

OCTOBER 27, 2017

CONSTRUCTION DOCUMENTS

**ALLIES & ROSS MANAGEMENT AND
DEVELOPMENT CORPORATION
TASK ORDER CONTRACT NO 33 –
GLEN HAZEL RAD**

Housing Authority of the City of Pittsburgh
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R3A Project No. 15074B

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DIVISION	SECTION TITLE	PAGES
	COVER SHEET	1
DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS		
000110	TABLE OF CONTENTS	3
000115	LIST OF DRAWINGS	4
DIVISION 01 - GENERAL REQUIREMENTS		
011000	SUMMARY	9
011200	MULTIPLE CONTRACT SUMMARY	3
012100	ALLOWANCES	7
012300	ALTERNATES	6
012500	SUBSTITUTION PROCEDURES	4
012500.2	SUBSTITUTION REQUEST	1
012600	CONTRACT MODIFICATION PROCEDURES	3
012600.1	CHANGE ORDER PROPOSAL FORM	1
012900	PAYMENT PROCEDURES	7
013100	PROJECT MANAGEMENT AND COORDINATION	11
013200	CONSTRUCTION PROGRESS DOCUMENTATION	14
013233	PHOTOGRAPHIC DOCUMENTATION	6
013300	SUBMITTAL PROCEDURES	14
014000	QUALITY REQUIREMENTS	8
015000	TEMPORARY FACILITIES AND CONTROLS	12
016000	PRODUCT REQUIREMENTS	6
017300	EXECUTION	9
017329	CUTTING AND PATCHING	5
017700	CLOSEOUT PROCEDURES	6
017823	OPERATION AND MAINTENANCE DATA	8
017839	PROJECT RECORD DOCUMENTS	5
017900	DEMONSTRATION AND TRAINING	5
DIVISION 2 – EXISTING CONDITIONS		
024119	SELECTIVE STRUCTURE DEMOLITION	6
DIVISION 3 – CONCRETE		
035416	HYDRAULIC CEMENT UNDERLAYMENT	4
DIVISION 6 – WOