags, holidays, lap marks, air bubbles, pin holes, and other detrimental effects in accordance with requirements of the MPI and this Specification.

- B. Inspection and Testing:
 - 1. Provide and pay for inspection and testing of the Work of this Section in accordance with the warranty provisions of the MPI.
 - 2. Inspection Agency's Duties:
 - a. Provide qualified personnel at Project Site. Cooperate with Architect and Contractor in performance of services.
 - b. Perform required inspection, sampling, and testing of Products and applications and ascertain compliance with requirements of MPI.
 - c. After each inspection and test, submit 1 copy of written report within 5 calendar days to Architect and Contractor. Include in each report the Project title, date of report, date and time of inspection, weather conditions during visit, name of inspector, identification of Product and substrate, location in Project, type of inspection or test, results of tests, and whether results indicate conformity with Contract Documents.
 - d. Promptly notify Architect and Contractor in writing of observed irregularities or non-conformity of workmanship of Projects. When requested by Architect, provide interpretation of test results, evaluation of analysis of cause (in event of test failure), and recommendations for remedial action.
 - 3. Inspection Agency's Limitations:
 - a. Inspection Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Inspection Agency many not approve or accept any portion of the Work for Owner or Architect.
 - c. Inspection Agency may not assume duties of Contractor or Applicator.
 - d. Inspection Agency has no authority to stop the Work.
 - 4. Applicator's Duties:
 - a. Pay inspection fees associated with inspection and warranty requirements set forth in MPI.
 - b. Notify inspection agency not less than 10 full working days prior to beginning Work of this Section.
 - c. Notify inspection agency not less than 2 full working days prior to expected time for operations requiring inspection or testing services.
 - d. Allow full access to the Work. Cooperate with inspection and testing personnel in performance of their duties of inspecting and testing of Work.
 - e. Provide incidental labor and facilities to provide access to Work to be inspected or tested. Repair destructive testing sites.
 - f. Correct deficiencies noted by Inspection Agency.

3.5 CLEANING AND PROTECTION

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

BID AND PERMIT SET

- 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, 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. Concrete Horizontal Surfaces: (floors and stairs)
 - 1. Two water-based urethane/epoxy coats (over TBD primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: Same as Finish
 - b. Finish: S-W ArmorSeal 8100, Water Based Epoxy Floor Coating, B70-8100 Series (less than 50 g/L VOC)
- B. Structural Steel and Metal Fabrications: (columns, beams, joists, interior guard rails and stair railings, etc.)
 - 1. Two water-based light industrial Coats (over alkyd shop primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W Kem Kromik Universal Metal Primer.
 - b. Finish: S-W Pro Industrial Acrylic Semi-Gloss, B66 Series, (less than 50 g/L VOC).
- C. Galvanized Metal: (doors, frames, misc. steel, pipes, overhead decking, ducts, etc.)
 - 1. Two water-based light industrial Coats (over alkyd primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W Pro Industrial Pro-Cryl Universal Acrylic Primer.
 - b. Finish: S-W Pro Industrial Acrylic Semi-Gloss, B66 Series, (less than 50 g/L VOC).
- D. Finish Carpentry, Transparent Finish: (including wood doors, wood window frames, casings, molding, wood paneling, etc.)
 - 1. Three coats, water-based urethane varnish. (Film-building System)
 - 2. Lightly sand between coats.
 - 3. Finish Sheen: Gloss Level 2.
 - a. Prime Coat: Same as Finish Coat.
 - b. Finish: S-W Minwax Polycrylic Protective Finish 3333 (less than 275 g/L VOC).
- E. Finish Carpentry, Opaque Finish: (wood trim, MDF panels and trim, etc.)

BID AND PERMIT SET

- 1. Latex wood primer.
- 2. Two acrylic finish coats.
- 3. Finish Sheen: Gloss Level 5.
 - a. Prime Coat: Latex wood primer.
 - b. Finish: Water-based alkyd, two coats, Gloss Level 5.
- F. Wood Handrails: (including hardwood flooring, etc.)
 - 1. Three water-based coats water-based urethane varnish. (Film-building System)
 - 2. Lightly sand between coats.
 - 3. Finish Sheen: Gloss Level 2.
 - a. Prime Coat: S-W Minwax Water Based Polyurethane for Floors (less than 250 g/L VOC) thinned 10 percent.
 - b. Finish: S-W Minwax Water Based Polyurethane for Floors (less than 250 g/L VOC).
- G. Gypsum Board: (Class Rooms, Offices, Hallways, etc.)
 - 1. Two acrylic coats (over vinyl acrylic primer).
 - 2. Finish Sheen: Gloss Level 3 or 4.
 - a. Primer: S-W ProMar 200 Zero VOC Interior Latex Primer B28W02600 (Volume Solids: 26 percent plus or minus 2 percent)
 - b. Finish: S-W ProMar 200 Zero VOC Int Latex Egg Shell, B20-2600 Series (Volume Solids: 42 percent plus or minus 2 percent)
- H. Gypsum Board: (Damp areas with higher maintenance requirements including Kitchens, Toilets, and Maintenance Spaces)
 - 1. Two water-based high-performance acrylic coats (over vinyl acrylic primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W ProMar 200 Zero VOC Interior Latex Primer B28W02600 (Volume Solids: 26 percent plus or minus 2 percent).
 - b. Finish: S-W Pro Industrial Acrylic Semi-Gloss, B66 Series, (less than 50 g/L VOC), (Volume Solids: 35 percent plus or minus 2 percent.
- I. Gypsum Board: (Wet areas such as Shower Rooms)
 - 1. Two solvent-based epoxy coats (over appropriate primer).
 - 2. Finish Sheen: Gloss Level 5.
 - a. Primer: S-W ProMar 200 Zero VOC Interior Latex Primer B28W02600 (Volume Solids: 26 percent plus or minus 2 percent)
 - b. Finish: S-W Macropoxy 646-100 Fast Cure Epoxy B58-620 (less than 100 g/L VOC)

BID AND PERMIT SET

- J. Exposed Structural Framing and Metal Deck Ceilings:
 - 1. S-W Pro Industrial Waterborne Acrylic Dryfall Eggshell B42W00082 (less than 50 g/L VOC)

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

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. Visual display board assemblies.
 - 2. Magnetic marker-board panels (MBD-#).
 - 3. Tack board/ strip (TBD-#).
 - 4. Tackboard for cabinet facing.
 - 5. Display strip (DS) and picture rail (PR).
- B. Related Requirements:
 - 1. Color and Material Schedule on drawings for visual display unit sizes and colors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
 - 2. Include electrical characteristics for motorized units.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Include sections of typical trim members.
- C. Samples for Verification: For each type of visual display unit indicated.
 - 1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch- (150-mm-) long sections of each trim profile.
 - 3. Display Rail: 6-inch- (150-mm-) long section of each type.
 - 4. Accessories: Full-size Sample of each type of accessory.
- D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weather-tight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: 50 years
 - 3. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 VISUAL DISPLAY MARKERBOARD ASSEMBLY (MBD)

- 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. Claridge Products and Equipment, Inc.
 - 2. ADP Lemco, Inc.
- B. Visual Display Board Assembly Factory fabricated.
 - 1. Basis-of-Design Product: LCS Magnetic Marker-Boards by Claridge.
 - 2. Assembly: Marker-Board.
 - 3. Corners: Square.
 - 4. Width: As indicated on Drawings.
 - 5. Height: As indicated on Drawings.
 - 6. Mounting Method: Direct to wall.
 - 7. Frame: Aluminum angle trim, white color.
 - 8. Frame depth: To match depth of marker-board.
- C. Marker-Board Panel: Porcelain-enamel-faced markerboard panel on core indicated.
 - 1. Color: Claridge No. 100, "White".
 - 2. Provide music lines on boards in Music Rooms.
- D. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

- E. Chalk Tray: Manufacturer's standard; continuous.
 - 1. Extruded aluminum, 3-1/4 inches wide with radius front edge, grooved tray, and castaluminum end closures; powder coat white finish.
- F. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnatedcork insert, end stops, and continuous paper holder, designed to hold accessories.
 - 1. Size: 1-inch by length of markerboard.
 - 2. Map Hooks: Two map hooks for every 48 inches (1200 mm) of display rail or fraction thereof.
 - 3. Flag Holder: One for each room.
- G. Paper Holder Display Rail: Extruded aluminum; designed to hold paper by clamping action.

2.4 VISUAL DISPLAY TACKBOARD ASSEMBLY (TBD)

- 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. Claridge Products and Equipment, Inc.
 - 2. ADP Lemco, Inc.
- B. Visual Display Board Assembly Factory fabricated.
 - 1. Basis-of-Design Product: 800 Series Tackboard by Claridge.
 - 2. Assembly: tack-board with aluminum trim
 - 3. Corners: Square.
 - 4. Width: As indicated on Drawings.
 - 5. Height: As indicated on Drawings.
 - 6. Mounting Method: Direct to wall.
 - 7. Frame: Aluminum angle trim; color, white.
 - 8. Frame depth: To match depth of tack-board.
- C. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
- D. Chalk Tray: Manufacturer's standard; continuous.
 - 1. Extruded aluminum, 3-1/4 inches wide, with radiused front edge, grooved tray, and castaluminum end closures; powder coat, white finish.

2.5 TACKBOARD FOR CABINET FACING

- A. Basis-of-Design Product: Series 3300 fabric-wrapped tackboard by Claridge.
- B. Materials: 1/4-inch (6-mm) thick cork surface laminated to 1/4-inch (6-mm) hard board backing. Fabric-covered with fabric-wrapped edges.

BID AND PERMIT SET

- C. Fabric Covering Basis-of-Design Product: Pattern, Flip: Orbit; color, 5F91 "Blizzard," by Steelcase Surfaces.
 - 1. Content: 42 percent post-consumer recycled polyester and 58 percent pre-consumer recycled polyester.
- D. Application: Cover front of cabinet doors as indicated on drawings.

2.6 DISPLAY STRIP ASSEMBLY

- 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. AS Hanging Display Systems: www.ashanging.com.
- B. Picture Rail (PR):
 - 1. Basis-of-Design Product: Classic Wall Track by AS Hanging Display Systems.
 - 2. Track: 1.17 inches (29.7 mm) high by 0.39 inch (9.9 mm) deep extruded aluminum track; 72 inches (10 cm) long.
 - 3. Weight Capacity: 300 pounds (135 kg) per track length.
 - 4. Finish: Painted warm white.
 - 5. Mounting Method: Color matching screws and wall anchors; direct to wall.
- C. Display Strip (DS):
 - 1. Basis-of-Design Product: Casso Display Rail II by AS Hanging Display Systems.
 - 2. Track: 2.0 inches (50.0 mm) high by 0.4 inch (10.8 mm) deep extruded aluminum track; 72 inches (10 cm) long, with extruded co-polymer gripper insert and end caps.
 - 3. Finish: Painted cool white.
 - 4. Mounting Method: Color matching screws and wall anchors; direct to wall.
- D. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

2.7 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
- C. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- D. Adhesives for Field Application: Mildew-resistant, non-staining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

BID AND PERMIT SET

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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.

2.9 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 and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

BID AND PERMIT SET

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations indicated on Drawings; mounting heights are to be coordinated with the Owner. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) on center. Secure tops and bottoms of boards to walls.

3.4 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101200 - DISPLAY CASES

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. Display cases.

1.3 DEFINITIONS

- A. Display Case: Glazed cabinet with tackboard panel back surface and adjustable shelves.
- B. Tackboard Panel: A material for holding push-pins or tacks typically consisting of a facing; such as fabric, vinyl, or cork; adhered to a substrate; such as fiberboard, hardboard, particleboard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases. Include furnished specialties and accessories.
- B. Shop Drawings: For display cases.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include sections of typical trim members.
- C. Samples for Verification: For each type of exposed finish for the following.
 - 1. Tackboard Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing and substrate indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch- (150-mm-) long sections of each trim profile including corner section.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For tackboard panels, for tests performed by a qualified testing agency.

DISPLAY CASES

BID AND PERMIT SET

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For display cases to include in maintenance manuals.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install display cases for indoor installations until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of openings for display cases by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain display cases from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.3 DISPLAY CASE

- A. Manufacturers: Subject to compliance with requirements provide products by, but not limited to, the following:
 - 1. The Tablet & Ticket Co.
 - 2. Claridge.
 - 3. Poblocki & Sons.
- B. Recessed Display Case: Factory-fabricated display case; with finished interior, operable glazed doors at front, and trim on face to cover edge of recessed opening.
 - 1. Basis-of-Design Product: 370 Series, Recessed Aluminum Display Case, by Claridge Products, Inc.
 - 2. Display Case Cabinet: Extruded aluminum.
 - 3. Face Frame: Aluminum.

BID AND PERMIT SET

- 4. Aluminum Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range.
- C. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.
 - 1. Thickness: Not less than 1/4-inch (6 mm) thick.
 - 2. Number of Doors: As indicated on Drawings.
- D. Shelves: 1/4-inch- (6-mm-) thick tempered glass; supported on adjustable shelf standards and supports.
 - 1. Shelf Depth: As indicated on drawings.
 - 2. Number of Shelves: As indicated on Drawings.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface. Provide standards extending full height of display case.
- F. Back Panel: Tackboard panel TBD-1. Side Panels: White melamine finish.
- G. Size: As indicated on Drawings.

2.4 MATERIALS

- A. Particleboard: ANSI A208.1, Grade M-1.
- B. Extruded-Aluminum Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063.
- C. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
- D. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 1. Color: White.
- E. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless-steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

BID AND PERMIT SET

- B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.
- C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.
- D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of illuminated units.
- C. Examine walls and partitions for proper backing for display cases.
- D. Examine walls and partitions for suitable framing depth if recessed units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

BID AND PERMIT SET

3.3 INSTALLATION

- A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches (400 mm) o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches (600 mm) o.c.
- C. Install display case shelving level and straight.

3.4 ADJUSTING AND CLEANING

- A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.
- B. Touch up factory-applied finishes to restore damaged areas.

END OF SECTION 101200

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

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. Cutout dimensional characters.

1.3 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: Half-size Sample of dimensional character.
 - 2. Exposed Accessories: Full-size Sample of each accessory type.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

DIMENSIONAL LETTER SIGNAGE

BID AND PERMIT SET

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
 - A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cutout Characters: Characters with uniform faces, square cut, sharp corners, and precisely formed lines and profiles, and as follows:
 - 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. A.R.K. Ramos.
 - b. ACE Sign Systems, Inc.
 - c. APCO Graphics, Inc.
 - d. Diskey Architectural Signage Inc.
 - e. Gemini Incorporated.
 - f. Matthews International Corporation; Bronze Division.
 - g. Metal Arts.
 - h. Metallic Arts.

BID AND PERMIT SET

- i. Southwell Company (The).
- 2. Character Material: Cast aluminum.
- 3. Character Height: As indicated.
- 4. Thickness: Manufacturer's standard for size of character.
- 5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
- 6. Mounting: Projecting studs.
- 7. Typeface: As selected by architect.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - 4. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

BID AND PERMIT SET

- 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
- 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
- 5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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.
- C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423 - SIGNAGE

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. Room-identification signs.
 - 2. Plaques.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 - 4. Show sign locations on floor plan.

BID AND PERMIT SET

- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide signage design in accordance with Beaverton School District Technical District Standards.

BID AND PERMIT SET

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

- 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. Graffix.
 - 2. ASI.
 - 3. InPro Corporation (IPC).
 - 4. 290 Sign Systems.
- B. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated-Sheet Sign: face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: 0.125 inch (3.18 mm).
 - b. For Interchangeable Signs: Provide clear acrylic cover sheet over back-sheet with signage printed on vinyl slip-in inserts.
 - c. Color(s): As selected by Architect from manufacturer's full range.
 - 2. Solid Acrylic Sign:
 - a. Sheet Thickness: 3/8 inch.
 - b. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Beveled.
 - b. Corner Condition in Elevation: Rounded to radius indicated.
 - 4. Mounting: Surface mounted to wall or glass with adhesive.
 - 5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Matte Clear Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

BID AND PERMIT SET

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

2.6 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.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.
- C. Mounting Methods:
 - 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.
- D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SCHEDULE

A. Reference Signage Schedule in drawings for sign types and signage messages.

END OF SECTION 101423

BID AND PERMIT SET

SECTION 101960 - CUBICLE CURTAIN AND TRACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes curtains and support system.
- B. Related Requirements:
 - 1. Section 092900 "Gypsum Board".
 - 2. Section 095113 "Acoustical Panel Ceilings".

1.2 REFERENCES

A. Underwriters Laboratories, Inc. - Flammability Test 214.

1.3 PERFORMANCE REQUIREMENTS

- A. Track: To support vertical test load of 50 lbs without visible deflection of track or damage to supports.
- B. Size track to support moving loads, sufficiently rigid to resist visible deflection.

1.4 SUBMITTALS

- A. Shop Drawings indicating:
 - 1. Reflected ceiling plan view of curtain track, hangers and suspension points.
 - 2. Attachment details.
- B. Product Data includes curtain fabric characteristics.
- C. Maintenance data.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Track: Extruded aluminum sections, one piece per cubicle track run.
 - 1. Color: White

BID AND PERMIT SET

- B. Track Ends: Positive stop to fit track extrusion.
- C. Carriers:
 - 1. Two-wheel nylon roller (with PVC drop with hook assembly) to accurately fit track.
 - 2. Designed to eliminate bind when curtain is pulled.
 - 3. Fitted to curtain to prevent accidental curtain removal.
 - 4. Provide at maximum 6-inch centers along curtain length (which is 10 percent longer than track.
 - 5. Manufacturer: Graber or approved equal.
- D. Cubicle Curtain:
 - 1. Shall be flame resistant with 20-inch wide mesh top, 100 percent polyester. Curtain shall be 10 percent longer than length of track.
 - 2. Basis-of-Design Manufacturer: Maharam® or, subject to compliance with requirements, comparable products by one of the following:
 - a. Designtex.
 - b. Momentum Textiles.
 - 3. Basis-of-Design Product: Skit 511470-002, "Metropolis"; by Maharam.

2.2 FINISHING

A. Exposed Aluminum Surfaces: Clear anodized finish.

2.3 FABRICATION

A. Track: Fabricate track bend with minimum 12-inch radius, without deforming track section, or impeding movement of carriers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and above ceiling supports are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Beginning of installation means installer accepts existing surfaces and conditions.

3.2 INSTALLATION

A. Install curtain track secure and rigid, true to ceiling line.

CUBICLE CURTAINS AND TRACKS

BID AND PERMIT SET

- B. Install end cap, stop device, splices and curved track sections.
- C. Secure track to suspended ceiling system.
- D. Protect units so they will be operable and undamaged at completion of project.
- E. Repair or replace damaged or defective units.

END OF SECTION 101960
BID AND PERMIT SET

SECTION 102113 - PHENOLIC-CORE TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
 - 2. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
 - 3. Section 102800 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6inch- (152-mm-) square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

BID AND PERMIT SET

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: One hinge(s) with associated fasteners.
 - 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: One door bumper(s) with associated fasteners.
 - 4. Door Pull: One door pull(s) with associated fasteners.
 - 5. Fasteners: Ten fasteners of each size and type.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by the following:
 - 1. CL (Compact Laminate) Phenolic, Floor to Ceiling Toilet Partitions; Bobrick Washroom Equipment, Inc.

BID AND PERMIT SET

- B. Or comparable products by one of the following:
 - 1. Accurate Partitions Corporation.
 - 2. Ampco.
 - 3. Bradley Corporation; Mills Partitions.
 - 4. Columbia.
 - 5. Scranton Products.
- C. Toilet-Enclosure Style: Floor and ceiling anchored.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with decorative high-pressure resin impregnated paper surface on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch-(13-mm-) thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; aluminum.
- G. Phenolic-Panel Finish:
 - 1. Color and Pattern: Bobrick Color No. 5882-58, "Citadel Warp."
 - 2. Edges: Black, polished and free of sharp edges.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch- (1.59-mm-) thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
 - 3. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at outswinging doors. Mount with through-bolts.
 - 4. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for

BID AND PERMIT SET

through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 32-inch- (914-mm-) wide in-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards (CG-1 and CG-2).
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guards: Full-size corner guards of maximum length equal to 2 percent of each type, installed, but no fewer than four (4) of each unit length.

BID AND PERMIT SET

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside wellventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 CORNER GUARDS (CG-1)

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed metal with formed edges; with 90-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
 - a. American Floor Products, Inc.
 - b. Babcock-Davis
 - c. Balco, Inc.
 - d. Construction Specialties, Inc.
 - e. InPro Corp. (IPC).
 - f. Nystrom.
 - 2. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 0.0625 inch (1.6 mm).
 - b. Finish: Directional satin, No. 4.
 - 3. Wing Size and Length:
 - a. CG-1: 1-1/2 by 1-1/2 inches (38 by 38 mm) by 4 feet long; 6 feet at Kitchen.
 - b. CG-2: 3-1/2 by 3-1/2 inches (89 by 89 mm) by 8 feet long.
 - 4. Corner Radius: 1/8 inch (3 mm).
 - 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes. Locate holes 1 inch from corner (not centered on wing), to coordinate with MDF and gypsum board seams.

BID AND PERMIT SET

2.4 MATERIALS

A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

BID AND PERMIT SET

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

BID AND PERMIT SET

SECTION 102800 - TOILET AND CUSTODIAL ACCESSORIES

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. Public-use washroom accessories.
 - 2. Childcare accessories.
 - 3. Under lavatory guards.
 - 4. Custodial accessories.
 - 5. Warm-air dryers.

B. Related Requirements:

- 1. Section 088000 "Glazing" for MR-4 and MR-5, large format mirrors.
- 2. Section 093000 "Ceramic Tiling" for ceramic toilet and bath accessories.
- 3. Section 061053 "Miscellaneous Rough Carpentry" for backing required for all wall mounted accessories listed in this Section.
- 4. ACMA Owner Furnished Material & Equipment Schedule on the Drawings.
- 5. Accessories Schedule on the Drawings.

1.3 DEFINITIONS

- A. OFCI: Owner Furnished, Contractor Installed.
- B. CFCI: Contractor Furnished, Contractor Installed.

1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

BID AND PERMIT SET

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: See ACMA Owner Furnished Material & Equipment Schedule.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer. Refer to Accessories Schedule on drawings for products.
- B. Toilet Tissue (Roll) Dispenser (TTD): OFCI.
- C. Paper Towel Dispenser (PTD): OFCI.

TOILET AND CUSTODIAL ACCESSORIES

BID AND PERMIT SET

- D. Waste Receptacle (WR-1 and WR-2): OFCI.
- E. Liquid-Soap Dispenser (SD): OFCI.
- F. Grab Bars (GB): CFCI.
 - 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. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 4. Outside Diameter: 1-1/4 inches (32 mm).
 - 5. Configuration and Length: As indicated on Drawings.
- G. Sanitary Napkin Vendor (SNV): CFCI, see Schedule on drawings.
- H. Sanitary Napkin Disposal (Surface Mounted) (SND): CFCI, see Schedule on drawings.
- I. Sanitary Napkin Disposal (Partition Mounted) (SND1): CFCI, see Schedule on drawings.
- J. Seat-Cover Dispenser (SCD): OFCI.
- K. Robe Hook (RH): Model B-233, CFCI.
- L. Mirror Units (MR), CFCI:
 - 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. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - 2. Frame: Stainless-steel channel.
 - a. Corners: Mitered and mechanically interlocked.
 - 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

BID AND PERMIT SET

- 4. Sizes:
 - a. MR-1: 24 inches by 36 inches (610 mm by 914 mm).
 - b. MR-2: 24 inches by 60 inches (610 mm by 1524 mm); vertical install.
 - c. MR-3: 60 inches by 24 inches (1524 mm by 610 mm); horizontal install.

2.3 CHILDCARE ACCESSORIES (CFCI)

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.
- B. Diaper-Changing Station (DCS):
 - 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. American Specialties, Inc.
 - b. Diaper Deck & Company, Inc.
 - c. Koala Kare Products.
 - 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250-lb (113-kg) static load when opened.
 - 3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: HDPE in manufacturer's standard color.
 - 6. Liner Dispenser: Built in.

2.4 UNDERLAVATORY GUARDS (CFCI)

- A. Under-lavatory Guards (UG):
 - 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. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
 - 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 - 3. Material and Finish: Antimicrobial, molded plastic, white.

BID AND PERMIT SET

2.5 CUSTODIAL ACCESSORIES (CFCI)

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Utility Shelf and Mop and Broom Holder (MH):
 - 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. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - 2. Basis-of-Design: Bobrick Model B-239.
 - 3. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 4. Length: 34 inches (1016 mm).
 - 5. Hooks: Four.
 - 6. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
 - 7. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
 - b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.6 WARM-AIR DRYER, HAND DRYER (HD) (CFCI)

- A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. World Dryer. Basis of Design: Model A Series/Stock #DA5-974.
 - 2. Description: Standard-speed, warm-air hand dryer.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Touch-button activated with timed power cut-off switch.
 - a. Operation Time: 30 to 40 seconds.
 - 5. Cover Material and Finish: Steel, with white enamel finish.
 - 6. Electrical Requirements: 115 V, 20 A, 2300 W.

2.7 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION 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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, or semirecessed -mounting method and relationships of box and trim to surrounding construction.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches (150 by 150 mm) square.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- 2.2 FIRE-PROTECTION CABINET
 - A. Cabinet Type: Suitable for fire extinguisher.
 - 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. American Specialties, Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Modern Metal Products, Division of Technico Inc.
 - B. Cabinet Construction: Non fire-rated.
 - C. Cabinet Material: Aluminum sheet for non-rated.
 - D. Recessed Cabinet (FEC-R):
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - E. Semi-recessed Cabinet (FEC-SR): One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
 - F. Cabinet Trim Material: Aluminum sheet.
 - G. Door Material: Aluminum sheet.
 - H. Door Style: Fully glazed panel with frame.
 - I. Door Glazing: Break glass.
 - J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

K. Accessories:

- 1. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- 2. Door Lock: Cylinder lock, keyed alike to other cabinets.
- 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate on cabinet.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.

BID AND PERMIT SET

D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated
 - 1. Fire-Protection Cabinets: 48 inches (1219 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

BID AND PERMIT SET

- D. Touch up marred finishes or, replace fire-protection cabinets that cannot be restored to factoryfinished appearance. Use only materials and procedures recommended or furnished by fireprotection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fireprotection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

BID AND PERMIT SET

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Kidde Residential and Commercial Division.
 - c. Larsen's Manufacturing Company.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 4A:80B:C, 10-lb (4.6-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.
 - 1. Basis-of-Design Product: Larsen's MP10 extinguisher.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

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. Knocked-down metal lockers.
 - 2. Locker room benches.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

BID AND PERMIT SET

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

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

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
 - 1. Obtain locks from single lock manufacturer.
- B. Basis-of-Design Product: Model 52463, Double-Tier, 3 wide Standard Steel Lockers, with 3 frames and 6 openings and Model 5246, Single wide units; manufactured by Lyon; www.lyonworkspace.com.

2.2 KNOCKED-DOWN METAL LOCKERS

- A. Size: Double-Tier, 3-wide; 36 inches (915 mm) wide by 18 inches (450 mm) deep by 66 inches high (1,676 mm). Also, provide single-wide lockers where required to fill in space too narrow for 3-wide lockers.
- B. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - 2. Doors for box lockers less than 15 inches (381 mm) wide may be fabricated from 0.048inch (1.21-mm) nominal-thickness steel sheet.
 - 3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 - 4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21mm) nominal-thickness steel sheet; welded to inner face of doors.
 - 5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 - 6. Door Style: Unperforated panel.
- C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
 - 2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
 - 3. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
 - 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - 1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
 - 2. Continuous Hinges: Manufacturer's standard, steel, full height.
 - 3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

BID AND PERMIT SET

- F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
 - 1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
 - a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact and, incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- G. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.
- I. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.
- J. Base: Not required. Lockers will be installed on Contractor constructed 4-inch (102 mm) high base.
- K. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
 - 1. Closures: Vertical-end type.
 - 2. Sloping-top corner fillers, mitered.
- L. Individual Sloping Tops: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
- M. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- N. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
- O. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.
- P. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
- Q. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

BID AND PERMIT SET

- R. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.3 LOCKS

A. Combination Padlocks: Provided by Owner.

2.4 LOCKER ROOM BENCHES

- A. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).
- B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
 - 1. Size:
 - a. Typical Bench: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick), 72 inches long. Provide with two heavy-duty pedestals per bench.
 - b. ADA Bench: 24-inch- (610-mm) wide by 48 inches long. Provide with two 19-inch by 19-inch by 2-inch (483- by 483- by 50.8-mm) steel backrest brackets per bench for attaching a 18-inch (457-mm) deep wood backrest to bench. Provide with four heavy-duty pedestals per bench.
 - 2. Laminated clear Maple hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
- C. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
 - 1. Tubular Steel: 1-1/2-inch- (38-mm-) diameter, 16-1/4 inches tall steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
 - a. Color: Match metal lockers.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

BID AND PERMIT SET

- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Triple-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.
- E. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- F. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- G. Continuous Base: Formed into channel or zee profile for stiffness and, fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloping-top corner fillers, mitered.
- I. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.
- J. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.
- K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slipjoint filler angle formed to receive filler panel.
- L. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension and designed for concealing fasteners and holes at exposed ends of non-recessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- M. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of non-recessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

METAL LOCKERS

BID AND PERMIT SET

- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.

BID AND PERMIT SET

- 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
- 4. Attach boxed end panels using concealed fasteners to conceal exposed ends of non-recessed metal lockers.
- 5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 **PROTECTION**

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes or, replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 107316 – METAL CANOPIES

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. Design, furnishing and installation of roll-formed aluminum overhead hanger rod style canopies.
 - 2. Delegated design.
- B. Related Requirements:
 - 1. Section 01 61 16 "Delegated Design Requirements".

1.3 SUBMITTALS

- A. Product Data: manufacturer's product data sheets describing materials, accessories, material color options, and installation details.
- B. Shop Drawings: Showing structural component locations/positions, material dimensions and details of construction and assembly to demonstrate compliance with project design intent.
- C. Samples:
 - 1. For Selection: Manufacturer's standard color charts or color chips.
 - 2. For Verification: 6-inch by 6-inch metal sample with selected metal finish and color.
- D. Delegated-Design Submittal: For metal canopies indicated to comply with performance requirements and design criteria, including structural calculations signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For professional engineer responsible for canopy engineering.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

BID AND PERMIT SET

- B. Engineer Qualifications: Qualified professional engineer, registered in State of Oregon, and responsible for delegated design.
- C. Field Measurement: Confirm dimensions prior to preparation of shop drawings, when possible.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Canopy Design: Conform to local building codes and local site design loads, including seismic performance criteria.
- B. Fire Performance: Non-combustible as tested per ASTM E 136.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain metal canopies from single source from single manufacturer.
- B. Basis-of-Design Product and Manufacturer: Lumishade Hanger Rod, High Load Roll Formed Canopy manufactured by Mapes Industries, Inc.; www.mapescanopies.com.

2.3 MATERIALS

- A. Metal Decking: Interlocking roll-formed, 2-1/2-inch (63.5-mm) deep "W" shaped pan; minimum 0.032-inch (0.81-mm) thick aluminum.
- B. Intermediate Framing Members: Extruded aluminum, alloy 6063-T6, in profile and thickness per manufacturer's standard materials and details.
- C. Hanger Rods and Attachment Hardware: Manufacturer's standard components.
- D. Fascia: Manufacturer's Standard 8-inch (203-mm) deep extruded "J"-shaped fascia; minimum 0.125-inch (3.2 -mm) aluminum.

2.4 FINISHES

- A. Framing, Decking, Fascia and Accessories: Provide manufacturer's standard two-coat fluoropolymer factory finish. Color as selected by Architect.
- B. Hanger Rods: Powder coat finish. Color as selected by Architect.

2.5 FABRICATION

A. Fabricate canopies in preassembled sections for ease of transport and installation.

METAL CANOPIES

BID AND PERMIT SET

- B. Connections: Mechanically assemble utilizing 3/16-inch (4.75-mm) fasteners with a minimum shear stress of 350 pounds.
- C. Decking: Designed and manufactured with interlocking roll-formed aluminum members.
- D. Concealed Drainage: Fabricate canopies so that water drains from covered surfaces into intermediate trough and then, directed to either the front for front drainage or to the rear for ground level discharge via one or more designated downspouts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surrounding substrates are ready for canopy installation.
- B. Confirm dimensions and elevations agree with reviewed shop drawings.
- C. Perform installation using a manufacturer's approved installer and schedule installation after adjacent concrete, masonry and roofing is completed.

3.2 INSTALLATION

- A. Install under supervision of the manufacturer's authorized representative to comply with performance requirements.
- B. Installation shall be in strict accordance with reviewed shop drawings. Give attention to protecting the canopy finish during handling and installation.

3.3 CLEANING AND ADJUSTING

- A. Verify canopy assembly is installed level, plumb, and in accordance with reviewed shop drawings. Adjust installation as necessary to achieve accurate, complete installation.
- B. After installation, clean entire canopy assembly.
- C. Repair and clean adjacent building surfaces that may have been damaged or soiled during canopy installation.

END OF SECTION 107316

SECTION 107500 - FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum Flagpoles.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.3 REFERENCE STANDARDS

- A. AASHTO M 36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2014.
- B. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- C. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- D. ASTM B241/B241M Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.
- E. NAAMM FP 1001 Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.4 SUBMITTALS

- A. Product Data: Provide data on pole, accessories, and configurations.
- B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Oregon, the State in which the Project is located.

BID AND PERMIT SET

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Flagpoles:
 - 1. American Flagpole; www.americanflagpole.com.:
 - 2. Concord Industries, Inc; www.concordindustries.com.:
 - 3. Pole-Tech Co., Inc; www.poletech.com.:
 - 4. Eagle Mountain Flag and Flagpole Company: www.eaglemountainflag.com
 - 5. Substitutions: See Section 016000 Product Requirements.

2.2 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001.
 - 1. Material: Aluminum.
 - 2. Design: Cone tapered.
 - 3. Mounting: Ground mounted type.
 - 4. Outside Butt Diameter: 8 inches.
 - 5. Outside Tip Diameter: 3-1/2 inches.
 - 6. Nominal Wall Thickness: 0.156 inches.
 - 7. Nominal Height: 35 ft; measured from nominal ground elevation.
 - 8. Halyard: External type.
- B. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 75 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.3 POLE MATERIALS

A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.4 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter.
BID AND PERMIT SET

- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Flag: 5 foot x 8 foot fabric, brass grommets, hemmed edges.
 - 1. American Flag: Similar to part number FLAG-US-04 by American Flagpole, or similar.
 - 2. Oregon State Flag:Similar to part number FLAG-OR-04 by American Flagpole, or similar.
 - 3. Vietnam POW/MIA Flag: Similar to part number FLAG-POW-MIA-04 by American Flagpole, or similar.
- D. Cleats: 9 inch size, aluminum with stainless steel fastenings, two per halyard.
- E. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box. Box to have locking cover, national lock set.
- F. Halyard: 5/16 inch diameter polypropylene, braided, white.
- G. Two snap hook attachments at each flag.

2.5 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage, 0.0598 inch steel, galvanized, depth as required per manufacturer's installation instructions.

2.6 FINISHING

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Aluminum: Mill finish.
- C. Finial: Spun finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

BID AND PERMIT SET

3.3 INSTALLATION

A. Install flagpole and fittings in accordance with manufacturer's instructions.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

END OF SECTION 107500

BID AND PERMIT SET

SECTION 112425 - FALL PROTECTION EQUIPMENT

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 systems and components to facilitate roof top maintenance where required, including the following.
 - 1. Anchor posts, tie-offs for roof fall protection.
 - 2. Delegated design.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications."
 - 2. Section 075423 "Thermoplastic Polyolifin (TPO) Roofing."
 - 3. Section 076200 "Sheet Metal Flashing and Trim."
 - 4. Section 079200 "Joint Sealants."

1.3 COORDINATION

- A. Coordinate the location of primary support for fall arrest anchors in conjunction with areas on façade of building requiring service and cleaning.
- B. Anchorages shall be unobstructed and located behind and in line with equipment or portion of building they are intended to service. Refer to the manufacturer's recommendations and anchor spacing and outside corner layout diagrams.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product proposed, including the following
 - 1. Test report certified by a professional engineer.
 - 2. General product data.
 - 3. Detailed drawings of equipment proposed.

BID AND PERMIT SET

- B. Shop Drawings:
 - 1. Fall Arrest Anchors:
 - a. Location plan.
 - b. Detailed plan and section showing typical anchor installation at parapet.
 - 2. Submit scaled shop drawings showing the following:
 - a. Location plans of all support equipment: Equipment location plans shall include identification number next to each piece of equipment that are permanently affixed to a structure, including anchors.
 - b. Drawings detailing all parts and accessories.
 - 1) Field welds shall be indicated on equipment details using AWS symbols and showing length and size. Auxiliary views shall be shown to clarify welding as required.
 - 3. Clearly specify equipment dimensions, materials, fabrication details, hardware, and installation instructions.
 - 4. Include notes with guidelines of proper use of system.
 - 5. Shop drawings shall be prepared under supervision of a registered U.S. Professional Engineer (PE) and shall bear engineer's seal and signature. Registered PE shall be licensed in jurisdiction where project is located. Include Professional Engineer's certified report of tested equipment.
- C. Field Inspection Report: Include completed inspection logbook in accordance with "Field Quality Control" Article.
- D. Installation Instructions: Include guidance on field testing.
- E. Certification:
 - 1. Fall Arrest Anchors: Letter of certification by registered U.S. Professional Engineer verifying that installed anchors are in compliance with OSHA regulations and ANSI/IWCA standards specified.
- F. Closeout Submittals: Maintenance and finish repair instructions.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Provide products from company specializing in design, fabrication, and installation of permanent fall restraint equipment with a minimum of ten (10) years of documented experience.
 - 2. Installer: Trained or approved by manufacturer in installation techniques and procedures, with minimum ten (10) years of documented experience installing permanent fall restraint equipment.

BID AND PERMIT SET

- 3. Inspector: Registered Professional Engineer with experience on fall restraint equipment.
- B. Regulatory Requirements
 - 1. Comply with Occupational Health and Safety Standards: 1910.66 Appendix C (Personal Fall Arrest).
 - 2. Welding shall comply with AWS D1.1 and shall be performed by welders qualified to work in jurisdiction where project is located.
 - 3. Comply with AISC publications:
 - a. Load and Resistance Factor Design for Structural Steel Buildings
 - b. Specifications for the Design of Cold-Formed Steel Structural Members

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original unopened packaging.
- B. Storage and Protection:
 - 1. Store materials in area protected from construction activities, and protected from materials and chemicals that are not compatible with anchors.
 - 2. Before installing, clean bolts that have become dirty.
 - 3. Do not install damaged materials. Ensure that they are removed from project site.

1.7 SEQUENCING AND COORDINATION

- A. Contractor is responsible for coordinating submittal process, fabrication, and delivery with construction of building elements receiving anchors.
- B. Coordinate anchor installation with parapet construction and coating.
- C. Manufacturer shall provide detailed installation instructions and directions for installation of embedded items, welded items, and through-bolted items, etc.
- D. Manufacturer shall provide installation assistance during installation of the equipment. However, the responsibility of the installation shall remain with the General Contractor unless equipment is installed and certified by the manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 016116 "Delegated Design Requirements," to design roof tie-off attachment to building structure and required structural modifications as required for installation.

- B. Anchorage Design Requirements:
 - 1. Safety anchor design shall comply with ANSI/IWCA I-14.1, "Window Cleaning Safety" and OSHA 1910.66, Appendix C, "Personal Fall Arrest."
 - 2. Structural Design Requirements:
 - a. Anchorage shall be capable of sustaining minimum ultimate load of 5,000 lbs in any direction load may be applied, without fracture or failure.
 - b. Anchorage shall be capable of sustaining minimum proof load of 2,500 lbs in any direction load may be applied, without permanent deformation or damage to anchorage.
 - c. Anchorage shall be designed with minimum 1,250 lbs in any direction load may be applied.
 - 3. Anchor system shall provide independent fall arrest anchorages in addition to suspension line anchorages for each descent location as required by OSHA and ANSI requirements.
 - a. Provide fall arrest anchors in parapets in locations identified on Drawings.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. GF Protection Inc.; www.guardianfall.com.
 - 2. Summit Anchor Co.; www.summitanchor.com.
 - 3. Tractel; www.tractel.com.
 - 4. Pro-bel; www.pro-bel.ca.

2.3 PRODUCTS

- A. Basis-of-Design Products: Subject to compliance with requirements and field conditions provide the following or tie-off posts by the manufacturers listed.
 - 1. Galvanized Roof Anchor: Model No. CB-18 by Guardian Fall Protection.
 - a. Style: For roof type indicated.
 - b. Height: As indicated and selected by Architect.
 - 1) As required for minimum roofing membrane Termination. Coordinate with roofing manufacturer.
 - c. Finish and Material: Hot-dipped galvanized steel
 - d. Fasteners: As recommended by manufacturer for code compliance, provide fasteners as required for roof type indicated.

2.4 FABRICATION

- A. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to appearance and performance.
- B. Grind off surplus welding material to ensure exposed surfaces are smooth to prevent abrasion to worker's ropes or cables.
- C. Welding: Shall be in accordance with the AWS D1.1/D1, "Structural Welding Code."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Examine areas and conditions under which permanent fall restraint equipment shall be installed.
 - 2. Report to general contractor any conditions that deviate from shop drawings or any defects in workmanship that would cause an unsafe installation. This report shall be verified in writing to the general contractor and any other responsible party.
- B. Correct conditions detrimental to timely and proper execution of work.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance by installer.
- E. Faults occurring in Work of this Section due to acceptance of unsatisfactory conditions shall be corrected at no additional cost to owner.

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install fall restraint system equipment in compliance with manufacturer's instructions. Install equipment level, tightly fitted, and flush to adjacent surfaces as needed for proper installation.
 - 2. Coordinate anchor installation with roofing installation to ensure a watertight and warrantable condition of the roofing. Anchors shall be directly flashed into roofing in a manner compatible with roofing system and anchors.
 - 3. When components come into contact with dissimilar metals, surfaces shall be kept from direct contact to prevent corrosion.
 - 4. No wall anchors shall be installed through membrane roofing system without specification detailing such from the Architect or water proofing contractor warranting the roof.

BID AND PERMIT SET

- 5. Deform a minimum of two threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism. Deform threads with 2 mm stainless steel punch
- B. Flashings: Deck flange shall be flashed in compliance with National Roofing Contractor Association (NRCA) recommendations.

3.3 REPAIR/ RESTORATION

A. Galvanizing Touch-Up: Immediately following erection, clean field welds and abraded areas. Repair damaged galvanizing areas in compliance with ASTM A780.

3.4 FIELD QUALITY CONTROL

- A. Inspection and Site Visits:
 - 1. Perform inspections and site visits while installation of anchors is in progress under supervision of qualified Professional Engineer.
 - 2. Perform on-site inspection of equipment welded to structure by an AWS Certified Welding Inspector verifying, in writing, size and quality of welds. Such an inspection shall be performed on each piece of equipment before roofing material is installed
 - 3. Perform on-site inspection on cast items while they are being tied in with rebar; ensure sufficient time before concrete is poured to allow adjustments to embedded items.
 - 4. Contractor shall be responsible to schedule site visits and inspections with sufficient advanced notice given to the inspection company.
- B. Field Tests:
 - 1. All equipment shall be tested on-site in accordance with manufacturer's recommendations, under the supervision of a professional engineer, and ANSI/IWCA I-14.1, "Window Cleaning Safety Standards", before equipment is placed into service.
 - 2. Equipment shall be tested under supervision of qualified Professional Engineer with experience with fall restraint equipment and manufacturers guidelines.
- C. Manufacturer shall assist or supervise installation of equipment installed by others.

3.5 ADJUSTING

- A. Verify that completed work has been installed correctly and products function properly. Make adjustments where needed to ensure satisfactory operation.
- B. Complete inspection logbook to certify the complete system for use. Note any deviations, changes, or corrections from the original shop drawings. Provide as-built anchor layout plan on A3 sheet (11 x 17 in.) paper or larger together with annual inspection logbook.

BID AND PERMIT SET

3.6 DEMONSTRATION

A. Manufacturer's service representative shall train Government personnel to operate the equipment, and adjust and test anchors. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 112425

BID AND PERMIT SET

SECTION 113110 - APPLIANCES

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. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Cleaning appliances.
- B. Related Requirements:
 - 1. Section 224216.16 "Commercial Sinks".
 - 2. Section 221319 "Sanitary Waste Piping Specialties".
 - 3. Section 221119 "Domestic Water Piping Specialties".

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- C. Product Schedule: For appliances.
- 1.5 INFORMATIONAL SUBMITTALS
 - A. Qualification Data: For manufacturer.

APPLIANCES

BID AND PERMIT SET

- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each appliance to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains, within 20 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Gas-Fuel Conversion: Provide gas-fueled appliances with manufacturer's high-altitude and propane conversion kit installed by a qualified service agency according to manufacturer's written instructions for Project location and type of fuel.

1.8 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Microwave Oven: Full warranty, including parts and labor, for on-site service on the magnetron tube.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Refrigerator/ Freezer and Icemaker, Sealed System: Full warranty, including parts and labor, for on-site service on the product.
 - 1. Warranty Period for Sealed Refrigeration System: Two years from date of Substantial Completion.
 - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
- D. Dishwasher: Full warranty, including parts and labor, for on-site service on the product.
 - 1. Warranty Period for Deterioration of Tub and Metal Door Liner: Three years from date of Substantial Completion.
 - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.

BID AND PERMIT SET

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.
- C. Accessibility: Where appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design, the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.3 COOKING APPLIANCES

- A. Microwave Oven:
 - 1. Basis-of-Design Product: Model LMC1575ST, 1.5 Cubic-Foot Countertop Microwave, by LG Appliances; www.lg.com/us/appliances.
 - 2. Type: Countertop.
 - 3. Description:
 - a. Capacity: 1.5 cubic feet.
 - b. Smart inverter.
 - c. EasyCleanTM interior.
 - d. ADA compliant.
 - e. Smooth glass touch control panel.
 - f. Power: 14 amps, 1600 Watts.
 - 4. Dimensions, exterior: 21.41 inches wide by 12.13 inches tall by 17 inches deep.
 - 5. Finish: Stainless steel.

2.4 REFRIGERATION APPLIANCES

- A. Refrigerator/ Freezer, Free Standing:
 - 1. Basis-of-Design Products: Model LFXS24623D, 3-Door French Door Refrigerator, by LG Appliances; www.lg.com/us/appliances.
 - 2. Type: Freestanding.
 - 3. Description:
 - a. Refrigerator Capacity: 16.2 cubic feet.
 - b. Freezer Capacity: 8.0 cubic feet.

BID AND PERMIT SET

- c. Ice and water dispenser.
- d. Ice production: 2.4 pounds daily.
- e. Water filtration system.
- f. Energy Star qualified.
- 4. Dimensions: 32-3/4 inches wide by 68-5/8 inches tall by 32-7/8 inches deep (without handles).
- 5. Finish: Black stainless steel.
- B. Refrigerator/ Freezer Drawers, Under Counter:
 - 1. Basis-of-Design Products: Model KUDF204ESB, 24-inch Refrigerator/Freezer Drawers, by Kitchen Aid; www.kitchenaid.com.
 - 2. Type: Under counter drawers.
 - 3. Description:
 - a. Refrigerator Capacity: 2.2 cubic feet.
 - b. Freezer drawer: freezer with ice maker.
 - c. Water filtration system.
 - d. Interior light: LED.
 - 4. Dimensions: 23-3/4 inches wide by 34-3/4 inches tall by 26-1/2 inches deep (with handles).
 - 5. Finish: Stainless steel.
- C. Icemaker:
 - 1. Basis-of-Design Product: Model KUID508ESS, 18-inch Automatic Ice Maker, by Kitchen Aid; www.kitchenaid.com.
 - 2. Type: Undercounter.
 - 3. Description:
 - a. Ice capacity storage: 35 pounds.
 - b. Ice production: 50 pounds daily.
 - c. Ambient temperature range: 55 deg F to 110 deg F.
 - d. Liner finish: Plastic.
 - 4. Dimensions: 17-7/8 inches wide by 34-3/8 inches tall by 25-5/8 inches deep (with handle).
 - 5. Finish: Stainless steel.

2.5 CLEANING APPLIANCES

- A. Dishwasher:
 - 1. Basis-of-Design Product: Model LDF5545, Front Control Dishwasher with QuadWashTM, by LG Appliances; www.lg.com/us/appliances.
 - 2. Type: Undercounter.
 - 3. Description:
 - a. Capacity: 15 place settings.

BID AND PERMIT SET

- b. Wash cycles: 9.
- c. Tub: stainless steel.
- d. Energy Star qualified.
- e. Water Factor: 2.8.
- f. Energy Use: 258 kWh per year.
- 4. Dimensions: 23.75 inches wide by 33.6 inches tall by 24.6 inches deep.
- 5. Finish: Stainless steel.
- B. Clothes Washer:
 - 1. Basis-of-Design Product: Model WT7700HVA, MEGA Capacity Top Load Washer with TurboWashTM Technology, by LG Appliances; www.lg.com/us/appliances.
 - 2. Type: Free Standing, top-load washer.
 - 3. Description:
 - a. Capacity: 5.7 cubic feet.
 - b. Wash programs: 14.
 - c. Drum: stainless steel.
 - d. Steam technology.
 - e. Electronic control panel with LED display.
 - f. Power requirement: 120V, 10 amps.
 - 4. Dimensions: 29 inches wide by 45 inches tall by 32-1/4 inches deep.
 - 5. Finish: Stainless steel.
- C. Clothes Dryer:
 - 1. Basis-of-Design Product: Model DLEX7700VE, 9.0 cubic-foot MEGA Capacity TurboSteamTM Dryer with EasyLoadTM Door, by LG Appliances; www.lg.com/us/appliances.
 - 2. Type: Free standing, electric dryer.
 - 3. Description:
 - a. Capacity: 9.0 cubic feet.
 - b. Drying programs: 14.
 - c. Temperature settings: 5.
 - d. TurboSteamTM technology.
 - e. Electronic control with LED display.
 - f. Power requirement: 240V, 30 amps.
 - g. Finish: Stainless steel.
 - 4. Dimensions: 29 inches wide by 45-1/8 inches tall by 31-1/2 inches deep.
 - 5. Finish: Stainless steel.

2.6 GENERAL FINISH REQUIREMENTS

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

BID AND PERMIT SET

B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where microwave ovens with vented exhaust fans will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

BID AND PERMIT SET

- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

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

END OF SECTION 113110

BID AND PERMIT SET

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES: FOOD SERVICE EQUIPMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 RELATED WORK

- A. Rough-ins and Final Connections: Service lines from rough-in to point of final connections are provided by plumbing and electrical contractors.
- B. Electrical: Wiring, conduit, fuses, breakers, final disconnects, junction boxes, and other required electrical apparatus not built-in or mounted on equipment are provided by electrical contractor.
- C. Plumbing: Controls, regulators, valves, stops, traps, strainers, checks, grease traps, and fittings not mounted on/in equipment are provided by plumbing contractor.
- D. Mechanical: Ductwork from above finished ceiling to building exhaust and supply fans, flue pipes, exhaust and supply fans for hoods, room ventilation, and air supply blowers are provided by mechanical contractor.
- E. Miscellaneous
 - 1. Provides backing plates or blocking in wall or ceiling partitions.
 - 2. Provides fittings secured to structural ceiling to accommodate hangers.
 - 3. Provides the forming of architectural enclosures, floor, wall openings or recesses for equipment.
 - 4. Caulks and seals Cold Storage Room floor sections to building floor.
 - 5. Finishes floors (masonry or poured-in-place) in cold storage rooms, concrete curbs and pads.

1.3 SYSTEM DESCRIPTION

- A. Delegated Design: Design canopy hoods with fire protection system, walk-in cold storage rooms, and seismic restraint of equipment using performance requirements and design criteria indicated, including comprehensive engineering analysis by a qualified professional engineer licensed by the State.
- B. Fabricated Equipment: Constructed to configuration, dimension, detail, and design as shown with materials and workmanship as specified.

BID AND PERMIT SET

- C. Manufactured Equipment: Mass produced and referenced by manufacturer's name and model number.
- D. Each model number includes the code *H011 as a suffix. This code is known as the Specified Identification System. It is not to be removed by the bidders. Its purpose is to identify the Food Service Consultant to the vendors providing equipment in the event it is necessary to communicate questions, clarifications, and comments, from prior to bid award through the final purchase. It is to be used on all correspondence, including fax and e-mail, when communicating with manufacturer representatives and factories.

1.4 DEFINITIONS

- A. Furnish Supply and deliver to Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
- B. Install (set in place) Work at Project Site, including actual unloading, unpacking, assembly, erecting, rigging, placing, anchoring, applying, finishing, curing, protecting, cleaning, and similar operations, ready for final utility connections by other Sections as appropriate.
- C. Coordinate Relay required information requested by other trades to ensure they are able to correctly perform their work related to the food service or laundry equipment installation.
- D. Provide Furnish and install complete, ready for intended use.
- E. Kitchen Equipment Contractor (KEC) All references to the Contractor in this Section 114000 shall refer to the Kitchen Equipment Contractor (KEC). Reference to any other Contractor shall be specific, such as General Contractor, Plumbing Contractor, Electrical Contractor, Architect, designated, etc.

1.5 LAWS, ORDINANCES AND STANDARDS

- A. STANDARDS: Except as otherwise indicated, comply with the following standards as applicable to the manufacture, fabrication, and installation of the work of this Section:
 - 1. Air Conditioning and Refrigeration Institute (ARI): Comply with the applicable regulations and references of the latest edition of standards for remote refrigeration system(s), components, and installation.
 - 2. American Gas Association (AGA): Comply with AGA standards for gas heated equipment and provide equipment with the AGA seal. Automatic safety pilots shall be provided on all equipment, where available. (Canadian Gas Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
 - 3. American National Standards Institute (ANSI): Comply with ANSI Z21-Series standards for gas-burning equipment and provide labels indicating name of testing agency.
 - 4. American National Standards Institute (ANSI): Comply with ANSI B57.1 for compressed gas cylinder connections and with applicable standards of the Compressed Gas Association for compressed gas piping.
 - 5. American National Standards Institute (ANSI): Comply with ANSI A40.4 and A40.6 for water connection air gaps and vacuum breakers.

- 6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE): Comply with the applicable regulations and the latest edition of standards for remote refrigeration system(s), components, and installation.
- 7. American Society of Mechanical Engineers (ASME): Comply with ASME Boiler Code requirements for steam generating and steam heated equipment and provide ASME inspection, stamp, and registration with National Board.
- 8. American Society for Testing and Materials (ASTM): Comply with ASTM C1036 for flat glass.
- 9. American Society for Testing and Materials (ASTM): Comply with ASTM C1048 for heat-treated flat glass Kind HS, Kind FT coated and uncoated glass.
- 10. American Welding Society (AWS): Comply with AWS D1.1 structural welding code.
- 11. National Electric Code (NEC): Comply with NFPA Volume 5 for electrical wiring and devices included with food service equipment, ANSI C2 and C73, and applicable NEMA and NECA standards.
- 12. National Electrical Manufacturers Association (NEMA): Comply with NEMA LD3 for high-pressure decorative laminates.
- 13. National Fire Protection Association (NFPA): Comply with the applicable sections of the NFPA for exhaust hood, ventilators, duct and fan materials, hoods fire suppression systems, construction and installation, as well as local codes and standards.
- 14. National Sanitation Foundation (NSF): Comply with the latest Standards and Revisions established by NSF for equipment and installation. Provide NSF Seal of Approval on each applicable manufactured item and on items of custom fabricated work. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.)
- 15. Sheet Metal and Air Conditioning Kitchen Equipment Contractor (KEC)'s National Association (SMACNA): Comply with the latest edition of SMACNA guidelines for seismic restraint of kitchen equipment and applicable local regulatory agencies requirements.
- 16. Underwriters Laboratories (UL): Provide either UL labeled products for electrical components and assemblies or, where no labeling service is available, "recognized markings" to indicate listing in the UL "Recognized Component Index". (Canadian Standards Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
- 17. UL 300 Standard: Wet chemical fire suppression systems for exhaust hoods/ventilators shall comply with these requirements.
- 18. American with Disabilities Act (ADA): Comply with requirements as applicable to this Project.
- 19. Refrigeration Service Engineers Society (RSES): Comply with the applicable regulations, the latest edition of standards for remote refrigeration system(s), components and installation, and the 1995 requirements of the Montreal Protocol Agreement.
- 20. All refrigerants used for any purpose shall comply with the 1995 requirements of the Montreal Protocol Agreement and subsequent revisions and amendments. No CFC refrigerants shall be allowed on this Project.
- 21. All refrigeration components installation, repairs, and/or associated work on any refrigeration system, self-contained or remote, shall be performed by a Certified Refrigeration Mechanic.
- 22. Comply with all applicable local codes, standards and regulations, and any special local conditions (example only: City of Los Angeles Testing Lab requirements or seismic standards compliance).

BID AND PERMIT SET

- 23. Jails, prisons, and all detention facilities shall comply with Correctional Standards as applicable to the specific Project. Verify the level of security and construction required with the Project Architect and provide all items in compliance. As a minimum, no part or component of any item provided shall be easily removable and used as a weapon.
- 24. Subway grating installed in floor drain troughs must meet IBC 1104.3.1 standards for maximum opening sizes in grates.
- 25. Confirm all drawings, specifications, and project documentation meet all federal, state, and local codes and regulations.

1.6 KITCHEN EQUIPMENT CONTRACTOR (KEC) QUALIFICATIONS

- A. In addition to requirements of Related Sections 1.02, submit evidence of compliance with the following qualifications and conditions:
 - 1. Five (5) years minimum continuous operation under the same company name and ownership.
 - 2. Evidence of Company's financial stability and financial ability to complete this Project without endangering that stability.
 - 3. List a minimum of comparable size and scope projects completed in the last five (5) years with Owner's contact name and telephone number.
 - 4. Have manufacturer's authorization to purchase, distribute, and install all items specified with this Project.
 - 5. Maintain a staff or have access to personnel with a minimum of five (5) years experience in the installation of comparable size and scope projects, and meeting NSF standards and requirements. (UL Sanitation standards and requirements may be accepted if acceptable to local code jurisdictions.)
 - 6. Maintain or have access to a fabrication shop meeting NSF standards and labeling requirements. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.) If other than the Kitchen Equipment Contractor (KEC)'s own fabrication shop, they shall have five (5) years minimum experience in the fabrication of comparable size, scope, and level of quality projects. The Kitchen Equipment Contractor (KEC) shall submit their company name and credentials to the Architect, who shall have the right of approval or disapproval
 - 7. Maintain a staff or have access to personnel experienced in the preparation of professional style shop drawings and submittals.
 - 8. Maintain or have access to manufacturer's authorized service personnel together with readily available stock of repair and replacement parts.
 - 9. Any sub-Kitchen Equipment Contractor (KEC) employed by Kitchen Equipment Contractor (KEC) for this Project shall comply with the same qualification requirements.

1.7 SUBSTITUTIONS

A. Refer to Division 1 for Substitution Request requirements.

1.8 APPROVED SUBSTITUTIONS AND/OR LISTED ALTERNATES

- A. Substitutions approved as noted in article 1.07 and/or any Listed Alternate Manufacturers listed in these Itemized Specifications or added by Addendum may be utilized in lieu of the primary specified manufacturer with the following conditions and understanding:
 - 1. The Project Documents are designed and engineered using the primary specified manufacturer and model. The Kitchen Equipment Contractor (KEC) shall assume total responsibility for any deviations required due to the utilization of a substitution/alternate manufacturer or model including, but not limited to, fitting alternates into the available space, providing directions for required changes, and assuming any and all associated costs for utility, building, food service design, architectural, or engineering changes directly or indirectly related to the substitution.
 - 2. The Kitchen Equipment Contractor (KEC) shall be responsible for supplying the model, which is equal to the primary specified model in regard to general function, features, options, sizes, accessories, utility requirements, finish, operation, and listing approvals. If the Owner or their appointed representative determines at any time during the construction and installation, prior to the final acceptance of the Project, that the substitution/alternate model submitted is not equal to the primary specified model, the Kitchen Equipment Contractor (KEC) shall assume all associated cost and implications required to replace the model submitted with the correct model.
 - 3. The bid proposal shall clearly state any substitutions/alternates which will be utilized, including the manufacturer and model number. The proposal shall also include a data sheet for each substitution/alternate with any and all deviations between the primary specified manufacturer and the substitution/alternate manufacturer itemized and listed on the data sheet. The manufacturers' cut sheets are not acceptable as a substitute for the data sheet. Complex alternates, such as utility distribution systems, exhaust hoods, ventilators, etc., shall include a shop drawing specific to the Project.
 - 4. Inclusion of an alternate manufacturer in the Itemized Specifications is not intended to indicate that there is an equal alternate unit to match every primary specified unit. It shall be the responsibility of the Kitchen Equipment Contractor (KEC) to ensure that the alternate unit submitted matches the primary specified unit and meets the other conditions, as stated above.
 - 5. Manufacturers not approved as substitutions or listed as a Listed Alternate will not be permitted unless submitted for prior approval, as described above and in the General and Supplementary Conditions and applicable Division-1 Specifications Sections.
 - 6. Submittal of a substitution/alternate manufacturer or model shall indicate agreement to the above stated conditions. Solely at the Owner's discretion, failure to comply with any of these conditions or to supply complete and correct data information shall result in the Kitchen Equipment Contractor (KEC) being required to provide the primary specified manufacturer at no additional cost to the Owner or to adjust the Contract cost.

1.9 DISCREPANCIES

A. Where discrepancies are discovered between the drawings and the specifications regarding quality or quantity, the higher quality or the greater quantity shall be included in the Bid Proposal. The Kitchen Equipment Contractor (KEC) shall notify the Architect, in writing, of any discrepancies discovered and await clarification prior to proceeding with the items or areas in question.

BID AND PERMIT SET

1.10 SUBMITTALS

- A. The Kitchen Equipment Contractor (KEC) shall review all submittals for basic compliance with the Contract Documents and correct as required prior to submitting to the Design Team (Architects/Engineers/ Consultants/Owner) for review. Failure to comply with this requirement, the submission of submittal(s) which are significantly inconsistent with the Contract Documents, or inconsistencies that are discovered during review by a Design Team member shall be justification for reimbursement by the Kitchen Equipment Contractor (KEC) to the Design Team member's company for the "lost" time or for the time required for a second review.
- B. Rough-In Drawings
 - 1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.
 - 2. Submit 1/4 inch (1:50) scale rough-in drawings for approval. These drawings shall be dimensioned from grid lines showing location of ducts, stubs, floor and wall sleeves for ventilation, plumbing, steam, electrical, refrigeration lines, beverage lines, concrete base and curb dimensions as required for equipment so supported.
 - 3. Site-verify mechanical, electrical and ventilating rough-in and sleeve locations.
 - 4. The Kitchen Equipment Contractor (KEC) shall be responsible for the accuracy of the information on their submittals.
 - 5. In the event rough-ins have been accomplished before the award of this contract, the Kitchen Equipment Contractor (KEC) shall check the existing facility and make adjustments to their equipment to suit building conditions and utilities, where possible. If not possible, the Kitchen Equipment Contractor (KEC) shall so state in a letter to the Owner and Architect with reasons and an alternate method and pricing.
- C. Shop Drawings
 - 1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.
 - 2. Submit shop drawings for items of custom fabrication included in this contract. Shop drawings shall be submitted at 3/4 inch (1:20) and/or 1-1/2 inch (1:10) scale and shall show dimensions, materials, details of construction, features and options, installation and relation of adjoining work requiring cutting or close fitting. Shop drawings shall also indicate reinforcements, anchorage and related work required for the complete installation of fixtures.
 - 3. Before proceeding with the fabrication of any item, the Kitchen Equipment Contractor (KEC) shall be responsible for verifying and coordinating all dimensions and details with site dimensions and conditions.

BID AND PERMIT SET

D. Product Data Submittal Manuals

- 1. Submit electronic PDF file of Product Data Submittal Manuals with a cover sheet and detailed information on every item included in this Section for approval. Detailed information shall include, but not be limited to, item number, description, quantity, model numbers, options and accessories provided, exact utility requirements, manufacturer's cut-sheets, reference to specific shop drawings, etc. Distribute one additional copy of installation and start-up instructions to the Installer. Mark each data sheet with the applicable project equipment item number. Each data sheet shall include NEMA plug and receptacle configuration for applicable items, where applicable. Every cover sheet and associated detailed submittal shall provide sufficient and complete information to verify that the Kitchen Equipment Contractor (KEC) is providing each item in compliance with the Contract documents.
- 2. Architect review of drawings, shop details, product data brochures, and service and parts manuals is for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Kitchen Equipment Contractor (KEC) from compliance with the contract documents or departures there from. The Kitchen Equipment Contractor (KEC) remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing their work in a safe, satisfactory, and professional manner.

1.11 OPERATION AND MAINTENANCE DATA MANUALS

- A. Operation and Maintenance Manuals (Service and Parts Manuals): Three (3) bound sets of manuals shall be furnished for items of standard manufacture on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner. Manuals shall be in alphabetical order according to manufacturer, including item numbers and utility options provided for the equipment installed.
 - 1. Installing company's name, address, telephone number, and date of completed installation.
 - 2. Serial numbers of principal pieces of equipment.
 - 3. Part numbers of all replaceable items.
 - 4. Lubrication data and belt sizes.
 - 5. Electrical characteristics including data for motors and heaters.
- B. Service Agency List: Submit a complete list of local service agencies with the service and parts manuals for included manufacturers, complete with telephone numbers for all buy-out equipment installed.
- C. Provide video tapes for maintenance, training, operation, etc. where available from the manufacturer.

BID AND PERMIT SET

1.12 AS-BUILT/RECORD DOCUMENTS

- A. Maintain one record set of Food service Equipment Plans with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation. Provide an "as-built" set in reproducible transparency form and electronic computer disk form.
- B. Provide one (1) final set of Product Data Submittal Manuals with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation as a specifications record set.
- C. These documents shall be provided on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner.
- D. Provide two (2) final complete set of Submittals to be retained by Architect as a Record Set.

1.13 SCHEDULE

- A. General: Time is of the essence in this agreement. Acceptance constitutes a guarantee that the Kitchen Equipment Contractor (KEC) can and will obtain materials, equipment, and manpower to permit overall completion of the entire building project on schedule upon notice to proceed. The Kitchen Equipment Contractor (KEC) shall coordinate their work with the progress schedule, as prepared and updated periodically by the General Kitchen Equipment Contractor (KEC) or Construction Manager.
- B. The Kitchen Equipment Contractor (KEC) shall notify the Food service Consultant and the Architect in writing of anticipated delays not within the realm of control of the Kitchen Equipment Contractor (KEC) immediately upon the Kitchen Equipment Contractor (KEC)'s realization that delays are imminent.
- C. The Kitchen Equipment Contractor (KEC) will not be granted relief for failure to meet schedules or failure of manufacturers to meet promised delivery dates unless the Kitchen Equipment Contractor (KEC) can establish, in writing, that orders were received by the manufacturer with reasonable lead times.
- D. The Kitchen Equipment Contractor (KEC) shall pay extra charges resulting from special handling or air shipment in order to meet the schedule if insufficient time was allowed in placing factory orders.

1.14 PRODUCT HANDLING

A. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's containers fully identified with manufacturer's name, trade name, type, class, grade, size, color, power requirement, if any, and item number.

BID AND PERMIT SET

- B. Storage of Materials, Equipment and Fixtures: Kitchen Equipment Contractor (KEC) is responsible for receiving and warehousing of equipment and fixtures until ready for installation. The Kitchen Equipment Contractor (KEC) will store materials, equipment, and fixtures in sealed containers. They shall be stored off the ground and under cover, protected from damage.
- C. Handling Materials and Equipment: The Kitchen Equipment Contractor (KEC) will verify and coordinate conditions at the building site, particularly door and/or wall openings and passages to assure access for all equipment. Pieces too bulky for existing facilities shall be hoisted or otherwise handled with apparatus as required. All special handling equipment charges shall be arranged for and paid for by the Kitchen Equipment Contractor (KEC).

1.15 PRODUCT PROTECTION

- A. The Kitchen Equipment Contractor (KEC) is responsible to protect their equipment against theft or damage during the progress of the project until final acceptance by the Owner. Items delivered to the job site at the Owner's or Contract Manager's request before the site is ready for installation should be signed for as approved by the Owner or Contract Manager.
- B. The Kitchen Equipment Contractor (KEC) will use all reasonable means to protect the materials of this Section before, during, and after installation and to protect the associated work and materials of the other trades.
- C. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment are not to be used for general storage by other trades and should be locked before leaving the site. Damage and theft resulting from the failure to secure boxes shall be repaired or replaced at the Kitchen Equipment Contractor (KEC)'s own expense. The Kitchen Equipment Contractor (KEC) shall be available, as needed, to open and secure walk-in boxes for the other trades to perform their work related to these walk-in boxes, within the other trades' schedules as not to delay their work.
- D. Kitchen Equipment Contractor (KEC) will verify if the flooring is to be acid washed. In the event of this type of cleansing, any equipment constructed of stainless steel shall not be delivered until a minimum of 24 hours after the final cleansing is completed.

1.16 WARRANTY

A. Work shall be guaranteed against defects for one (1) year from the date of operation of the equipment. The Kitchen Equipment Contractor (KEC) will provide a written warranty of each component to include work in this Section to cover all testing and re-testing as may become necessary for one year past the Contract final acceptance date. Any equipment, system, or element failing to perform as directed in this Section shall be repaired or replaced at no cost to the Owner (including labor and transportation), excluding replacement cost of damaged components or work caused by misuse of the equipment.

BID AND PERMIT SET

B. Additional Warranty: Refrigeration systems shall include a start-up and one-year service and maintenance contract in addition to the regular one-year warranty as stated above, plus an additional four-year warranty on sealed portions of condensing units, including refrigerant lost. This shall include all refrigerators, ice cream makers and cabinets, ice makers, freezers, dispensers, walk-in coolers/freezers compressors, and/or any other items with refrigeration system(s).

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Equipment schedule: Refer to schedule on Food service Drawings and Part 5 Itemized Specifications for equipment included in this Section.

2.2 MATERIALS

A. Metals

- 1. Stainless Steel: AISI Type 302/304, hardest workable temper, and No.4 directional polish. Standard gauges are noted in these specifications under Heading 2.04; Section B.1.
- 2. Galvanized Steel Sheet: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment.

Note: Where painted finish is indicated, provide mill phosphatized treatment in lieu of chemical treatment.

- 3. Steel Sheet: ASTM A569 hot-rolled carbon steel.
- 4. Galvanized Steel Pipe: ASTM A53 or ASTM A120, welded or seamless, schedule 40, galvanized.
- 5. Steel Structural Members: Hot rolled or cold formed, carbon steel unless stainless steel is indicated.

Note: Galvanized Finish (G.I.): ASTM A123 hot-dipped zinc coating, applied after fabrication.

- 6. Aluminum: ASTM B209B221 sheet, plate and extrusions (as indicated), alloy, temper and finish as determined by manufacture / fabricator, except 0.40-mil natural anodized finish on exposed work unless another finish is indicated.
- B. Plastic Laminate: NEMA LD3, Type 2, 0.050" thick, except Type 3, 0.042" for post-forming smooth (non-textured). Color and texture as selected by the Architect/Interior Designer.
 - 1. Comply with NSF Standard No. 35.
 - 2. Veneered with approved waterproof and heat proof cement. Rubber base adhesives are not acceptable.

BID AND PERMIT SET

- 3. Applied directly over close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free laminated surface; or commercial grade furniture particle board, Cortron or equal.
- 4. If specified plywood or particle board is unavailable, submit specifications and sample of alternate material for approval. If specified for a "wet" area, only marine grade wood products will be approved for these areas.
- 5. Exposed faces and edges shall be faced with 1/16 inch (1 .6mm) thick material. Cover corresponding backs with approved backing and balancing sheet material. No unfinished exposed plywood/particle board will be acceptable.
- C. Hardwood Work Surfaces: Laminated edge grained hard maple (Acer saccharum), NHLA First Grade with knots, holes and other blemishes culled out, kiln dried at 8 percent or less moisture, waterproof glue, machined, sanded, and finished with NSF approved oil-sealer.
- D. Solid Surface Material (SSM): Unless otherwise specified, provide 1/2" thick 100% homogeneous filled acrylic material meeting ANSI Z124.6 Type 6, as manufactured by DuPont Company and known as Corian. Color(s) and pattern(s) as selected by the Architect/ Interior Designer.
 - 1. Comply with NSF Standard No. 51.
 - 2. Acrylic adhesive shall be used for all joints.
 - 3. Install directly over 3/4" thick (minimum) substrate of close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free surface or a commercial grade furniture particle board, Cortron or equal. Provide additional bracing and support as required by the SSM manufacturer.
 - 4. Fabrication shall be by a fabricator trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Fabricator.
 - 5. Installation shall be by an installer trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Installer.
 - 6. All fabrication and installation of Corian and all components attached to or installed in or through Corian shall be in compliance with manufacturer's instructions and the DuPont Corian Food Service Guidelines and Design Manual. Of particular concern are the sections, details, and instructions on the installation of drop-in or built-in hot or cold components.
 - 7. All other Solid Surface Material (SSM), which may be specified by others to be used in food service areas, must comply with NSF certification and ANSI Standard No. 51.
- E. Insulation
 - 1. For low temperature applications, such as ice bins, cold pans, or fabricated under counter freezers, use urethane, rigid board foam or foamed-in-place, not less than 2 inches (50mm) thick, except that vertical surfaces of cold pans and ice bins may be 1 inch (25mm) thick. Insulation shall be bonded at joints to prevent condensation on exterior.
 - 2. For refrigerated applications, such as fabricated undercounter refrigerators, use urethane rigid board foam or foamed-in-place, or Styrofoam rigid board foam 2 inches (50mm) thick, bonded at joints.
 - 3. For heated type applications, such as plate warmers, use block type rock wool, minimum 1 inch (25mm) thick.

- 4. At counter tops, subject to heat from cooking equipment and refrigeration compressors, use 1 inch (25mm) thick B&Z Products (1-800-999-0890) Marinite I, or equal, to insulate underside of top.
- 5. Marinite material shall be added between freezer or refrigerator and 14 gauge (2.0) stainless steel top.
- 6. All insulation shall be fully encased or enclosed.
- F. Joint Materials
 - 1. Sealants: 1-part or 2-part, polyurethane or silicone based, liquid elastomeric sealant, nonsolvent release type, Shore A hardness of 30, except 45 if subject to traffic. Sealants shall be NSF Listed for use in food zones. Installation shall comply with applicable requirements of NSF Standards.
 - 2. Backer Rod: 3/8 inch or larger joints shall be polyurethane rod stock, larger than joint width.
 - 3. Gaskets: Solid or hollow (but not cellular) neoprene or polyvinyl chloride, light grey, minimum of 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.
- G. Paint and Coatings
 - 1. Provide the types of painting and coating materials which, after drying or curing, are suitable for use in conjunction with food service, durable, non-toxic, non-dusting, non-flaking, mildew resistant, and comply with governing regulations for food service.
 - 2. Galvanize Repair Paint: MIL-P-21035.
 - 3. Sound Deadener: NSF listed sound deaden material such as latex sound deadener for internal surfaces of metal work and underside of metal counters and tables between work top and underbracing.
 - 4. Pretreatment: SSPC-PT2 or PT3, of FS TT-C490.
 - 5. Primer Coating for Metal: FS TT-P-86, type suitable for baking, where indicated.
 - 6. Enamel for Metal: Synthetic type, FA TT-P-491, type suitable for baking, where indicated.

2.3 FABRICATED PRODUCTS

A. Hardware

- 1. General: Manufacturer's standard, but not less than ANSI 156.9 Type 2 (Institutional), satin finish stainless steel or dull chrome finish on brass, bronze, or steel.
- 2. Hinged Door Hardware: Hinged doors shall be mounted with heavy duty NSF approved hinges with Component Hardware Group, Model No. P62-1010 pulls, or equal. Catches shall be heavy-duty magnetic type, except as otherwise indicated.
- 3. Drawer Hardware: Slides to be 200 pounds minimum capacity per pair, 300 series stainless steel, full extension, side-mounting, self-closing type, with stainless steel ball bearings and positive stops, Component Hardware Group Series S52, or equal. Pulls shall be Component Hardware Group, Model No. P62-1 012, or equal.

BID AND PERMIT SET

- 4. Sliding Door Hardware: Sliding doors shall be mounted on large, quiet ball bearing rollers in 14-gauge (2.0mm) stainless steel overhead tracks and be removable without the use of tools. Bottom of cabinet shall have stainless steel guide-pins and not channel tracks for doors.
- 5. All hardware shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.

B. Casters

- 1. Type and size as recommended by caster manufacturer, NSF approved for the type and weight of equipment supported, but not less than 5 inch (127mm) diameter heavy-duty, ball bearing, solid or disc wheel with non-marking grease proof rubber, neoprene or polyurethane tire, unless otherwise specified. Minimum width of tread shall be 1-3/16 inch (30mm). Minimum capacity per caster shall be 250 pound (113.4kg), unless otherwise noted in itemized specifications.
- 2. Provide solid material wheels with stainless steel rotating wheel guard.
- 3. To be sanitary, provide sealed wheel and swivel bearings and polished plated finish per NSF.
- 4. Unless otherwise indicated, equip each item with two (2) swivel-type casters and two (2) fixed casters. Provide foot brakes on two (2) casters on opposite front corners of equipment.
- 5. Unless equipment item is equipped with another form of all-around protective bumper, provide circular rotating bumper above each caster, 5 inch (127mm) diameter tire of light grey synthetic rubber (hollow or closed-cell) on cadmium-plated disc.
- C. Plumbing Fittings, Trim and Accessories
 - 1. General: Where exposed or semi-exposed, provide bright chrome plated brass or polished stainless steel units. Provide copper or brass where not exposed.
 - 2. Vacuum Breakers: Provide with food service equipment as listed in the itemized specifications.
 - 3. Water Outlets: At sinks and at other locations where water is supplied (by manual, automatic or remote control), furnish commercial quality faucets, valves, dispensers or fill devices of the type and size indicated and as required to operate as indicated.
 - 4. Waste Fittings: Except as otherwise indicated, furnish 2 inch (50mm) remote-lever waste valve and 3-1/2 inch (89mm) strainer basket.
- D. Electrical Materials
 - 1. General: Provide standard materials, devices and components as recommended by the manufacturer or fabricator, selected and installed in accordance with NEMA standards and recommendations and as required for safe and efficient use and operation of the food service equipment without objectionable noise, vibration and sanitation problems.
 - 2. Before ordering equipment, confirm pertinent electrical requirements with the serving electrical utility, such as actual voltages available, number of phases and number of wires in the system.
 - 3. Wire electrical work for fabricated equipment completely to a junction or pull box which is wholly accessible and mounted on the equipment. Wiring shall be labeled for outlet or item served. Verify local requirements for UL Listing on complete assembly and provide if required.

BID AND PERMIT SET

- 4. Components shall bear the UL label or be approved by the prevailing authority.
- 5. Provide Custom fabricated refrigerator units with vapor tight light receptacles, shatterproof lamps and automatic switches. Conceal wiring.
- 6. Controls and Signals: Provide recognized commercial grade signals, on-off push buttons or switches, and other speed and temperature controls as required for operation, complete with pilot lights and permanent signs and graphics to assist the user of each item. Provide stainless steel cover plates at control and signal electrical boxes. Locate controls and switches out of heat zones, in easily accessible locations that preclude accidental contact by employees.
- 7. Internal Wiring of Fixtures and Equipment
 - a. The Kitchen Equipment Contractor (KEC) shall be responsible for internal wiring of electrical devices built into or forming an integral part of fabricated equipment items. Wiring will be in metal conduit, connected to an accessible pull-box or j-box, and tagged for intended use. Refer to Section 26 Specifications for color coding of wiring.
 - b. Each standard item shipped in sections shall be properly connected internally and verified by the Kitchen Equipment Contractor (KEC).
 - c. Furnish dish washers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.
 - d. Where light fixtures are specified or detailed as part of counters, furnish and install cases or fixtures, light fixtures, lamps and shields. Provide warm white lamps unless otherwise specified. If fluorescent light fixtures are specified, provide ballasts and include shields. Provide shields for all light fixtures.
 - e. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:
 - 1) In heat zone: shall have UL approved insulation and be not less than 300volt rated heat resistant insulation with nickel wire.
 - 2) Connection wiring extended in raceway or conduit to junction or pull box shall be not less than 600 volt rated heat resistant insulation covered wire, UL approved, or equal.
 - f. Wiring for fabricated refrigerator and freezer cabinets shall be UL approved insulated cable from exterior junction box to internal components, within insulation unless code requires metallic conduit:
 - 1) Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal-Tite Flex or approved equal shall be used.
 - 2) Internal wiring shall be UL approved rubber covered 600 volt rated conductor, except door heaters, which shall be Nichrome wire with silicone braided jacket, having resistance of 10.4 watts per lineal foot.
 - 3) Mount convenience outlets, lighting receptacles, (rubber or porcelain) and door switches in approved boxes. Convenience outlets for evaporators shall be twist lock type. Solid connections, as for freezer evaporators, shall be made vapor tight.

BID AND PERMIT SET

- g. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed Seal -Tite conduit equal to Anaconda type "UA". UL approved, complete with approved liquid tight connectors on each end, and designed to provide electrical grounding continuity.
- h. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) shall not be permitted for wet areas. Exposed outlet boxes shall be liquid tight type, with threaded hubs.
- 8. Convenience and Power Outlets
 - a. Make cutouts and install appropriate boxes or outlets in fabricated fixtures, complete with wiring, conduit, outlet and stainless steel cover plate.
 - b. Outlets and plugs shall conform to NEMA standards.
 - c. Electrical outlets and devices shall be first quality "Specification Grade".
 - d. Furnish GFCI outlets where adjacent to sink compartments, as per the National Electrical Code.
- 9. Plugs and Cords: Where cords and plugs are provided, they shall comply with National Electrical Manufacturer's Association (NEMA) requirements. Indicate NEMA configuration for each applicable item.
- 10. Heating Equipment
 - a. Install electric and heating equipment as to be readily cleanable or removable for cleaning.
 - b. Steam heated custom fabricated equipment shall be a self-contained assembly, complete with control valves located in an accessible position.
- 11. Motors: Totally enclosed type, except drip-proof type where not exposed to a dust or moisture condition; ball bearings, except sleeve bearings on small timing motors; windings impregnated to resist moisture; horse-power and duty-cycle ratings as required for the service indicated.
- 12. Power Characteristics: Refer to Division 26 specifications for project power characteristics. Also, refer to individual equipment requirements, for loads and ratings.

2.4 FABRICATION OF METAL WORK

- A. General Fabrication Requirements
 - 1. Remove burrs from sheared edges of metalwork, ease the corners and smooth to eliminate cutting hazard. Bend sheets of metal at not less than the minimum radius required to avoid grain separation in the metal. Maintain flat, smooth surfaces without damage to finish.
 - 2. Reinforce metal at locations of hardware, anchorages, and accessory attachments wherever metal is less than 14 gauge (2.0mm) or requires mortised application. Conceal reinforcements to the greatest extent possible. Weld in place, on concealed faces.

BID AND PERMIT SET

- 3. Exposed screws or bolt heads, rivets, and butt joints made by riveting straps under seams and then filled with solder will not be accepted. Where fasteners are permitted, provide Phillips head, flat or oval head machine screws. Cap threads with acorn nuts, unless fully concealed in inaccessible construction, and provide nuts and lock washers unless metal for tapping is at least 12 gauge (2.5mm). Match fastener head finish with finish of metal fastened.
- 4. Where components of fabricated metal work are indicated to be galvanized and involve welding or machining of metal heavier than 16 gauge (1.6mm), complete the fabrication and provide hot-dip galvanizing of each component, after fabrication, to the greatest extent possible (depending upon available dip-tank sizes). Comply with ASTM A123.
- Welding and Soldering 5.
 - Materials 18-gauge (1.27mm), or heavier, shall be welded. a.
 - Seams and joints shall be shop welded or soldered as the nature of the material b. may require.
 - Welds must be ground smooth and polished to match original finish. c.
 - Where galvanizing has been burned off, clean and touch up the weld with high d. grade aluminum paint.
- 6. Provide removable panels for access to mechanical and electrical service connections, which are concealed behind or within food service equipment, but only where access is not possible and not indicated through other work.
- 7. Closures: Where ends of fixtures, splash backs, shelves, etc., are open, fill by forming the metal or welding sections, if necessary, to close entire opening flush to walls or adjoining fixtures.
- 8. Rolled Edges: Rolled edges shall be as detailed, with corners bull nose, ground and polished.
- 9. Coved Corners: Stainless steel food service equipment shall have 1/2 inch (13mm) or larger radius coves in horizontal and vertical corners, and intersections, per NSF standards.
- B. Metal and Gauges
 - Except as otherwise indicated, fabricate exposed metalwork from stainless steel. 1. Fabricate the following components from the gauge of metal indicated and other components from not less than 20 gauge (0.8mm) metal:

16 gauge.

16 gauge.

18 gauge.

18 gauge.

18 gauge.

16 gauge.

18 gauge.

18 gauge.

12 gauge.

18 gauge (double pan construction).

- Table and counter tops: 14 gauge. a. 14 gauge.
- Sinks and drain boards: b.
- Shelves: с.
- d. Front drawer and door panels:
- Single pan doors and drawer fronts: e.
- Enclosed base cabinets: f.
- Enclosed wall cabinets: g.
- Exhaust hoods and ventilators: h.
- Pan-type insets and trays: i.
- Removable covers and panels: j.
- Skirts and enclosure panels: k.
- Closure and trim strips over 4" wide: 18 gauge. 1.
- Hardware reinforcement: m.

BID AND PERMIT SET

n.	Gusset plates:	10 gauge.
0.	Custom channel bases:	14 gauge.

- C. Work-Surface Fabrication
 - 1. Fabricate metal work surfaces by forming and welding to provide seamless construction using welding rods matching sheet metal, grinding and polishing. Where necessary for disassembly, provide waterproof gasketed draw-type joints with concealed bolting.
 - 2. Reinforce work surfaces 30 inches on center both ways with galvanized or stainless steel concealed structural members. Reinforce edges, which are not self-reinforced, by formed edges.
- D. Metal Top Construction
 - 1. Metal tops shall be one-piece welded construction, including field joints. Secure to a full perimeter galvanized steel channel frame cross-braced not farther than 2'-6" (760mm) on center. Fasten top with stud bolts or tack welds. If hat sections are used in lieu of channels, close ends.
 - 2. Use properly designed draw fastening, trim strip, or commercial joint material to suit requirement, only if specified.
- E. Structural Framing
 - 1. Except as otherwise indicated, provide framing of minimum 1 inch (25mm) pipe-size round pipe or tube members with mitered and welded joints and gusset plates ground smooth. Provide 14 gauge (2.0mm) stainless steel tube for exposed framing, and galvanized steel pipe for concealed framing.
 - 2. Where indicated, flange rear and end edges up to form splashes integrally with top, with vertical and horizontal corners coved of not less than 1/4 inch (6mm) radius, die formed. Turn back splashes 1 inch to wall across top and ends with rounded edge on break, unless otherwise specified.
 - 3. For die-crimped edges, use inverted "V" 1/2 inch (13mm) deep inside and 2 inch (38mm) deep on outside, unless otherwise shown. For straight down flanges, make 1- 3/4 inch (45mm) deep on outside. For bull nose edges, roll down 1-3/4 inch (45mm).
 - 4. Edges: die-formed, integral with top. For rounded corners, form to 1 inch radius, weld, and polish to original finish.
- F. Field Joints: For any field joint required because of size of fixture, use butt-joints, reinforce on underside with angles of same material, bolt together with non-corrosive bolts and nuts, field weld, grind and polish.
- G. Pipe Bases: Construct pipe bases of 1-5/8 inch (41mm) diameter 18 gauge (1.2mm) stainless steel tubing. Fit legs with polished stainless steel sanitary adjustable bullet feet to provide for adjustment of approximately 1-1/2 inch (38mm), without exposing threads. Space legs to provide ample support for tops, precluding any possibility of buckling or sagging and in no case more than 6'-0" centers.

H. Legs and Cross-rails

- 1. Equipment legs and cross rails shall be 1-5/8 inch (41mm), 16-gauge (1 .59mm) stainless steel tubing.
- 2. Welds at cross rails shall be continuous and ground smooth. Please note: tack welds are not acceptable.
- 3. Camber bottom of legs inward and fit with a stainless steel bullet-type foot with not less than 2 inch (50mm) adjustment. Flanged feet with bolt holes may be required dependent on design applications. Provide proper type feet in compliance with local codes. Use stainless steel in all applications.
- 4. Peg free standing legs to floor with 1/4 inch (6mm) stainless steel rod.
- 5. Components
 - a. Stainless Steel Gusset: Stainless steel exterior to fit 1-5/8 inch (41mm) tubing, with Allen screw for fastening and adjustment. Not less than 3 inches (76mm) diameter at top and 3-3/4 inch (95mm) long. Outer shell 16-gauge (1.6mm) stainless steel, reinforced with 12-gauge (2.5mm) mild steel insert welded interior shell, or approved equal.
 - b. Stainless Steel Low Counter Legs: Stainless steel exterior 5-3/4 inch (146mm) minimum, 7 inch (1 78mm) maximum length with stainless steel 3- 1/2 inch (89mm) square plate with four counter-sunk holes, welded to top for fastening.
 - c. Stainless Steel Adjustable Foot: Stainless steel 1-1/2 inch (38mm) diameter tapered at bottom to 1 inch (25mm) diameter, fitted with threaded cold rolled rod for minimum 1-1/2 inch (38mm) diameter x 3/4 inch (19mm) threaded bushing plug welded to legs, or approved equal. Push-in foot not acceptable.
- 6. Fasten legs to equipment with gussets, as follows:
 - a. Sinks: Reinforced with bushings and set screw.
 - b. Metal Top Tables and Dish Tables: Welded to galvanized steel channels, 14gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.
 - c. Wood Top Tables: Welded to stainless steel channels, 14-gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.
- I. Shelves
 - 1. Construct solid shelves under pipe base tables of 16 gauge stainless steel, with 1-1/2 inch turned down and under edges on exposed sides, and 2 inch turn up against walls or equipment. Fully weld to pipe legs.
 - 2. In fixtures with enclosed bases, turn up shelves on back and sides with 1/4 inch (6mm) (minimum) radius and feather slightly to ensure a tight fit to enclosure panels.
- J. Sinks
 - 1. Construct sinks of 14 gauge stainless steel with No.4 finish inside and outside.
 - 2. Form back, bottom and front of one piece, with ends and partitions welded into place. Partitions: double thickness, 1 inch minimum space between walls. Multiple compartments shall be continuous on the exterior, without applied facing strips or panels.
 - 3. Cove interior vertical and horizontal corners of each tub not less than 1/4 inch radius, die formed. Outer ends of drain boards to have roll rim risers not less than 3 inches high.

- 4. Drill faucet holes in splashes 2-1/2 inches below top edge. Verify center spacing with faucet specified.
- 5. Sink insets shall be deep drawn of 16-gauge (1 .59mm), or heavier, polished stainless steel. Weld into sink drain boards with 1-1/2 inch x 1-1/2 inch x 14 gauge stainless steel angle brackets, securely welded to sinks and galvanized cross angles spot welded to underside of drain boards to form an integral part of the installation.
- 6. The bottom of each compartment shall be creased such as to ensure complete drainage to waste opening. Slope bottom of sink bowls toward outlet.
- K. Drains, Wastes and Faucets
 - 1. Furnish and install T&S Brass faucets model B-3940-01 stainless steel rotary drain assembly with connected overflow assembly, in die-drawn inset type sinks and bain-marie sinks.
 - 2. Other custom fabricated sinks shall be furnished with T&S Brass faucets model B3940-01 stainless steel rotary drain assembly, with S/S cap nut over overflow outlet. Waste connection shall have 2 inch (50mm) external thread size, with 1-1/2 inch (38mm) internal thread size.
 - 3. Rotary Handle: Of sufficient length to extend to front edge of sink. No riveting, screws or soldering permitted to fit drains to sinks, with all parts of drains easily removable for servicing and replacement. Rotary handle bracket to be provided as part of the sink fabrication.
 - 4. Water pans for steam tables shall be fitted with 1 inch (25mm) drains with chrome-plated brass stand pipes.
 - 5. All faucets furnished with equipment included in this Section shall be lead-free and comply with NSF Standard #61, Section #9, such as manufactured by Fisher, Chicago, or T&S. Where the itemized specifications list a faucet by manufacturer and model, the Kitchen Equipment Contractor (KEC) shall verify that the listed faucet complies with this requirement.
 - 6. If the listed faucet does not comply, the Kitchen Equipment Contractor (KEC) shall submit similar model which does comply from the same manufacturer where available or from one of the above manufacturers.
- L. Workmanship
 - 1. Best quality in the trade. Field verify dimensions before fabricating, conform all items to dimensions of building, neatly fit around pipes, offsets and other obstructions.
 - 2. Fabricate only in accordance with approved shop drawings, showing pipes, obstructions to be built around, and location of utilities and services.

M. Enclosures

- 1. Provide enclosures, including panels, housings, and skirts for service lines, operating components and mechanical and electrical devices associated with the food service equipment, except as specifically indicated to be "open".
- 2. Where equipment is exposed to customer view, enclose of service lines, operating components, and mechanical and electrical devices.

BID AND PERMIT SET

N. Casework

- 1. Enclosure: except as otherwise indicated, provide each unit of casework (base, wall, overhead and free-standing) with a complete-enclosure metal cabinet, including fronts, backs, tops, bottoms, and sides.
- 2. Bases shall be made of 18-gauge (1.27mm) stainless steel sheets reinforced by forming the metal.
- 3. Ends, partitions and shelves are stainless steel.
- 4. Unexposed backs and structural members are galvanized.
- 5. Vertical ends and partitions are single wall, with a 2 inch (50mm) face.
- 6. Sides and through partitions are flush with bottom rail, welded at intersections.
- 7. Shelves: Provide adjustable standards for positioning and support of shelves in casework, except bottom shelf of cabinet mounted on legs or as specified. Turn back of shelf units up 2 inches and hem. Turn other edges down to form open channel. Reinforce shelf units to support 40 pounds per square foot loading, plus 100 percent impact loading.
- 8. Bottom front rail of bases set on masonry platform shall be continuously closed and sealed to platform.

O. Doors

- 1. Metal doors shall be double-cased stainless steel. Outer pans shall be 18-gauge (1.27mm) stainless steel with corners welded, ground smooth and polished. Inner pan shall be 20-gauge (.95mm) stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or Styrofoam used as a core. The two pans shall be tack welded together and joints solder filled. Doors shall finish approximately 3/4 inch (19mm) thick and be fitted with flush recessed type stainless steel door pulls.
- 2. Wood doors shall be fabricated as detailed. If Formica or other plastic surfaces are used, sides and backs must be laminated.
- 3. Hinged doors shall be mounted on heavy-duty NSF approved hinges, or as noted on plans or specifications.
- P. Drawer Assemblies
 - 1. Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with fully enclosed housing.
 - 2. Slide assembly consists of one pair of 200 pound stainless steel roller bearing extension slides, with side and back enclosure panels, front spacer angle, two drawer carrier angles secured to slides and stainless steel front.
 - 3. Drawer bodies for general storage are to be 20 inches x 20 inches (508mm x 508mm), with 18 gauge stainless steel containers.
 - 4. Drawers intended to hold food products shall be removable type with 12 x 20 (305mm x 508mm) stainless steel food pans in a stainless steel assembly.
 - 5. Drawer fronts are double cased, 3/4 inch (19mm) thick with 18 gauge (1.27mm) stainless steel welded and polished front pan. Steel back pan is tightly fitted and tack welded. Sound deaden with rigid insulation material.
 - 6. Provide drawers with replaceable soft neoprene bumpers or for refrigerated drawers, a full perimeter soft gasket.
BID AND PERMIT SET

- Q. Closed Base: Where casework is indicated to be located on a raised-floor base, prepare casework for support without legs and for anchorage and sealant application, as required for a completely enclosed and concealed base.
- R. Support from Floor: Equip floor supported mobile units with casters and equip items indicated as roll-out units with manufacturer's standard one-directional rollers. Otherwise, and except for closed-base units, provide pipe or tube legs with adjustable bullet-design feet for floor supported items of fabricated metalwork. Provide 1-1/2 inch adjustment of feet (concealed threading).
- S. Shop Painting
 - 1. Clean and prepare metal surfaces to be painted. Remove rust and dirt. Apply treatment to zinc coated surfaces which have not been mill phosphatized. Coat welded and abraded areas of zinc coated surfaces with galvanize repair paint.
 - 2. Apply 1.5 mil (dry film thickness) metal primer coating, followed by 2, 1.0 mil (dry film thickness) metal enamel finish coatings.
 - 3. Bake primer and finish coatings in accordance with paint manufacturer's instructions for a baked enamel finish.
- T. Sound Deadening
 - 1. Sound deaden underside of metal tops, drain boards, under shelves, cabinet interior shelves, etc., above the underbracing/reinforcing/framing only.

2.5 FILTER EXHAUST HOODS

- A. Filter Exhaust Hoods
 - 1. 18 Gauge type 304 stainless steel external welded construction, in accordance with the latest edition of NFPA No.96, including all applicable appendices. Exposed welds to be ground and polished.
 - 2. Grease Removal: UL classified, non-adjustable, stainless steel grease filters with dripchannel gutters, drains and collection basins.
 - 3. Light Fixtures: Furnish type of fixture specified. Fixtures shall be UL listed for hoods, NSF approved, with sealed safety lenses and stainless steel exposed conduit for wiring.
 - 4. Exhaust Duct: Furnish welded stainless steel formed duct collars at ceiling or wall duct connections, where exposed. Furnish exposed to view ductwork as specified. Verify size and location of duct connections required in this contract, before fabrication. Other ductwork will be by the Mechanical Section.
 - 5. Fire Extinguishing System: Pre-piped liquid chemical or water fire suppressant system, as specified, complying with applicable local and NFPA regulations. Wet chemical fire suppression systems shall comply with UL 300 Standards.

BID AND PERMIT SET

2.6 REFRIGERATION EQUIPMENT

A. General

- 1. Furnish either single or multiple compressor units, as specified or recommended by the manufacturer for the sizes and variations between connected evaporator loads as indicated.
- 2. Furnish units of the capacities indicated, arranged to respond to multiple-evaporator thermostats and defrosting timers. Include coils, receivers, compressors, motors, motor starters, mounting bases, vibration isolation units, fans, dryers, valves, piping, insulation, gauges, winter control equipment and complete automatic control system.
- 3. Refrigerant: Pre-charge units with type or types recommended by manufacturer for services indicated, with quick-disconnect type connections where specified, ready to receive refrigerant piping runs to evaporators and (where remote) to condensers. All refrigerant and associated components shall comply with the requirements of the Montreal Protocol Agreement. No CFC refrigerants or associated components shall be used where available. HCFC refrigerants and components, with a minimum 2010 phase-out date, and intermediate replacement refrigerants are to be used only when HFC refrigerants are not available. Kitchen Equipment Contractor (KEC) shall be responsible for coordinating with manufacturers. Provide refrigerant leak monitoring devices where required by federal, state, or local codes.
- 4. The minimum outdoor operating ambient temperature for design of units is -10 degrees Fahrenheit, or as applicable for extreme low local conditions. The maximum indoor design temperature for operation of compressor units is 95 degrees Fahrenheit. The maximum outdoor ambient design temperature shall be determined with prevailing conditions at mounting location(s) of compressor(s), such as sun exposure, limited ventilation, high fences/walls, roof color and materials, local climatic extremes, etc., but in no case shall it be less than 100 degrees Fahrenheit.
- B. Components
 - 1. Coils: Coils for fabricated refrigerators shall have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
 - 2. Expansion Valves: Remote refrigeration system shall be complete with thermostatic expansion valves at the evaporator.
 - 3. Thermometers
 - a. Fabricated refrigerated compartments to be fitted minimally with a flush dial thermometers, with chrome plated bezels and to be provided as specified.
 - b. Thermometers shall be adjustable and shall be calibrated after installation.
 - c. Thermometers shall have an accuracy of ± 2 degrees Fahrenheit (1 degree Centigrade).
 - 4. Hardware
 - a. Refrigerator hardware for fabricated refrigerator compartments shall be heavy-duty components.
 - b. Self-closing hinges.
 - c. Latches to be magnetic edge mount type, unless specified or detailed otherwise.

- 5. Locks
 - a. Doors and drawers for walk-in coolers/freezers and reach-in refrigerated compartments, both fabricated and standard, shall be fitted with cylinder locking type latches and provided with master keys.
- C. Cold Pans: Ice pans, refrigerated pans and cabinets shall be provided with breaker strips, where adjoining top or cabinet face materials, to prevent transfer of cold.
- D. All open top mechanically cooled custom fabricated or standard buy-out refrigerators and/or cold pans shall comply with NSF Standard #7 requirements, as of April 1, 1998. The Kitchen Equipment Contractor (KEC) shall verify that the specified unit complies with this requirement or submit a similar model, which does comply, from the same manufacturer where available.
- E. Ventilation of Refrigerated Equipment
 - 1. Adequate ventilation shall be provided for custom fabricated equipment with integral refrigeration condensing units, both built-in and drop-in. If flow through ventilation cannot be provided, provide flow direction partitions and an additional fan capable of cooling the condensing unit.
 - 2. If, in the opinion of the Kitchen Equipment Contractor (KEC), additional room ventilation is required to ensure correct operating temperatures of standard buy-out, custom fabricated or remote refrigeration condensing units, or compressor rack assemblies, they shall so state in a letter to the Architect for evaluation and direction.

2.7 MISCELLANEOUS MATERIALS

- A. Nameplates: Whenever possible, locate nameplates and labels on manufactured items, in accessible position, but not within customer's normal view. Do not apply name-plates or labels on custom fabricated work, except as required for compliance with governing regulations, insurance requirements, or operator performance.
- B. Manufactured Equipment Items: Furnish items as scheduled or herein specified. Verify dimensions, spaces, rough-in and service requirements, and electrical characteristics before ordering. Provide trim, accessories and miscellaneous items for complete installation.
- C. Insert Pans
 - 1. General: Provide cut-outs, openings, drawers, or equipment specified or detailed to hold stainless steel insert pans with a full complement of pans as follows:
 - a. One (1) stainless steel, 20-gauge (0.95mm) minimum, solid insert pan for each space, sized per plans, details, or specifications.
 - b. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size pan for each opening.
 - c. Provide maximum depth pan to suit application and space.
 - 2. Provide 18-gauge (1.27mm) removable stainless steel adapter bars where applicable.

- 3. Provide all cut-outs and openings or equipment specified or detailed to hold stainless steel insert pans with a hinged stainless steel removable night cover.
- D. Tray Slides: Before fabrication of counters with tray slides, verify:
 - 1. Size and shape of tray. Edge of tray shall not overhang outer support/slider by more than 2". If edge of tray exceeds this dimension, notify Architect, in writing, for evaluation and adjustment, if necessary.
 - 2. Configuration of corners, turns, and shape of tray slides for proper support and safe guidance of trays.
 - 3. Tray slide capable of supporting 200 pounds per linear foot, live load.
- E. Self-leveling dispensers: Verify type and make of ware, dimensions and weight, request samples from Operator and submit to the dispenser manufacturer for proper sizing and calibration of dispensers.
- F. Carbon dioxide (co') equipment: Where equipment requires connection with compressed co' cylinder for operation, provide proper sized cylinder manifold and control system (integral with equipment) with proper connectors for Department of Transportation (DOT) approved type cylinders, complete with cylinder safety devices and supports.
- G. Reasonable quietness of operation of equipment is a requirement. The Kitchen Equipment Contractor will be required to replace or repair any equipment producing out-of-the-ordinary intolerable noise. This also includes providing and installing bumpers and gaskets for doors and drawers on fabricated and standard manufactured items and sound insulation where feasible.

2.8 ITEMIZED SPECIFICATIONS

- A. Refer to the following pages for specific specification information on each item included in this Section.
- ITEM 1 MANAGERS STATION: 1 REQUIRED
 - A. Owner furnished and installed.
- ITEM 2 STAFF LOCKERS (HALF SIZE): 6 REQUIRED
 - A. Specified by Architectural Division.

ITEM 3 DRY STORAGE SHELVING: 1 LOT REQUIRED

A. InterMetro, Super Adjustable Super Erecta *H011 super adjustable shelving. Shelf sections shall be five tier high using individual posts with adjustable feet, top caps, and joining clamps equally spaced over 86-5/8 inch plated posts with bottom shelf located 8 inches above finished floor. Install in sizes and configuration as shown on Sheet FS1.1.

BID AND PERMIT SET

- B. Include one 22" x 48" HP2248PD dunnage rack.
- C. Verify room size before ordering.

ITEM 4 CORNER/CHANNEL GUARDS: 1 LOT REQUIRED

- A. Fabricate as detailed and construct vertical corner/channel guards and low wall caps of one piece all welded 14 gauge stainless steel. Install in locations shown on Sheet FS1.1. Install with stainless steel screws.
- B. Seal guards to walls and at joints as required.

ITEM 5 HAND WASHING SINKS: 2 REQUIRED

- A. Advance Tabco, model 7-PS-62*H011.
- B. Seal to wall.
- ITEM 6 SLIM JIMS: 2 REQUIRED
 - A. Rubbermaid, model FG354000 *H011. Color: light gray.

ITEM 7 UTILITY CARTS: 2 REQUIRED

A. Lakeside, model 243 *H011 with set of four round corner bumpers.

ITEM 8 WALK-IN COLD STORAGE ROOMS: 2 REQUIRED

- A. Imperial Manufacturing, modular sandwich panel design Foam-A-Lite cold storage rooms complete in configuration shown on Sheet FS1.1. Each room shall incorporate the following:
 - 1. Provide one each cooler and freezer walk-in doors and door frames 36 inch x 78 inch stainless steel inside and out with 14 inch x 14 inch insulated glass window (heated for freezer) and 36" high 1/8" polished aluminum diamond tread plate interior and exterior kick plates. Doors hinged as shown on plan. Include Kason #944 deadbolt mortise locksets with interior safety releases, exterior Kason #1229 chrome pull handles, interior Allegis #3200CH Chrome heavy-duty door handle, Kason #1094000013 concealed mounting door closers, and Kason #1248 chrome spring assisted hinges (three per door). Hinge doors as shown on plans.
 - 2. Provide 1/8" polished aluminum diamond tread plate wainscot up to 36" above finished floor on exposed exterior face of walk-ins.
 - 3. Exposed exterior, closure panels, and trim strips to adjacent walls and ceiling shall be 20 gauge stainless steel finish. Exposed interior shall be .040 stucco embossed aluminum except ceiling which shall be .040 aluminum with baked white acrylic finish. Unexposed surfaces shall be 26 gauge galvanized steel.

BID AND PERMIT SET

- 4. Finished exterior height of 8 foot-10 inches. Interior height of rooms shall be 8 foot-6 inches. All insulation shall be 4 inch thick foamed in place, Class 1, urethane insulation including insulation in floor depression. See Sheets FS3.1 for depression details.
- 5. Install surface mounted 4-1/2 inch diameter dial thermometers above each door.
- 6. Heated vacuum vent for freezer.
- 7. Provide 3/8 inch diameter nylon coil hangers mounted on 3 inch x 3 inch aluminum plates with nuts and retainers to support evaporator hung from ceiling panel.
- 8. Furnish penetrations to accommodate all electrical, plumbing, and refrigeration lines. Furnish stainless steel escutcheons.
- 9. Provide Kason 48" long 1810 LED cooler and freezer ceiling light fixtures as noted on Sheet FS1.4 (four fixtures in each room). Field connections under Division 26. Include lamps.
- 10. Provide Kason, model 1908-603 press type switches mounted inside and outside of each room as indicated on electrical plan.
- 11. All electrical conduit shall be run concealed within the walk-in walls or above the ceiling panels (coordinate with electrician)
- 12. Install in floor depression complete with 6" Class 1 R-Max thermal insulation board and vapor barrier of 15 lb. felt protective slip sheet applied over insulation and flashed up height of cove and joints lapped 6" minimum.
- 13. Refer to Architectural Room Finish Schedule for cooler/freezer wearing floor and base material inside and out by Division 9.
- 14. Walk-ins shall bear Oregon State Seal.
- B. Walk-ins shall comply with current state energy codes.
- C. Walk-ins shall be installed by this manufacturer or this manufacturer's certified installer only and must have a minimum 5 years' experience installing Imperial walk-ins.
- D. Walk-in doors are to be secured in the "open" position until the concrete sub-floor cures and until manufacturer states that it is safe to close. Oxidized panels will be replaced at the Contractors' expense.

ITEM 9 REFRIGERATION SYSTEMS: 2 REQUIRED

- A. System A: Cooler @ $+35^{\circ}F$ to $+40^{\circ}F$
 - 1. Evaporator: Trenton TPLP209MAS1BR6-ESP; 8,687 BTU at 20°F suction temperature. Include expansion valve, drier strainer, liquid line solenoid, and room thermostat.
 - 2. Condensing Unit: Trenton TEHA010M8-HTC3; 9,2580 BTU at 90° ambient air temperature. Include crank case heater.
- B. System B: Freezer @ -10° F to $+0^{\circ}$ F
 - 1. Evaporator: Trenton TPLP209LES2BR6-ESPE; 9,000 BTU at -15°F suction temperature. Include expansion valve, drier-strainer, liquid line solenoid, room thermostat, and electric defrost system.
 - 2. Condensing Unit: Trenton TEHA025L6-HTC3; 9,300 BTU at +90°F ambient air temperature. Include crank case heater.

BID AND PERMIT SET

- C. Each system shall incorporate the following:
 - 1. Flexible vibration eliminator in suction line.
 - 2. Circuit breaker, automatic starting switch, motor protectors and pressure limit switch, all enclosed with interconnecting wire installed in a junction box ready for line connections.
 - 3. Liquid line dehydrator filter of ample capacity.
 - 4. Suction line filter of ample capacity.
 - 5. Thermal expansion valve for evaporator.
 - 6. Thermostat set to cut-in at -3°F and cut-out at -6°F for freezer. Cut-in at +38°F and cutout at +34°F for refrigerator.
 - 7. Suction pressure regulator.
 - 8. Crank case heaters.
 - 9. Refrigerant Lines: Hard copper type "L" with "Silfos" brazed joints. Use refrigeration service tubing.
 - 10. Full charge refrigerant and oil.
 - 11. Condensing units are located outside on the roof above the Kitchen. Verify exact location with Architectural plans. Raised pad specified by architectural division.
 - 12. Beacon II System Controller. Locate inside Kitchen Office as shown on Sheet FS1.4.
- D. Where refrigerant suction lines are trapped, use next size smaller pipe in vertical portion of the trap than that indicated so as to acquire sufficient gas velocity for proper oil return.
- E. Provide anti-sweat pipe covering 3/4 inch Armstrong Armaflex or equivalent for suction lines from evaporator to condensing unit.
- F. Provide painted 1 inch drain tubing from evaporator to nearest indirect drain as shown on Sheet FS1.2. Trap at outlet end.
- G. Provide Raychem, model H611250 heating cable with H900 power connection to wrap all drain lines running through freezer.
- H. Evaporators and condensing units as shown on the Contract Documents shall be installed under the supervision of a licensed Refrigeration Contractor subject to review by the Consultant.
- I. Provide testing, charging, adjusting, operational testing, and cleaning of equipment and lines.

ITEM 10 WALK-IN COOLER SHELVING: 1 LOT REQUIRED

- A. InterMetro, Metroseal 3 *H011 Super Adjustable wire shelving. Shelf sections shall be four tier high using 74-5/8 inch high individual posts with adjustable feet, and top caps equally spaced with bottom shelf located 8" above finished floor. Install in sizes and configuration as shown on Sheet FS1.1.
- B. Include one 22" x 48" HP2248PD dunnage rack.
- C. Verify room size before ordering.

BID AND PERMIT SET

ITEM 11 WALK-IN FREEZER SHELVING: 1 LOT REQUIRED

- A. InterMetro, Metroseal 3 *H011 Super Adjustable wire shelving. Shelf sections shall be four tier high using 74-5/8 inch high individual posts with adjustable feet, and top caps equally spaced with bottom shelf located 8" above finished floor. Install in sizes and configuration as shown on Sheet FS1.1.
- B. Include one 22" x 48" HP2248PD dunnage rack.
- C. Verify room size before ordering.

ITEM 12 MOP SINK CABINET: 1 REQUIRED

- A. Advance Tabco, model 9-OPC-84DL-300 *H011 left side with the following accessories:
 - 1. Model TA-46 door lock,
 - 2. Model K-94-BACK-300 stainless steel back panel.
 - 3. Model K-472 service faucet holes; verify height.
 - 4. Service faucet specified by Plumbing Division.
 - 5. 18-gauge type "304" stainless steel cabinet.
- B. Install assembly complete.

ITEM 13 NOT USED

ITEM 14 NOT USED

ITEM 15 SHEET PAN RACKS: 3 REQUIRED

A. New Age, model 1331-PB *H011.

ITEM 16 MOBILE INSULATED HOLDING CABINET: 1 REQUIRED

A. Cres-Cor, model 100-1841D *H011 transport cart with the following accessories:

- 1. Perimeter bumper.
- 2. Push handle.
- 3. Two Kold Keepers.
- B. Furnish complete.

ITEM 17 MOBILE WASTE RECEPTACLES: 6 REQUIRED

A. Rubbermaid, model FG263200 *H011 with FG264043 dolly and FG263100 matching lid. Color: grey.

FOOD SERVICE EQUIPMENT

BID AND PERMIT SET

ITEM 18 VEGETABLE PREP SINK TABLE: 1 REQUIRED

- A. Pacific Stainless Products, model DCS-3024-14-B42 *H011 fully welded custom sink table. Sink table shall incorporate the following:
 - 1. T & S, model B-0133-ADF08-B spray rinse faucet with 8" add-on faucet. Include wall bracket. Install behind single pre-rinse sink.
 - 2. Two Component Group, model DSS-8000 rotary waste assemblies with 14 gauge stainless steel lever waste brackets welded to underside of sink compartment.
 - 3. Model PRSTM full length cantilever potrack with shelf (notch shelf around spray rinse). Seal post openings in backsplash.
 - 4. Sound deaden underside of top and sink compartment.
 - 5. Stainless steel under shelf below left drain board.
 - 6. Rear and end stainless steel leg set bracing below right drain board to allow for mobile waste receptacle.
- B. Install assembly complete. Clip and seal to wall.

ITEM 19 REACH-IN REFRIGERATOR: 1 REQUIRED

A. Traulsen, model RHT232WUT-FHS *H011 with doors hinged standard.

ITEM 20 MOBILE HOT HOLDING CABINETS: 2 REQUIRED

A. Cres-Cor, model H-137-UA-12D *H011 with Key Lock handle and Perimeter Bumper.

ITEM 21 ISLAND COOK'S TABLES WITH CIRCULAR POT RACKS: 2 REQUIRED

- A. Pacific Stainless Products, model WKS-8430-IS *H011 fully welded table with the following accessories:
 - 1. One model SDAS-202006S stainless steel drawer assembly as shown.
 - 2. Model PRC-84-TMS full length table mount circular potrack with shelf.
 - 3. Adjustable stainless steel flanged feet.
 - 4. Stainless steel under table mount electrical receptacle at end of table per Sheet FS1.4.
- B. Install assembly complete.

ITEM 22 MICROWAVE OVEN: 1 REQUIRED

A. Panasonic, model NE-1025 *H011.

ITEM 23 CANOPY HOOD WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

A. Gaylord, model ELX-GBD-DCA-66 *H011 2'-6" high 18 gauge stainless steel canopy hood. Refer to factory file #18-1156. The hood shall incorporate the following:

BID AND PERMIT SET

- 1. UL listed damper assembly.
- 2. LED light fixtures. Furnish and install lamps.
- 3. Model 150-LS light on/off switch. Furnish loose for installation by Division 16.
- 4. Ansul R102-ASEF-1T-4N Restaurant Fire Suppression System with Automan Regulated Release Assembly furnished and installed by Gaylord. Install in accordance with NFPA bulletin 96, including all current amendments to protect this hood including surface protection as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Gaylord. All contactors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation. System control cabinet shall be installed in location shown.
- 5. Include 18 gauge stainless steel removable closure panels and trim as required to seal hood to ceiling and walls. Verify ceiling height. Submit shop drawings prior to fabrication.
- 6. Install hood with 80" clearance from finished floor.
- B. Exhaust and supply duct work and fans furnished and installed by Division 23.

ITEM 24 STAINLESS STEEL WALL FLASHING: 1 LOT REQUIRED

- A. Fabricate 20 gauge stainless steel Number 4 finish wall flashing bonded to gypsum board with heat resistant mastic beginning directly above base tile on wall and terminating 2" above bottom edge of canopy hood. Flashing shall run full length of canopy hood.
- B. Note: ceiling and wall flashing shall meet Mechanical Code Sections 507.4 and 507.9. Verify all requirements and provide flashing (insulated for 1 hour rating if required) to meet the codes.
- C. Install flashing with no exposed fasteners or screws in interlocking sections of equal lengths. Verify that surfaces are flat and smooth with a maximum variation of 1/16" in 10 feet.
- D. Install assembly complete

ITEM 25 DOUBLE STACK COMBI-OVEN STEAMER/CONVECTION OVEN: 1 REQUIRED

- A. Blodgett, model BX-14G *H011 combi-oven/steamer stacked with DFG-200 *H011 convection oven with the following accessories:
 - 1. Everpure Kleensteam water filtration system. Include two extra filter media per oven (turn over to Owner for inventory).
 - 2. Stacking kit
 - 3. Backflow preventer.
 - 4. Three fry baskets.
 - 5. Installation Kit.
 - 6. 6" heavy-duty casters; two with brakes and approved restraining device.

BID AND PERMIT SET

B. Install assembly complete.

ITEM 26 BOIL COOK TOP: 1 REQUIRED

A. Garland, model 36ES15 *H011 with 6" high swivel casters with brakes.

ITEM 27 12-GALLON TILTING KETTLE WITH STAND: 1 REQUIRED

- A. Cleveland, model KET-12-T *H011 with the following accessories:
 - 1. Model ST-28 stainless steel stand with removable drain drawer.
 - 2. Lift-off cover.
 - 3. Double pantry fill faucet with swing spout.
 - 4. Lid hanging bracket.
 - 5. Food strainer for pour spout and drain strainer.
 - 6. Measuring strip.
- B. Install assembly complete.

ITEM 28 MOBILE POT AND PAN SHELVING: 1 REQUIRED

- A. InterMetro, model PR48VX3 *H011.
- ITEM 29 NOT USED
- ITEM 30 NOT USED
- ITEM 31 NOT USED
- ITEM 32 NOT USED
- ITEM 33 NOT USED

ITEM 34 POT WASHING SINK TABLE: 1 REQUIRED

- A. Pacific Stainless Products, model TCS-(1)2824L-(2)2424-14-Bf30L-B36R *H011 fully welded custom "Spec Line" sink table in configuration per plan. Include the following accessories:
 - 1. T & S, model B-0133-ADF08-B spray rinse faucet with 8" add-on faucet. Include wall bracket. Install between 24" long sinks.
 - 2. T & S, model B-0230-LN with 061X spout splash mount faucet installed between 24" and 28" long sinks.

BID AND PERMIT SET

- 3. Three Component Hardware Group, model DSS-8000 rotary waste assemblies with 14 gauge stainless steel lever waste brackets welded to underside of triple sink compartments.
- 4. 14" deep sinks.
- 5. Sound deaden underside of top and sink compartments.
- B. Submit factory drawing for approval.
- C. Install assembly complete. Clip and seal to wall.

ITEM 35 CLEAN DISHTABLE: 1 REQUIRED

- A. Fabricate as detailed and construct top and back splash of one piece all welded 14 gauge stainless steel. Reinforce underside of top with enclosed stainless steel hat sections. Sound deaden underside of top and mount on a stainless steel leg stand consisting of circular gussets, tubular legs, and adjustable bullet feet. Reinforce legs with 16 gauge stainless steel shelf and/or leg braces as shown. Soiled Dishtable shall incorporate the following:
 - 1. Install table limit switch furnished with Item 37.
- B. Install assembly complete.
- C. Clip and seal to walls.

ITEM 36 VAPOR EXHAUST DUCTS: 2 REQUIRED

- A. Fabricate two 18 gauge stainless steel steam tight exhaust ducts as detailed and connect to stainless steel vent stacks furnished with Warewasher, Item 37. Extend each duct 4 inches above finished ceiling and trim with stainless steel at ceiling penetrations. Seal all gaps at trim.
- B. Exhaust fan furnished and installed under Division 23.

ITEM 37 WAREWASHER WITH BOOSTER HEATER: 1 REQUIRED

- A. Hobart, model CL44eN-EGR *H011 with 30 KW electric booster heater and tank heat for left to right operation. Include the following:
 - 1. Stainless steel vent hoods.
 - 2. Table limit switch.
 - 3. 6 inch higher than standard chamber.
 - 4. Flanged stainless steel feet.
- B. Install assembly complete.

BID AND PERMIT SET

ITEM 38 SOILED DISHTABLE WITH TRAY RETURN WINDOW: 1 REQUIRED

- A. Fabricate as detailed and construct top, back/endsplashes, and pass-thru tray return window of one piece all welded 14 gauge stainless steel. Include all welded integral stainless steel sink as shown. Reinforce underside of top with enclosed stainless steel hat sections. Sound deaden underside of top and sink compartment and mount on a stainless steel leg stand consisting of circular gussets, tubular legs, and adjustable bullet feet. Reinforce legs with 16 gauge stainless steel shelves and/or leg braces as shown. Soiled Dishtable shall incorporate the following:
 - 1. T & S, model B-0133-ADF08-B spray rinse faucet with 8" add-on faucet. Include wall bracket. Install behind single pre-rinse sink.
 - 2. Weld-in Item 39 sink adapter flange at single pre-rinse sink.
 - 3. Pre-rinse sink to include 14 gauge stainless steel removable rack glides held in place with stainless steel bar stock welded to sink sides.
 - 4. Coordinate pass-thru window and coiling door tracking interface with General Contractor.
- B. Install assembly complete.
- C. Clip and seal to walls.

ITEM 39 DISPOSER: 1 REQUIRED

- A. Red Goat, model A2P-RSA7 *H011 with the following accessories:
 - 1. RAC2-KP Nema 4X control.
 - 2. Water flow controls to include flow control valve, solenoid valve, and vacuum breaker.
- B. Install assembly complete in single pre-rinse sink at Soiled Dishtable.

ITEM 40 HOSE REEL WITH CONTROL CABINET: 1 REQUIRED

- A. T & S, model B-7102-01 *H011. Include model B-2339-LR recessed reel rinse control box assembly. Install in location shown. Coordinate recess in wall with General Contractor.
- B. Install in location shown. Coordinate recess in wall with General Contractor.
- C. Install assembly complete. Seal to wall.

ITEM 41 FLATWARE/TRAY PICK-UP CARTS: 2 REQUIRED

A. Cambro, model TDC2029 *H011. Verify color with architect before ordering.

ITEM 42 FLAT TOP FOOD SERVING COUNTERS: 2 REQUIRED

A. Low Temp Colorpoint, model 36-ST *H011 with the following accessories:

BID AND PERMIT SET

- 1. 36" counter top height.
- 2. 34" tray slide height.
- 3. Solid 'V' ridge stainless steel tray slide.
- 4. Plastic laminate faced base cabinet in color and pattern as selected by the Owner.
- 5. Include cam operated line-up locks.
- B. Install assembly complete.

ITEM 43 HEATED PASS-THRU GRAB 'N GO CASES: 2 REQUIRED

A. Hatco, model GR2SDS-24D *H011 with black designer corner caps, inset, and unit panels.

ITEM 44 HOT FOOD SERVING COUNTERS: 2 REQUIRED

A. LTI, model QSCHP-3-F *H011 with the following accessories:

- 1. 36" counter top height.
- 2. 34" tray slide height.
- 3. Solid 'V' ridge stainless steel tray slide.
- 4. BSI, model ZG9930 with display lights. Powder coat black finish. Counter top mount with narrow flanges.
- 5. Plastic laminate faced base cabinet in color and pattern as selected by the Owner.
- 6. Include cam operated line-up locks.
- B. Install assembly complete.

ITEM 45 COLD FOOD SERVING COUNTERS: 2 REQUIRED

- A. Low Temp Colorpoint, model 36-CFMA *H011 with the following accessories:
 - 1. 36" counter top height.
 - 2. 34" tray slide height.
 - 3. Solid 'V' ridge stainless steel tray slide.
 - 4. BSI, model ZG9930 with display lights. Powder coat black finish. Counter top mount with narrow flanges.
 - 5. Plastic laminate faced base cabinet in color and pattern as selected by the Owner.
 - 6. Include cam operated line-up locks.
- B. Install assembly complete.

ITEM 46 MOBILE REFRIGERATED MILK COOLER: 1 REQUIRED

A. Beverage Air, model ST34N-S *H011 with exterior stainless steel finish.

BID AND PERMIT SET

ITEM 47 PORTABLE TRAFFIC CONTROL RAILINGS: 1 LOT REQUIRED

- A. Tensator, TensaBarrier system, model 889T2 *H011 double tape system with Basics Base and modular cassette.
- B. Refer to Sheet FS1.1 for layout and configuration.
- C. Verify tape color with Architect.

ITEM 48 DOUBLE-SIDED ICED SALAD BARS: 2 REQUIRED

- A. Cambro, model VBRHD6 *H011 with heavy duty casters. Include 34" high double-sided tray rails, end tables at each end, and full size covers for all wells. Provide with six Camchiller inserts for each unit.
- B. Color: Black.

ITEM 49 FLAT TOP MOBILE COUNTERS: 2 REQUIRED

- A. Low Temp Colorpoint, model 50-ST-EB *H011 with the following accessories:
 - 1. 36" counter top height.
 - 2. Plastic laminate faced base cabinet in color and pattern as selected by the Owner.
- B. Install assembly complete.

ITEM 50 REACH-IN REFRIGERATED MERCHANDISING CASES: 2 REQUIRED

A. True, model GDM-7-S-LD *H011.

ITEM 51 REACH-IN FREEZER MERCHANDISING CASES: 2 REQUIRED

A. True, model GDM-7F-LD *H011 with stainless steel exterior finish.

ITEM 52 MOBILE CASHIER STATIONS: 2 REQUIRED

- A. Cambro, model VCSWRHD *H011 with heavy duty casters. Include double-sided tray rails positioned at low height.
- B. Color: Black.

ITEM 53 POINT OF SALE SYSTEM: 1 LOT REQUIRED

A. Owner furnished and installed.

FOOD SERVICE EQUIPMENT

BID AND PERMIT SET

ITEM 54 DOUBLE-SIDED ICED CONDIMENT BAR: 1 REQUIRED

- A. Cambro, model VBRT6110 *H011 with heavy duty casters. Include 34" high double-sided tray rails, end tables at each end, and full size covers for all wells. Provide with six Camchiller inserts.
- B. Color: Black.

PART 3 - EXECUTION

3.1 SUPERVISION

A. A competent supervisor, representing the Kitchen Equipment Contractor (KEC), shall be present at all times during progress of the Kitchen Equipment Contractor (KEC)'s work.

3.2 SITE EXAMINATION

- A. Verify site conditions under the provisions of the General Conditions, Supplementary Conditions and applicable provisions of Division 1 Sections. Notify the Architect, in writing, of unsatisfactory conditions for proper installation of food service equipment.
- B. Verify wall, column, door, window, and ceiling locations and dimensions. Fabrication and installation should not proceed until dimensions and conditions have been verified and coordinated with fabrication details.
- C. Verify that wall reinforcement or backing has been provided and is correct for wall supported equipment. Coordinate placement dimensions with wall construction Section.
- D. Verify that ventilation ducts are of the correct characteristics, and in the required locations.
- E. Verify that utilities are available, of the correct characteristics, and in the required locations.

3.3 INSTALLATION

- A. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- B. Install items in accordance with manufacturer's instructions.

BID AND PERMIT SET

- C. Set each item of non-mobile and non-portable equipment securely in place, leveled and adjusted to correct height. Anchor to supporting substrate where indicated, and where required for sustained operation and use without shifting or dislocation. Conceal anchorages wherever possible. Adjust counter tops and other work surfaces to a level tolerance of 1/16 inch (maximum offset, and plus or minus on dimension, and maximum variation in 2'-0" run from level or indicated slope). Provide anchors, supports, bracing, clips, attachments, etc., as required to comply with the local seismic restraint requirements. The Guidelines for Seismic Restraint of Kitchen Equipment, as prepared for the Sheet Metal Industry Fund of Los Angeles and endorsed by SMACNA, should be followed.
- D. Complete field assembly joints in the work (joints which cannot be completed in the shop) by welding, bolting-and-gasketing, or similar methods as indicated and specified. Grind welds smooth and restore finish. Set or trim flush, except for "T" gaskets as indicated.
- E. Provide closure plates and strips where required, with joints coordinated with units of equipment.
- F. Provide sealants and gaskets all around each unit to make joints airtight, waterproof, verminproof, and sanitary for cleaning purposes.
- G. Joints up to 3/8 inch wide will be stuffed with backer rod to shape sealant bead properly, at 1/4 inch depth.
- H. At internal corner joints, apply sealant or gaskets to form a sanitary cove of not less than 3/8 inch radius.
- I. Shape exposed surfaces of sealant slightly concave with edges flush with faces of materials at joint.
- J. Provide sealant filled or gasketed joints up to 3/8 inch joint width. Wider than 3/8 inch, provide matching metal closure strips, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.
- K. Treat enclosed spaces, inaccessible after equipment installation, by covering horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.
- L. Insulate to prevent electrolysis between dissimilar metals.
- M. Cut and drill components for service outlets, fixtures, piping, conduit, and fittings.
- N. Coordinate the installation of approved dry pendant sprinkler head in each cooler and freezer. Sprinkler heads should be installed in coolers/freezers only if required by local codes.
- O. Verify and coordinate the mounting heights of all wall shelves and equipment, with equipment located below them for proper clearances.

BID AND PERMIT SET

P. Coordinate with the Plumbing and Electrical Divisions and provide holes in food service equipment for plumbing and electrical service to and through the fixtures, as required. This includes welded sleeves, collars, ferrules, or escutcheons. Locate these services so that they do not interfere with intended use and/or servicing of the fixture. No alterations of the building are allowed without written permission by the General Contractor and/or Architect. (i.e. – routing refrigerant lines).

3.4 ADJUSTING

- A. Test and adjust equipment, controls and safety devices to ensure proper working order and conditions.
- B. Repair or replace equipment which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

3.5 CLEANING AND RESTORING FINISHES

- A. After completion of installation and completion of other major work in food service areas, remove protective coverings and clean food service equipment internally and externally.
- B. Restore exposed and semi-exposed finishes, to remove abrasions and other damages, polish exposed metal surfaces and touch-up painted surfaces. Replace work, which cannot be successfully restored.
- C. Polish glass, plastic, hardware and accessories, fixtures and fittings.
- D. Wash and clean equipment and leave in a condition ready for the Owner to sanitize and use.

3.6 TESTING, START-UP AND INSTRUCTIONS

- A. Delay the start-up of equipment until service lines have been tested, balanced, and adjusted for pressure, voltage and similar considerations and until water and steam lines have been cleaned and treated for sanitation.
- B. Make arrangements for demonstration of food service equipment operation and maintenance in advance with the Owner/Operator.
- C. Demonstrate food service equipment to familiarize the Owner and the Operator on operation and maintenance procedures, including periodic preventative maintenance measures required. Include an explanation of service requirements and simple on-site service procedures as well as information concerning the name, address and telephone number of qualified local source of service. The individual performing the demonstration shall be knowledgeable of operating and service aspects of the equipment.
- D. Provide a written report of the demonstration to the Owner, outlining the equipment demonstrated and malfunctions or deficiencies noted. Indicate individuals present at demonstration.

BID AND PERMIT SET

E. Final Cleaning: After testing and start-up, clean the food service equipment and leave in a condition ready for the Owner to sanitize and use.

3.7 CLEAR AWAY

A. Throughout the progress of their work, the Kitchen Equipment Contractor (KEC) shall keep the working area free from debris and shall remove rubbish from premises resulting from work being done by them. At the completion of their work, the Kitchen Equipment Contractor (KEC) shall leave the premises in a clean and finished condition.

END OF SECTION 114000

BID AND PERMIT SET

SECTION 115123 - LIBRARY STACK 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 steel-bracket shelving.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, and details.
 - 1. Include methods of anchoring them to building structures at locations recommended by manufacturer and as required for seismic restraint.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Design Calculations: For seismic design of library stack systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Shelf Units: Five percent of quantity installed for each size and type indicated, but no fewer than 5 units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

BID AND PERMIT SET

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of library stack systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Spacesaver Library Shelving; www.spacesaver.com.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Library stack systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and per performance requirements indicated on structural drawings.

2.3 STEEL-BRACKET CANTILEVER SHELVING

- A. Steel-Bracket Shelving: ANSI Z39.73 shelving designed for library use, consisting of two uprights and two spreaders per section forming a four-sided frame, with adjustable shelves on one or both sides of uprights cantilever-hung by brackets.
- B. Bookstack Units:
 - 1. Type: Mechanically fastened, self-supporting units.
 - 2. Configuration: Double and Single-faced units with gusset plates, per layout on drawings.
 - 3. Width: 24 inches (610 mm) and 30 inches (762 mm), per layout on drawings.
 - 4. Height: 84 inches (2133 mm).
 - 5. Shelf Depth: 15 inches (381 mm) nominal.
 - 6. Base Support: Contractor-constructed base.
 - 7. Shelves: Provide six adjustable shelves, with end brackets, per bookstack unit, for both 24and 30-inch wide units.
- C. Frames:
 - 1. Basis-of-Design Product: Spacesaver seismic welded frames, 84 inches (2133 mm) tall, 24- and 30-inches (610- and 762-mm) widths.
 - 2. Uprights: Steel channels, 0.060 inch (1.52 mm) thick, with slots to receive shelf bracket tabs at 1 inch (25 mm) on center.
 - a. Sloped Display Frames: Where indicated, provide upright post frames with additional steel angles, 0.060 inch (1.52 mm) thick, 36 inches (914 mm) high, slotted

BID AND PERMIT SET

to receive shelving and welded to frame or gusset plates at 10-degree angle to allow better visibility of lower two shelves.

- 3. Spreaders: Tube steel, 0.060 inch (1.52 mm) thick.
- 4. Longitudinal Bracing: Provide one diagonal steel rod with turnbuckles for each of three units in each range of shelving.
- 5. Reinforcing Gusset Plates: Triangular steel plates, 0.060 inch (1.52 mm) thick, with return flange along bottom edge.
- D. Adjustable Shelves: 0.048-inch- (1.22-mm-) thick cold-rolled steel sheet. Provide two brackets per shelf; 0.060-inch- (1.52-mm-) thick cold-rolled steel.
- E. Base Shelves: Not required. Bottom shelf will be a typical adjustable shelf installed at bottom of Contractor-constructed base.
- F. Support Feet: Square steel tube, 0.060 inch (1.52 mm) thick, with black vinyl caps at open ends of tube shape, designed to receive and fit snugly around uprights, extending from both faces of double-faced units or one face of single-faced units.
- G. Levelers: Adjustable pin levelers at carpeted surfaces and adjustable glides elsewhere.
- H. End Panels: Provide one at end of each range.
 - 1. Veneer-Faced End Panels: 3/4 to 1 inch (19 to 25 mm) thick.
 - a. Style: Flat, square top.
 - b. Face: High-pressure decorative laminate.
- I. Back Panels: Provide one-piece panels at each single-faced unit; 0.048-inch- (1.22-mm-) thick cold-rolled steel sheet, with smooth finish, sized to completely fill space between uprights.

2.4 FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish, consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- B. Finishing: Apply manufacturer's standard, baked, clear finish, consisting of a sealer and a topcoat. Sand and wipe clean between applications of sealer and topcoat.

2.5 ACCESSORIES

- A. Wall Anchors: Manufacturer's standard galvanized-steel anchors.
- B. Wall Column Supports: 84 inches long.
- C. Top Bracing: Minimum 1- by 1-3/4-inch (25- by 44-mm) transverse struts, 0.048-inch- (1.22-mm-) thick steel channels, welded or bolted to top of stack units and securely fastened to structure.

BID AND PERMIT SET

- D. Corner Filler Panels: Provide corner filler panels; 0.048-inch- (1.22-mm-) thick cold-rolled steel, with fitted caps, in color and finish to match shelving. Locate to fill gaps at abutting shelving units.
- E. Adjustable Shelf Dividers: One-piece, "W"-shaped hanging steel wire (squeeze-type) shelf partitions, with hooks or tabs to fit in slots in divider shelves.
- F. Shelf Label Holders: Clear plastic, 5 inches (127 mm) long, designed to snap over adjustable shelves.
 - 1. Provide one per shelf.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Vacuum and clean Contractor-constructed base, over which shelving is to be installed.
- B. Install library stack systems at locations indicated on Drawings and according to manufacturer's written instructions.
- C. Level and plumb bookstack units to a tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm).
- D. Install type of shelves at locations indicated and at spacing indicated or, if not indicated, at equal spacing in each unit.
- E. Install bookstacks using floor anchors, wall anchors, or top bracing in locations recommended by manufacturer and as indicated on Shop Drawings.

END OF SECTION 115123

BID AND PERMIT SET

SECTION 115200 - AUDIO VISUAL EQUIPMENT

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. Manual and electrically operated, front-projection screens and controls.
 - 2. TV support mounts.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for metal support framing for front-projection screens.
 - 2. Section 061053 "Miscellaneous Rough Carpentry" for wood backing for screen installation.
 - 3. Section 274116 "Audio Visual Systems" for other projection screens and projection equipment.

1.3 DEFINITIONS

- A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.
- B. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
 - 1. Drop lengths.
 - 2. Location of seams in viewing surfaces.
 - 3. Location of screen centerline relative to ends of screen case.
 - 4. Anchorage details, including connection to supporting structure for suspended units.
 - 5. Details of juncture of exposed surfaces with adjacent finishes.

BID AND PERMIT SET

- 6. Location of wiring connections for electrically operated units.
- 7. Wiring diagrams for electrically operated units.
- 8. Accessories.
- C. Samples for Initial Selection: For finishes of surface-mounted screen cases.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 MANUALLY OPERATED, FRONT-PROJECTION SCREENS

- A. General: Manufacturer's standard units consisting of case, screen, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Mounting: surface-mounted on wall.
- C. Size: As indicated on drawings.

- A. Basis-of Design Product: Da-Lite Model C, with CSR (controlled screen return), Projection Screen.
 - 1. Other Manufacturers: Subject to compliance with requirements, products by one of the following will also be acceptable:
 - a. Draper.
 - b. Stewart Filmscreen Corporation.

2.3 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

- A. Recessed-Mounted, Metal-Encased, Electrically Operated Screens: Manufacturer's standard units consisting of recessed ceiling case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Basis-of-Design Product: Access / Series E Projection Screen by Draper.
 - 2. Locations:
 - a. Library: HDTV format, 9 feet, 0 inches tall by 16 feet, 0 inches wide (220-inch diagonal); 16:10 format, 10 feet, 0 inches tall by 16 feet, 0 inches wide (222-inch diagonal).
 - b. Film Classroom: HDTV format, 79 inches tall by 140 inches wide (161-inch diagonal); 16:10 format, 87.5 inches tall by 140 inches wide (165-inch diagonal).
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 4. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - a. Provide power supply for low-voltage systems if required.
 - b. Provide locking cover plates for switches.
 - c. Provide key-operated, power-supply switch.
 - d. Provide infrared remote control consisting of battery-powered transmitter and receiver.
 - e. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.
 - 5. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.

BID AND PERMIT SET

- 6. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm-) diameter metal rod with ends of rod protected by plastic caps.
 - a. Roller for motor in roller is supported by vibration- and noise-absorbing supports.
- B. Large, Recessed-Mounted, Metal-Encased, Electrically Operated Screens: Motor-in-roller units designed and fabricated for recessed mounting in ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide with matching end caps and concealed mounting.
 - 1. Basis-of Design Product: Paragon / Series E Recessed Projection Screen by Draper.
 - 2. Locations:
 - a. Commons: 16:9 format, 160 inches tall by 284 inches wide; 16:10 format, 177 inches tall by 284 inches wide.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 4. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - a. Provide power supply for low-voltage systems if required.
 - b. Provide locking cover plates for switches.
 - c. Provide key-operated, power-supply switch.
 - d. Provide infrared remote control consisting of battery-powered transmitter and receiver.
 - e. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.
 - 5. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 - 6. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm-) diameter metal rod with ends of rod protected by plastic caps.
 - a. Roller for motor in roller is supported by vibration- and noise-absorbing supports.

2.4 FRONT-PROJECTION SCREEN MATERIAL

- A. Matte Reflective Viewing Surface: Peak gain of not less than 1.3, and half-gain angle of at least 40 degrees from the axis of the screen surface.
- B. Material: vinyl sheet.

BID AND PERMIT SET

- C. Mildew-Resistance Rating: Zero or 1 when tested according to ASTM G 21.
- D. Flame Resistance: Passes NFPA 701.
- E. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
- F. Seamless Construction: Provide screens, in sizes indicated, without seams.
- G. Edge Treatment: Black masking borders.
- H. Size of Viewing Surface: As indicated on drawings.

2.5 RECESSED, FLAT-SCREEN TV MOUNT

- A. Basis-of-Design Product: Model PNRIWUB by Chief Manufacturing; www.lagrandav.com.
- B. Description: dual-arm, in wall, swing arm mount designed to create a low-profile installation.
- C. Accessory: Model PAC501 in-wall recessed box housing to receive PNRIWUB mount.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 - 1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.
 - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
 - 2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
 - 3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

END OF SECTION 115200

BID AND PERMIT SET

SECTION 115313 - LABORATORY FUME HOODS

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. Bench-top laboratory fume hoods.
 - 2. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices included with fume hoods.
 - 3. Fume hood base cabinets.
 - 4. Work tops within fume hoods.
 - 5. Laboratory sinks and cup sinks in fume hoods.
 - 6. Water, laboratory gas, and electrical service fittings in fume hoods.
 - 7. Darkroom vent-hood.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring fume hoods.
 - 2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring fume hoods.
 - 3. Section 096513 "Resilient Base and Accessories" for resilient base applied to fume hood base cabinets.
 - 4. Section 123216 "Manufactured Casework" for base cabinets.
 - 5. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for field quality-control testing of fume hoods.
 - 6. Section 230923 "Direct Digital Control (DDC) System for HVAC" for VAV controls for fume hood exhaust.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.

BID AND PERMIT SET

B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For laboratory fume hoods.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.
 - 3. Indicate locations and types of service fittings together with associated service supply connection required.
 - 4. Indicate duct connections, electrical connections, and locations of access panels.
 - 5. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
 - 7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
 - 8. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Samples: For fume hood exterior finishes, interior lining, and epoxy work tops.
- D. Delegated-Design Submittal: For fume hoods indicated to comply with seismic performance requirements and design criteria.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Showing compliance with specified performance requirements for asmanufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

BID AND PERMIT SET

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fume Hoods with Steel Exterior:
 - 1. Basis-of-Design Product and Manufacturer: Model H08K5448-00 Supreme Air Fume Hood; Kewaunee Scientific Corporation.
- B. Darkroom Vent-Hood:
 - 1. Basis-of-Design Product and Manufacturer: Model SWVHWA-120. Vent-Hood, canopy type, for darkroom walk-around sinks; Sebastian Darkroom Products; Division of California Stainless MFG, Inc.
- C. Source Limitations: Obtain laboratory fume hoods from single manufacturer.
- D. Product designations indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Drawings and Specifications, may be considered. See Section 016000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

- A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110:
 - 1. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
 - 2. As-Installed (AI) Rating: AI 0.05 (0.05 ppm).
 - 3. Average Face Velocity: 100 fpm (0.51 m/s) plus or minus 10 percent with sashes fully open.
 - 4. Total CFM: 470 CFM at 100 fpm, with static pressure of 0.10 inch.
 - 5. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sashes fully open.
 - 6. Sash Position: Fully open.
 - 7. Release Rate: 4.0 L/min.

BID AND PERMIT SET

- 8. Test Setup Modifications: Conduct tests with a minimum of three and a maximum of five people in the test room and with two 1-gal. (3.8-L) round paint cans, one 12-by-12-by-12-inch (300-by-300-by-300-mm) cardboard box, and three 6-by-6-by-12-inch (150-by-150-by-300-mm) cardboard boxes in the fume hood during the test. Position items from 6 to 10 inches (150 to 250 mm) behind the sash, randomly distributed, and supported off the work surface by 2-by-2-inch (50-by-50-mm) blocks.
- 9. Walk-by Test: At the conclusion of containment test, execute three rapid walk-bys at 30second intervals, 12 inches (300 mm) behind the mannequin. Test-gas concentration during each walk-by shall not exceed 0.1 ppm and shall return to specified containment value within 15 seconds.
- B. Static-Pressure Loss: Not more than 1/2-inch wg (124 Pa) at 100-fpm (0.51-m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fume hoods for seismic performance.
- D. Seismic Performance: Fume hoods, including attachments to other work, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project indicated on Structural drawings.
 - 2. Component Importance Factor: As indicated on Structural drawings.

2.3 FUME HOODS

- A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.
- C. Bypass Fume Hoods: Provide bypass fume hoods. Compensating bypass above the sash opens as sash is closed. Provide sufficient bypass capacity so that face velocity with sash opening of 6 inches (150 mm) does not exceed 3 times the face velocity with sash fully open.
- E. VAV Control: Equip fume hoods with an electronic control unit with a sensing device that monitors face velocity, and a motorized damper on the exhaust connection that maintains a constant face velocity by controlling air volume in response to control unit. Equip units with manual override switch that opens motorized damper to provide maximum exhaust capacity regardless of sash position.

2.4 FUME HOOD MATERIALS

- A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.
- B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

- C. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces and, having a flame-spread index of 25 or less according to ASTM E84.
- D. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - f. Flame-Spread Index: 25 or less according to ASTM E84.
 - 2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 - 3. Color: As selected by Architect from manufacturer's full range.
- F. Glass: Clear, laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two plies not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.
 - 2. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 3. Permanently mark safety glass with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Fasteners: Provide stainless steel fasteners where exposed to fumes.

2.5 DARKROOM VENT-HOOD MATERIALS

- A. Vent-Hood Construction:
 - 1. Entire hood constructed of non-corrosive polyvinyl chloride (PVC). Top surface of vent acts as utility shelf for darkroom accessories. Vent-hood supported from structure above by stainless steel rods.
 - 2. Exhaust duct stack: 8-inch diameter PVC fume duct from top of vent-hood to above ceiling ductwork by mechanical system. Number of duct stacks dependent on length of vent-hood.

- 3. Damper: Adjustable damper plates at vent-hood entrance port to allow on-site airbalancing.
- 4. Mechanical requirements: Building mechanical exhaust system shall provide required CFM at pressure loss specified by vent-hood product data sheet for size of vent-hood.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vent-hood for seismic performance.
- C. Seismic Performance: Vent-hood, including attachments to other work, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project indicated on Structural drawings.
 - 2. Component Importance Factor: As indicated on Structural drawings.

2.6 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch (889-by-2007-mm) door opening.
- G. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- H. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- I. Interior Lining: Provide one of the following unless otherwise indicated:
 - 1. Glass-fiber-reinforced polyester, not less than 3/16 inch (4.75 mm) thick.
 - 2. Epoxy, not less than 1/4 inch (6.35 mm) thick.
 - 3. Glass-fiber-reinforced epoxy, not less than 3/16 inch (4.75 mm) thick.
- J. Lining Assembly: Unless otherwise indicated, assemble with stainless steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
 - 1. Fasten lining components together with stainless steel cleats or angles to form a rigid assembly to which exterior panels are attached.
 - 2. Fasten lining components to a rigid frame assembly fabricated from steel and to which exterior panels are attached.
 - 3. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.

BID AND PERMIT SET

- M. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom. Secure baffle to cleats at rear of hood with stainless steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
 - 1. Provide preset baffles unless otherwise indicated.
 - 4. Provide epoxy-coated, stainless steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.
- N. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
 - 1. Duct-Stub Material: stainless steel.
- O. Bypass Grilles: Provide grilles at bypass openings of fume hoods.
- P. Sashes: Provide operable sashes of type indicated.
 - 1. Fabricate from 0.048-inch- (1.21-mm-) thick steel sheet, with chemical-resistant finish. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.
 - 2. Glaze with laminated safety glass.
 - 4. Counterbalance vertical-sliding sash with sash weight and stainless-steel cable system to hold sash in place regardless of position. Provide ball-bearing sheaves, plastic glides in stainless steel guides, and stainless-steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.
- Q. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1inch (25-mm) space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch (25-mm) opening for air intake. Airfoil directs airflow across work top to remove heavier-thanair gases and to prevent reverse airflow.
- R. Light Fixtures: Provide vaporproof, two-tube, rapid-start, fluorescent light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch- (6.35-mm-) thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Provide units with fluorescent tubes easily replaceable from outside of fume hood.
 - 1. Provide fluorescent tubes with color temperature of 3500 K and minimum color-rendering index of 85.
- T. Filler Strips: Provide as needed to close spaces between fume hoods or fume hood base cabinets and adjacent building construction. Fabricate from same material and with same finish as fume hoods or fume hood base cabinets, as applicable.
- U. Ceiling Extensions: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.
- V. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

W. Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.

2.7 FUME HOOD BASE CABINETS, WORK TOPS, TROUGHS, SINKS AND SERVICE FITTINGS

- A. Comply with Section 123216 "Manufactured Casework."
- B. Work Tops: Epoxy.
 - 1. Work-Top Configuration: Raised (marine) edge with beveled edge and corners.
 - 2. Where acid storage cabinets are indicated beneath fume hoods, provide holes in work tops as need to accommodate cabinet vents.
 - 3. Where epoxy sinks occur in epoxy work tops, provide integral sinks bonded to tops with invisible joint line.
 - 4. Where epoxy sinks occur in phenolic-composite work tops, provide drop-in sinks with 1/4-inch (6-mm) thick lip around perimeter of sink.
 - 5. Where stainless steel sinks, cup sinks, or troughs occur in stainless steel tops, factory weld into one integral unit.
 - 6. For perchloric acid fume hoods, provide stainless steel work tops with 1/2-inch (13-mm) raised front edge and integral drain trough at back of top with top sloped to trough.
- C. Cup Sinks: Epoxy, 5-inch (127-mm) diameter.
 - 1. Provide epoxy cup sinks with polypropylene strainers and integral tailpieces.
 - 3. Knee Space: Provide clear floor space not less than 36 inches (915 mm) wide by 25 inches (635 mm) deep by 27 inches (685 mm) high within fume hood base stands unless otherwise indicated.
 - 4. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.

2.8 CHEMICAL-RESISTANT FINISH

- A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
BID AND PERMIT SET

2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.9 ACCESSORIES

- A. Airflow Indicator and Alarm: Provide each fume hood with manufacturer's standard airflow indicator with audible and visual alarm that activates when airflow sensor reading is outside of preset range.
- B. Airflow Indicator: Provide each fume hood with airflow indicator of one of the following type(s):
 - 1. Indicator Type: Direct-reading aneroid (Magnehelic-type) gage that measures exhaust duct static pressure of fume hood as an indication of airflow.
 - 2. Indicator Type: Thermal anemometer that measures fume hood face velocity and indicates whether it is below normal, normal, or above normal.
 - 3. Indicator Type: Thermal anemometer that measures fume hood face velocity and displays data as digital readout.
- C. Airflow Alarm: Provide fume hoods with audible and visual alarm that activates when airflow sensor reading is outside of preset range.
 - 1. Provide with thermal-anemometer or aneroid (Magnehelic-type) gage airflow sensor.
 - 2. Provide with reset and test switches.
 - 3. Provide with switch that silences audible alarm and automatically resets when airflow returns to within preset range.
- D. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
 - 1. Provide with silence and test switches.
- E. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.
- F. Bypass Grille Blank-off Panel: Provide fume hoods with blank-off panel on bypass grille designed for use with sash stops to reduce exhaust air volume and provide design face velocity with sash at 50 percent open position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

BID AND PERMIT SET

3.2 FUME HOOD INSTALLATION

- A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- B. Comply with requirements in Section 123216 "Manufactured Casework" for installing fume hood base cabinets, work tops, and sinks.
- C. Comply with requirements for installing water and laboratory gas service fittings and electrical devices.
 - 1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods unless otherwise indicated.

3.3 DARKROOM VENT-HOOD INSTALLATION

- A. General: Install vent-hood according to manufacturer's written instructions. Install level, plumb, and true; adjust hanging rods as required, and securely anchor to building structure.
- B. Locate top of vent-hood no more than 20 inches above darkroom sink rail for proper operation of vent-hood.
- C. Coordinate installation of vent-hood exhaust duct with building mechanical ductwork.

3.4 FIELD QUALITY CONTROL

- B. Field test installed fume hoods according to ASHRAE 110 to verify compliance with performance requirements.
 - 1. Adjust fume hoods, hood exhaust fans, darkroom vent-hood and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
 - 2. After making corrections, retest hoods that failed to perform as specified.

3.5 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 115313

LABORATORY FUME HOODS

SECTION 116143 - STAGE CURTAINS

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. Variable acoustic adjustable stage curtains, scrims, and drops CU-1 and CU-2).
 - 2. Draw-curtain tracks.
 - 3. Curtain rigging.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for steel framing and supports for stage-curtain systems.
 - 2. Color and Material Schedule on drawings for curtain descriptions.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product and the following:
 - 1. Tracks: Capability of each track to support the weight and operation of curtains that it supports.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and attachment details of curtains.
 - 2. Include fabric assembly and hanging details.
 - 3. Dimension operating clearances.
 - 4. Include documentation of capacity of each batten, track, attachment, and rigging component to support loads.
 - 5. Points of attachment for proscenium curtain and cyclorama and the corresponding static and dynamic loads imposed on structure.
 - 6. Locations of equipment components.

BID AND PERMIT SET

C. Samples for Initial Selection: For each type of stage curtain indicated. Include color charts showing full range of colors, textures, and patterns available, together with 12-inch- (300-mm-) square Sample (any color) of each fabric type and seam.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which tracks, battens, and other stage-curtain equipment will be attached.
 - 2. Locations of lighting fixtures and cabling, ductwork, piping, and sprinklers.
 - 3. Rigging equipment for stage equipment.
- B. Product Certificates: For the following, from manufacturer:
 - 1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.
 - 2. Rigging: Compliance of suspended battens and tracks with requirements.
- C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For stage curtains and rigging to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of stage curtains.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install stage curtains until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

BID AND PERMIT SET

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of stagecurtain systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, faulty operation of rigging.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STAGE-CURTAIN SYSTEMS

- A. Description: Complete stage-curtain systems, including stage curtains, tracks, draw-curtain machines, and rigging; with necessary accessories for support and operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Black Sheep Enterprises.
 - b. S&K Theatrical Draperies, Inc.
 - c. Sew What? Inc.
 - d. Stagecraft Industries, Inc.
 - e. Tru-Roll, Inc.
- B. Source Limitations: Obtain stage-curtain systems from single manufacturer. Obtain each color, grade, finish, type, and variety of fabric from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stage-curtain systems, including comprehensive engineering analysis and attachments to building structure, using performance requirements.
- B. Structural Performance: Stage-curtain systems and attachments to structure shall withstand the effects of gravity and operational loads and the following loads and stresses:
 - 1. Design Loads: Weight of curtains and support hardware.
- C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Flame-Propagation Resistance: Passes NFPA 701.
 - a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant

BID AND PERMIT SET

chemicals and whether it requires retreatment after cleaning or after a designated time period of use.

b. Permanently attach 12-inch- (300 mm-) square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.3 CURTAIN FABRICS

- A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.
- B. Heavyweight Woven Cotton Velour: Napped fabric of 100 percent cotton weighing not less than 25 oz./linear yd. (775 g/linear m), with pile height not less than 79 mils (2 mm); 54-inch (1372-mm) minimum width.
 - 1. Color/ Texture/ Pattern: Black.
 - 2. Fullness: 100 percent.
 - 3. Size: As required to mask extent of green screen; refer to Drawings.
- C. Medium-Weight Woven Cotton Velour: For front setting curtains. Napped fabric of 100 percent cotton weighing not less than 20 oz./linear yd. (620 g/linear m), with pile height not less than 75 mils (1.9 mm); 54-inch (1372-mm) minimum width.
 - 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. Dazian LLC.
 - b. Frankel/Fabric One.
 - c. JB Martin Company.
 - d. KM Fabrics, Inc.
 - 2. Color/Texture/Pattern: Black.
- D. Muslin: For Cyclorama. Sheer, plain-woven fabric.
 - 1. Fabric: 100 percent cotton weighing not less than 16 oz./linear yd. (495 g/linear m); 100-inch (2540-mm) minimum width.
 - 2. Color: Black.

2.4 LINING

A. Cotton Lining: Yarn-dyed denim cloth of 100 percent cotton; woven in a warp-faced twill; 54-inch (1372-mm) minimum width; black.

BID AND PERMIT SET

2.5 CURTAIN-BOTTOM WEIGHTS

- A. Individual Weights: Curtain manufacturer's standard segmented weights to suit each curtain type and location.
- B. Proof Coil Chain: Grade 30, No. 8, zinc plated, 3/16 inch (4.7 mm), ASTM A 413/A 413M.
- C. Weight Tape: Curtain manufacturer's standard, continuous weight tape to suit each curtain type and location.
- D. Pipe or Conduit Weight and Stiffener: Curtain manufacturer's standard or recommended stiffening pipe or conduit that slides into bottom hem, suitable for curtain type and location indicated.

2.6 CURTAIN FABRICATION

- A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width. Orient velour fabric with the fabric nap down.
- B. Vertical and Top Hems: Machine sew hems as follows unless otherwise indicated:
 - 1. Vertical Hems: Minimum 2 inches (50 mm) wide, and not less than 4 inches (102 mm) wide at borders, valance, teasers, and tormentors, with not less than a 1-inch (25-mm) tuck and with no selvage material visible from front of curtain. Sew open ends of hems closed.
 - 2. Turnbacks: Provide leading-edge turnbacks for traveler curtains, formed by folding back not less than 12 inches (300 mm) of face fabric, with not less than a 1-inch (25-mm) tuck, and vertically secured by sewing.
 - 3. Top Hems: Reinforced by double-stitching 3-1/2-inch- (89-mm-) wide, heavy, laminated synthetic webbing to top edge on back side of curtain with not less than 2 inches (50 mm) of face fabric turned under.
- C. Fullness:
 - 1. 50 Percent Fullness: Provide fullness, exclusive of turnbacks and hems, by sewing additional material into 3-inch (75-mm) double-stitched, flat, box pleats spaced at 12 inches (300 mm) on center along top hem reinforcement.
- D. Grommets: Brass, No. 3, or No. 4.
 - 1. Black Curtains: Provide brass or aluminum grommets with black finish.
 - 2. Pleated Curtains: Double grommets for each round pleat and place 1 inch (25 mm) from corner of curtain; for snap hooks or S-hooks.

BID AND PERMIT SET

- E. Bottom Hems: Machine sew hems as follows unless otherwise indicated:
 - 1. For Curtains with Fullness:
 - a. Curtains That Do Not Hang to Floor: Hems not less than 3 inches (75 mm) deep, with 3/4-inch (19-mm) weight tape, and with open ends of hems sewn closed.
 - b. Floor-Length Curtains: Hems not less than 6 inches (150 mm) deep, with 1-inch (25mm) weight tape sewn to top seam of the bottom hem, clear of the finished bottom edge, and with open ends of hems sewn closed.
 - 2. Lining: Where indicated, provide lining for curtain in same fullness as face fabric and finished 2 inches (50 mm) shorter than face fabric. Sew or otherwise securely attach lining to top hem of face fabric. Attach lining to face fabric along bottom and side seams with 4-inch- (100-mm-) long strips of heavy woven cotton tape.

2.7 CURTAIN ACCESSORIES

A. S-Hooks: Manufacturer's standard heavy-duty plated-wire hooks, not less than 2 inches (50 mm) long.

2.8 STEEL CURTAIN TRACK

- A. Steel Track: Roll-formed, galvanized, commercial-quality, zinc-coated steel sheet, ASTM A 653/A 653M; G60 (Z180) coating designation; with continuous bottom slot and with each half of track in one continuous piece; black paint finish; complete with necessary accessories for support and operation.
 - 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. Automatic Devices Company.
 - b. H & H Specialties Inc.
 - c. Tru-Roll, Inc.
 - 2. Curved Track: Factory-fabricated sections.
 - 3. Cable Guides for Curved Track: Outside idlers, mule pulleys, spindles, and guides; quantity sufficient for configuration of curve(s) and length of track.
 - 4. Steel Thickness: As recommended by manufacturer for loads and operation.
 - a. Medium Duty: Minimum 0.064 inch (1.63 mm).
- B. Curved-Suspended-Track Stiffener: NPS 1-1/2 (DN 40) steel pipe for supporting both sections of suspended curved tracks; curved to match track.
- C. Clamp and Bracket Hangers: Steel clamps and brackets of sufficient strength required to support loads for attaching track to overhead support.

BID AND PERMIT SET

- D. Track-Lap Clamp: Metal to match track channel for attaching two tracks at center overlap.
- E. Folding Guide: Where indicated, equip carriers with rear-fold or backpack guide and rubber spacers to fold curtain from the offstage end of the track; sized for use with operating line if any.
- F. Medium-Duty Track System: Equip track with components as recommended by manufacturer for loads and operation. Provide end stops for track.
 - 1. Curtain Carriers: Standard carriers of plated steel with a pair of nylon wheels riveted parallel to body. Equip carriers with plated-steel swivel eye for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.
 - a. Master Curtain Carriers: One master carrier, for each leading curtain edge, of plated steel with two pairs of nylon wheels and with two line clamps per carrier.
 - 2. Pulleys: One dead-end, single-wheel pulley; one live-end, double-wheel pulley; and one adjustable pulley to maintain proper tension on operating line; each containing guarded ball-bearing sheaves enclosed in steel housings. Provide pulleys with steel housing finished to match track and with bracket for securing off-stage curtain end.
- G. Manual Cord Operation: Provide with cord operating line, 3/8-inch- (9-mm-) diameter, stretchresistant operating cord of braided synthetic-fiber jacket over solid, synthetic-fiber, linear filaments.

2.9 CURTAIN RIGGING

- A. Supports, Clamps, and Anchors: ASTM A 153/A 153M, Class B, galvanized sheet steel in manufacturer's standard thicknesses, galvanized after fabrication.
- B. Trim and Support Cable: 1/4-inch- (6-mm-) diameter, 7 by 19 galvanized-steel cable with a breaking strength of 7,000 lb (3175 kg). Provide fittings according to cable manufacturer's written instructions for size, number, and method of installation, including a drop-forged galvanized turnbuckle to allow for leveling.
- C. Trim and Support Chain: ASTM A 391/A 391M, Grade 80, hardened alloy steel chain rated for overhead lifting.
- D. Inserts, Bolts, Rivets, and Fasteners: Manufacturer's standard corrosion-resistant units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.

BID AND PERMIT SET

- B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install stage-curtain system according to curtain and track manufacturer's written instructions.

3.3 TRACK INSTALLATION

- A. Ceiling-Mounted Track: Drill track at intervals not greater than manufacturer's written instructions for spacing and, fasten directly to structure.
- B. Beam-Mounted Track: Install track by suspending from beam clamps securely mounted to I-beam structure at track-support spacing, according to manufacturer's written instructions.
- C. Wall-Mounted Track: Install track by suspending from brackets securely mounted to wall construction at track-support spacing, according to manufacturer's written instructions.
- D. Track-Support Spacing: According to manufacturer's recommendations for applied loads, but not exceeding the following dimensions between supports:
 - 1. Medium-Duty Track: 48 inches (1219 mm).
 - 2. Curved Walk-Along Track: 48 inches (1219 mm), with additional supports at curves and splices.
- E. Install track for center-parting curtains with not less than 24-inch (600-mm) overlap of track sections at center, supported by track lap clamps.

3.4 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with S-hooks.

3.5 CURTAIN SCHEDULE

- A. Stage Curtain: As indicated on Drawings and as follows:
 - 1. Type: Proscenium.
 - 2. Horizontal Accessory Curtain: Valance, Border
 - 3. Size and Arrangement: As indicated on Drawings.
 - 4. Fabric: Medium-weight woven cotton velour.
 - 5. Lining: Cotton.
 - 6. Fullness: 50 percent.
 - 7. Bottom Weights: Weight tape.
 - 8. Hanging Accessories: S-hooks.
 - 9. Track: Medium-duty steel with single-curtain capacity.

BID AND PERMIT SET

- 10. Track Shape: Straight.
- 11. Operation: Manual walk-along.
- B. Stage Curtain: As indicated on Drawings and as follows:
 - 1. Type: Cyclorama.
 - 2. Size and Arrangement: As indicated on Drawings.
 - 3. Fabric: Muslin.
 - 4. Lining: Cotton.
 - 5. Fullness: 50 percent.
 - 6. Bottom Weights: Weight tape.
 - 7. Hanging Accessories: S-hooks.
 - 8. Track: Medium-duty steel with single-curtain capacity.
 - 9. Track Shape: Curved as indicated on Drawings.
 - 10. Operation: Manual walk-along.

END OF SECTION 116143

SECTION 122113 – HORIZONTAL LOUVER BLINDS

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. Horizontal louver blinds with aluminum slats (HLB-1).
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.
 - 2. Color and Material Schedule on drawings for blind colors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.
- D. Samples for Initial Selection: For each type and color of horizontal louver blind.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type and color of horizontal louver blind indicated.
 - 1. Slat: Not less than 12 inches (300 mm) long.
 - 2. Tapes: Full width, not less than 6 inches (150 mm) long.
 - 3. Horizontal Louver Blind: Full-size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
 - 4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.
- F. Product Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

BID AND PERMIT SET

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Flame-Resistance Ratings: Passes NFPA 701.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wetwork and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Provide two (2) year warranty on materials and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS (HLB-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Levolor; Riviera or comparable product by one of the following:
 - 1. CACO Inc. Window Fashions.
 - 2. Hunter Douglas
 - 3. Springs Window Fashions;
- B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
 - 1. Width: 1 inch (25 mm).
 - 2. Thickness: Not less than 0.008 inch (0.20 mm).
 - 3. Spacing: Manufacturer's standard.
 - 4. Finish: Ionized antistatic, dust-repellent, baked polyester finish.
 - 5. Features:
 - a. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.
- C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.
 - 1. Capacity: One blind(s) per headrail unless otherwise indicated.
 - 2. Ends: Capped or plugged.
 - 3. Manual Lift Mechanism:
 - a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range.
 - b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
 - 4. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 - a. Tilt: Full.
 - b. Operator: Clear-plastic wand.
 - c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.

BID AND PERMIT SET

- 5. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.
- 6. Manual Lift-Operator and Tilt-Operator Locations: Right side or left side of headrail, dependent on window access, unless otherwise indicated.
- 7. Integrated Headrail/Valance: Manufacturer's standard.
- D. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.
 - 1. Type: Top contoured to match crowned shape of slat.
- E. Lift Cords: Manufacturer's standard braided cord.
- F. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
 - 1. Type: Braided polyester jacket cord.
- G. Valance: Manufacturer's standard.
- H. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
 - 1. Type: Overhead.
 - 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- I. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.
- J. Colors, Textures, Patterns, and Gloss:
 - 1. Slats: As selected by Architect from full range of industry colors.
 - 2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4-inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
- C. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.
 - 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

BID AND PERMIT SET

- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish:
 - 1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 2. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

BID AND PERMIT SET

- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

3.5 SCHEDULE

A. Provide horizontal louver blinds at all interior glazing.

END OF SECTION 122113

SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers (RS-1 and RS-2).
 - 2. Motor-operated roller shades with single rollers.
 - 3. Installation schedule at end of Section.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark interior face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

BID AND PERMIT SET

E. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (RS-1 AND RS-2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc., EuroTwill or comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Stainless steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right or left side of interior face of shade as required for access.
 - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 - 3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

- F. Shadebands:
 - 1. Shadeband Material:
 - a. RS-1: Light-filtering fabric at exterior windows; 3 percent openness.
 - b. RS-2: Light-blocking, blackout shades at designated locations.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - 3. Color and Finish: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.
- G. Installation Accessories:
 - 1. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.

2.3 MOTOR-OPERATED, ROLLER SHADES (RS-3 AND RS-4)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc., ElectroShade or comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following for remote-control activation of shades:
 - a. Keyed Control Station: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - 3. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
 - 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated

BID AND PERMIT SET

without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

- 1. Roller Drive-End Location: Right or left side of interior face of shade as required for access.
- 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
- 3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- F. Shadebands:
 - 1. (RS-3) Shadeband Material: Light-filtering fabric, 3 percent openness.
 - 2. (RS-4) Shadeband Material: Light-blocking fabric.
 - 3. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Exposed with endcaps and integral light seal at bottom where it meets the sill.
 - b. Color and Finish: As indicated in Color and Materials Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.
- G. Installation Accessories:
 - 1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open.
 - 2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Vinyl coated polyester.
 - 3. Orientation on Shadeband: Up the bolt.
 - 4. Openness Factor: 3 percent.

BID AND PERMIT SET

- 5. Color:
- C. Light Blocking Fabric:
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Vinyl coated polyester.
 - 3. Orientation on Shadeband: Up the bolt.
 - 4. Openness Factor: Opaque.
 - 5. Color: As indicated in Color and Material Schedule in drawings or if not indicated, as selected by Architect from full range of industry colors.

2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

ROLLER WINDOW SHADES

BID AND PERMIT SET

- C. Roller Shade Locations: At exterior windows.
- D. Mount to window header per manufacturer's typical details. Align to top of mullion UNO.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.6 ROLLER SHADE SCHEDULE

- 1. RS-1: Manual operation, single-roller shades with light-filtering shade fabric.
 - a. Application: All exterior windows.
- 2. RS-2: Electrically operated, dual roller shades with light-filtering shade fabric, manuallyoperated black-out shade fabric, and light-blocking edge channels.
 - a. Applications: Photo and film classrooms and science labs.
- 3. RS-3: Electrically operated, single-roller shades with light-filtering shade fabric.
 - a. Applications: Clerestory windows located at or above 10 feet above finish floor.

END OF SECTION 122413

SECTION 123216 - MANUFACTURED CASEWORK

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. Music instrument storage cabinets.
 - 2. Plastic-laminate-faced cabinets of stock design.
 - 3. Cabinet hardware.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring casework.
 - 2. Section 064100 "Architectural Casework" for wood veneer and plastic laminate clad architectural cabinets.
 - 3. Section 096513 "Resilient Base and Accessories" for resilient base applied to plasticlaminate-faced casework.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

BID AND PERMIT SET

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.
 - 1. Indicate locations of hardware and keying of locks.
 - 2. Indicate locations of blocking and reinforcements required for installing casework.
 - 3. Include details of support framing system.
 - 4. Indicate locations of and clearances from adjacent walls, doors, windows, other building components.
- C. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.
- D. Samples: For cabinet finishes.
- E. Samples for Verification: 8-by-10-inch (200-by-250-mm) Samples for each type of finish and the following:
 - 1. One full-size finished storage cabinet complete with hardware, doors, and drawers.
 - 2. Maintain full-size Samples at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Sample Warranty: For special warranty.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: a certified participant in AWI's Quality Certification Program.
- B. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

BID AND PERMIT SET

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install manufactured wood casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - 2. Warranty Period: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Wenger Corporation; www.wengercorp.com.
- B. Other Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:
 - 1. Case Systems, Inc.
 - 2. Stevens Industries, Inc., .
 - 3. TMI Systems Corporation.
- C. Source Limitations: Obtain manufactured plastic-laminate-faced casework from single manufacturer.

2.2 CASEWORK, GENERAL

A. Educational casework shall meet or exceed the requirements for Architectural Woodwork Institute Quality Standards Section 400B and 1600B for custom grade flush overlay constructed

BID AND PERMIT SET

casework. Specific requirements set forth within this specification shall take precedence over the AWI Standard.

- B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-faced cabinets. Other manufacturers' casework of similar sizes and door configurations, of same finish materials, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."
 - 1. Basis-of-Design Product and Manufacturer: Ultrastor Storage Cabinets; Wenger Corporation.

2.3 MATERIALS

- A. High Pressure Plastic Laminate (PL-#)
 - 1. Plastic laminate shall meet standard of NEMA LD3, and shall be of the following thickness:
 - a. Balancing Sheet: 0.020 inch (0.51 mm).
 - b. Horizontal Surfaces: 0.050 inch (1.27 mm).
 - c. Vertical Surfaces: 0.028 inch (0.71 mm).
 - d. Cabinet Liner: Pressure fused laminate bonded to substrate. Color shall be manufacturer's standard almond, gray or white as selected by Architect.
 - 2. Manufacturers: Products indicated in Drawings are to establish the quality and aesthetic desired for this Project. Other manufacturers listed below are also acceptable, provided that they manufacture products in color and texture to match that which is selected and specified:
 - a. Formica.
 - b. Abet Laminati
 - c. Nevamar.
 - d. Laminart.
 - e. Wilsonart.
 - 3. Color Selection: Refer to Color and Material Schedule on Drawings.
- B. Hardboard: Hardboard shall meet or exceed Commercial Standards CS-251 and Federal Specifications LLL-B-00810. Tempered hardboard 1/4 inch (6.4 mm) thick, prefinished.
- C. Edging: ABS Plastic T-molding edgeband. Solid, high-impact, purified, color-thru, acidresistant, trimmed and inside/outside length-radiused for uniform appearance, buffed and cornerradiused for consistent design. Use for door/drawer edges and countertops, unless noted otherwise. Color to match adjacent PL-# color.

- D. Hardware:
 - 1. Hinges:
 - a. Heavy duty, five knuckle 2-3/4-inch (70-mm) institutional type hinge. Mill ground, hospital tip, tight pin feature with all edges eased. Hinge to be full wrap around type of tempered steel 0.095 inch (2.4 mm) thick. Each hinge to have minimum nine screws, #7, 5/8-inch (16 mm) FHMS to assure positive door attachment.
 - b. One pair per door to 36-inch (914 mm) height. One and one-half pair over 37 inches (940 mm) in height. Two pairs on doors wider than 24 inches (610 mm) or for doors 73 inches (1854 mm) or higher. Hinge to accommodate 13/16-inch (20.7 mm) thick laminated door and, allow 270-degree swing.
 - c. Finish to be dull chrome for fixed cabinetry.
 - 2. Pulls: Solid aluminum wire pulls, fastened from back with two screws. Provide two pulls for drawers more than 24 inches (610 mm) wide.
 - a. Color: As selected by Architect from manufacturer's full range of colors.
 - 3. Catches:
 - a. 7 lb. (3.18 kg) magnetic catch for base and wall cabinets. Provide two 7 lb. (3.18 kg) pulls at each tall cabinet door. Catch housing to be molded in color to match cabinet interior.
 - b. Where cabinet locks are indicated on pair of doors, provide both magnetic catch and thumb latch.
 - c. Do not provide catch at sliding drawers.
 - 4. Adjustable Shelf Supports: To be twin pin design with anti tip-up shelf restraints for both 3/4-inch (19 mm) and 1-inch (25.4 mm) shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum of 300 lbs. (136 kg) each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection.
 - 5. Locks: To be disc tumbler lock keyed alike and master keyed. Dull chrome finish.
 - a. Hinged doors and drawers Olympus 100DR, 200DW.
 - b. Refer to Casework General Notes for location of locks.
- E. Detailed Requirements for Cabinet Construction:
 - 1. Sub-Base:
 - a. Cabinet Subbase: All fixed under-counter and tall units shall have an individual factory-applied base, separate and continuous (no cabinet body sides-to-floor), 3/4-inch (19-mm)-thick water resistant MDO with concealed fastening to cabinet bottom. Ladder-type construction, of front, back and intermediates, to form a secure and level platform to which cabinets attach. Base is nominal 4 inches high unless shown otherwise. Panel to the floor or separate particle board base is unacceptable.
 - b. No levelers are permitted.

BID AND PERMIT SET

- 2. Cabinet Top and Bottom:
 - a. Base and tall cabinet bottoms to be MDO, laminated as indicated on drawings.
 - b. Solid sub-top to be 3/4 inch (19 mm). Furnish for all base and tall cabinets. Stretchers are unacceptable.
 - c. Wall cabinet bottoms and tops are 3/4-inch (19-mm)-thick.
 - d. Exterior exposed wall cabinet bottoms to be pressure fused laminate both sides. Assembly devices to be concealed on bottom side of wall cabinets.
- 3. Cabinet Ends:
 - Solid plywood, premium grade with radiuses on edges, sanded smooth finish.
 Doors to have eased corners, with a radius of 6-inch (152-mm) diameter on all four sides.
 - b. Exposed exterior cabinet ends to be natural grain of plywood, radiused and sanded smooth.
- 4. Fixed and Adjustable Shelves:
 - a. MDO. Leading exposed edge of shelves to be edged with T-Mold in color specified.
 - b. Thickness: 3/4-inch (19-mm) standard shelving to be maximum 23 inches (584 mm) wide. One-inch (25.4-mm) shelving is required for shelves 24 inches (610 mm) wide and over.
 - c. Thickness of shelves at all widths of open cabinets: 1 inch (25.4 mm).
- 5. Cabinet Backs:
 - a. Standard cabinet back to be 1/2-inch (12.7-mm) thick, laminated MDO. Wall and tall cabinets are provided with a 1 inch by 1-3/4 inches (25.4 by 44.5 mm) mounting strip used to secure the cabinet to the wall. Exposed back on fixed or moveable cabinets is MDO with the exterior surface finished in laminate as selected.
- 6. Door and Drawer Fronts:
 - a. Plastic laminated doors and drawer fronts to be 1/2-inch (12.7-mm) thick for all hinged and sliding doors. Core material to be 3/4-inch (19-mm)-thick, MDO with PLAM on both interior and exterior faces. Drawer fronts and hinged doors are to overlay the cabinet body. Maintain a maximum 1/8-inch (3.2-mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet. Radius edges of drawer fronts.
 - b. Exposed edges to be edged with T-Mold in color specified.
- 7. Vertical and Horizontal Dividers: MDO 1/2-inch (12.7-mm) thick, smooth both faces. Secure in cabinet with molded plastic clips.
- 8. ADA-Americans with Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on architectural plans as "ADA," or by General Note. Comply with Federal Register Volume 56, No. 144, Rules and Regulations:
 - a. 12-inch (305 mm) Deep Shelving, Adjustable or Fixed: Not to exceed a range from 9 inches (229 mm) above finish floor to 54 inches (1372 mm) above finish floor.

BID AND PERMIT SET

- F. Shelf Supports: Refer to Details.
- G. Workmanship:
 - 1. All exposed exterior cabinet surfaces to be high pressure plastic laminate, colors as specified. Laminate surface/backer to core under controlled conditions, by approved and regulated laminating methods to assure a premium lamination. Natural-setting adhesives that cure through chemical reaction are required. Methods requiring heat are not allowed; "contact" methods of laminating are not allowed.
 - 2. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components.
 - 3. End panels shall be doweled to receive bottom and top.
 - 4. All cases shall be square, plumb and true.
 - 5. Provide removable back panels and closure panels for plumbing access.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify site dimensions of cabinet locations in building prior to fabrication.

3.2 CASEWORK INSTALLATION

- A. Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.
- B. Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1/16 inch (1.6 mm) of a single plane. Fasten each individual cabinet to floor at toe space with fasteners spaced 24 inches (610 mm) on center. Bolt continuous cabinets together. Secure individual cabinets with not less than 2 fasteners into floor where they do not adjoin other cabinets.
 - 1. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch (1.6 mm).

BID AND PERMIT SET

- C. Wall Cabinets: Securely fasten to solid supporting material and not to lath or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets.
 - 1. Reinforcement of stud walls to support wall mounted cabinets will be accomplished during wall erection by trade involved; however, indicated accurate location and sizing of reinforcement is responsibility of casework installer.
- D. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to flat in mortises unless otherwise indicated. Turn screws to flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.
- E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessories in accordance with approved location drawings and manufacturer's installation recommendations. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely and smoothly without binding.

3.4 ADJUSTING

- A. Repair or remove and replace defective work, as directed by Architect upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.5 CLEANING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protection: Provide 6 mil (0.15 mm) plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at minimum of 4 feet (1,219 mm) on center. Protect installed casework and fittings from damage by work of other trades.

END OF SECTION 123216

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bicycle racks.
- B. Bike/Skate Deterrent.
- C. Basketball Equipment
- D. Deck Drain Grate

1.2 RELATED REQUIREMENTS

- A. Section 32 1313 Concrete Paving
- B. Section 03 3000 Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2008.
- B. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions.
- B. Selection Samples: For each finish product specified, color chips representing manufacturer's sample of the specified color.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Handle products with sufficient care to prevent scratches and other damage to the finish.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

- A. Materials: 1-1/2 inch galvanized steel tubing.
- B. Mounting: Surface mount. 5-1/2 inch diameter surface mount plates at each end.
- C. Anchors: 9/16" x 2-1/2" concrete anchors. 3 anchors at each surface mount plate (6 anchors total at each bike rack). All hardware to be tamper-proof.
- D. Approved Products:
 - 1. Bola by Landscape Forms, Inc., or approved equal.
 - 2. Model LRAF-Flange-galv by Life Rax Co.; 503-722-9420, or approved equal.
 - 3. Substitutions: Under provisions of Section 012500.

2.2 BIKE/SKATE DETERRENT

- A. Materials: 6061 T6 Aluminum.
- B. Finish: Hard Anodize
- C. Mounting: Two 3/8" x 1-1/2" studs and epoxy.
- D. Approved Product:
 - 1. Model G-012 by Skatestoppers, El Cajon, CA (619) 447-6374, or approved equal.
 - 2. Substitutions: Under provisions of Section 012500.

2.3 DECK DRAIN GRATE

- A. Grate: 12 inch square cast gray iron with 1/4 inch or smaller openings for ADA compliance. Approved product: Vertigo 9090DR-12 by ironsmith, or approved.
- B. Frame: 12 inch square steel angle frame with concrete anchors. Approved product: 9000FDR-12 by ironsmith, or approved.

2.4 BASKETBALL HOOP

- A. Pole Size: 6 inch x 6 inch steel, black powder coated. Include 1 inch thick pole padding.
- B. Backboard: 72 inch x 42 inch x 1/2 inch thick tempered glass. Mount rim through glass with grommets so there is no pressure on the glass.
- C. Extension Arm: 4 6 feet from front of pole to backboard based on

BID AND PERMIT SET

- D. Mounting: Bolt down or direct bury per manufacturer's specifications.
- E. Height: Regulation 10 foot and 8 foot, refer to Site Plan for locations.
- F. Approved Products:
 - 1. Hercules Platinum Basketball Goal from www.produnkhoops.com, or approved equal.
 - 2. Ultimate 42 inch x 72 inch basketball system, Model BA873U-BK from www.bisoninc.com, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surfaces to receive site furnishings are acceptable prior to installation.
- B. If substrate preparation is the responsibility of another installer, notify Owner's Representative of unsatisfactory preparation before proceeding.
- C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.2 PREPARATION

- A. Ensure surfaces to receive site furnishings are clean, flat, and level.
- B. Review location of furnishings to be installed with Owner's Representative prior to installing. Contractor should mark or stake the proposed location for approval.

3.3 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install products as detailed and per manufacturer's recommendations. Set level, plumb, square, and correctly located as indicated on the drawings.
- C. Secure as specified or as recommended by manufacturer. Obtain Owner's Representatives approval of method prior to installation.

3.4 SKATE DETERRENT INSTALLATION

- A. Provide sample mock-up of Skate Deterrent for approval.
- B. Install skate deterrents a maximum of 36 inches on center on all concrete walls and segmental block walls that are less than 3 feet in height and abut a paved surface.

BID AND PERMIT SET

- C. Drill and epoxy mounting pins into predrilled holes per the manufacturer's installation instructions.
- D. Coordinate exact locations with Owner's Representative prior to installation.

3.5 BASKETBALL HOOP INSTALLATION

- A. Confirm final location of basketball hoop installation with Owner's Representative after the final product and extension from the pole to backboard is determined.
- B. Install in accordance with manufacturer's installation instructions. Direct bury or bolt to footing as required by manufacturer.

3.6 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.7 **PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 129300
SECTION 142400 - HYDRAULIC ELEVATORS

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 machine room-less hydraulic passenger elevators.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 2. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 3. Section 055000 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills.
 - e. Pit ladders.
 - f. Cants made from steel sheet in hoistways.

1.3 ALLOWANCES

- A. Elevator Car Allowances: Provide finished passenger and service elevator cars. Allowance includes furnishing and installing the following:
 - 1. Car wall finishes, including trim.
 - 2. Car floor finishes.
 - 3. Car ceiling finishes.
 - 4. Car door finishes.
 - 5. Hoistway door and frame finishes.
 - 6. Car light fixtures.
 - 7. Handrails.
 - 8. Cutouts and other provisions for installing elevator signal equipment in cars.

1.4 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

HYDRAULIC ELEVATORS

BID AND PERMIT SET

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.5 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing; coordination with building structure; relationships with other construction; and locations of equipment.
 - 2. Include large-scale layout of car-control station and standby-power operation control panel.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.
- C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch- (75-mm-) square Samples of sheet materials and 4-inch (100-mm) lengths of running trim members.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, as shown on Drawings, and electrical service including standby-power generator, as shown and specified, are adequate for elevator system being provided.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.10 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Furnish well casing and coordinate delivery with related excavation work.
- C. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of design product: Subject to compliance with requirements, provide Otis Hydrofit or comparable products by, but not limited to the following:
 - 1. Schindler Elevator Corp.
 - 2. ThyssenKrupp Elevator.
- B. Source Limitations: Obtain elevators from single manufacturer.
 - 1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 - 2. Project Seismic Design Category: As indicated on structural drawings.
 - 3. Elevator Component Importance Factor: 1.5.
 - 4. Provide earthquake equipment required by ASME A17.1/CSA B44.
 - 5. Provide seismic switch required by ASCE/SEI 7.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 - 1. Elevator Number(s): elevator number as shown on Drawings.
 - 2. Emergency Elevator Number(s): elevator number as shown on Drawings.
 - 3. Type: Holeless, beside-the-car, telescoping, cylinder.
 - 4. Rated Load: 3500 lb (1588 kg).

BID AND PERMIT SET

- 5. Rated Speed: 125 fpm (0.64 m/s).
- 6. Operation System: Single automatic operation.
- 7. Auxiliary Operations:
 - a. Standby-powered lowering.
 - b. Battery-powered lowering.
 - c. Automatic dispatching of loaded car.
 - d. Nuisance call cancel.
 - e. Loaded-car bypass.
 - f. Automatic operation of lights and ventilation fans.
- 8. Security Features: Card-reader operation.
- 9. Car Enclosures:
 - a. Elevator to be ADA compliant and wheelchair accessible and able to hold a stretcher.
 - b. Inside Height: Not less than 93 inches (2362 mm) to underside of ceiling.
 - c. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
 - d. Car Fixtures: Satin stainless steel, No. 4 finish.
 - e. Side and Rear Wall Panels: Plastic laminate.
 - f. Reveals: Satin stainless steel, No. 4 finish.
 - g. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - h. Door Sills: Aluminum.
 - i. Ceiling: Satin stainless steel, No. 4 finish with recessed perimeter lighting.
 - j. Handrails: 3 inches (76 mm) flat satin stainless steel, No. 4 finish, at rear of car.
 - k. Floor prepared to receive resilient flooring specified in Section 096519 "RESILIENT TILE FLOORING"
- 10. Hoistway Entrances:
 - a. Width: 42 inches (1067 mm).
 - b. Height: 84 inches (2134 mm).
 - c. Type: Single-speed side sliding, right-hand.
 - d. Frames: Satin stainless steel, No. 4 finish.
 - e. Doors: Satin stainless steel, No. 4 finish.
 - f. Sills: Aluminum.
- 11. Hall Fixtures: Satin stainless steel, No. 4 finish.
- 12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

BID AND PERMIT SET

2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
 - 1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch-(25-mm-) thick, glass-fiber insulation board.
 - 2. Motor shall have variable-voltage, variable-frequency control.
- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.
- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
 - 1. Cylinder units shall be connected with dielectric couplings.
 - 2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
- D. Hydraulic Fluid: Nontoxic, biodegradable, fire-resistant fluid, made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives, that is approved by elevator manufacturer for use with elevator equipment.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Car Frame and Platform: Welded or bolted steel units.
- G. Guides: Tee-section steel rails with brackets and fasteners. Provide guides at top and bottom of car frame.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Security Features: Security features shall not affect emergency firefighters' service.
 - 1. Card-Reader Operation: System uses card readers at hall push-button stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable for interconnecting card readers, other security access system equipment, and elevator controllers.

BID AND PERMIT SET

2.6 DOOR-REOPENING DEVICES

- A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessorcontrolled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8-inch (22.2-mm) nominal thickness.
 - 2. Floor Finish: Specified in Specified in Section 0996519 "Resilient Tile Flooring".
 - 3. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from elevator manufacturer's full range.
 - 4. Fabricate car with recesses and cutouts for signal equipment.
 - 5. Fabricate car door frame integrally with front wall of car.
 - 6. Enameled- or Powder-Coated-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
 - 7. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 8. Sight Guards: Provide sight guards on car doors.
 - 9. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - 10. Metal Ceiling: Flush panels, with four low-voltage downlights in each panel. Align ceiling panel joints with joints between wall panels.
 - 11. Light Fixture Efficiency: Not less than 35 lumens/W.
 - 12. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).

BID AND PERMIT SET

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: 1 hour.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 - 1. Steel Subframes: Formed from cold- or hot-rolled steel sheet, with factory-applied enamel or powder-coat finish or rust-resistant primer. Fabricate to receive applied finish as indicated.
 - 2. Stainless-Steel Frames: Formed from stainless-steel sheet.
 - 3. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches (76 mm) high, on both jambs of hoistway door frames.
 - 4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 5. Sight Guards: Provide sight guards on doors matching door edges.
 - 6. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - 7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

BID AND PERMIT SET

- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283111 "Digital, Addressable Fire-Alarm System."
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide hall push-button station at each landing as indicated.
 - 1. Provide manufacturer's standard wall-mounted units.
 - 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
 - 3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Section 283111 "Digital, Addressable Fire-Alarm System."
- G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide one of the following:
 - 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
 - 2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- I. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby-power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

2.10 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Stainless-Steel Bars: ASTM A 276, Type 304.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Install piping above the floor, where possible. Install underground piping in casing.
- E. Lubricate operating parts of systems as recommended by manufacturers.
- F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- G. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.
- H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- I. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

BID AND PERMIT SET

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 **PROTECTION**

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication,

BID AND PERMIT SET

cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

- 1. Perform maintenance during normal working hours.
- 2. Perform emergency callback service during normal working hours with response time of 4 hours or less.

END OF SECTION 142400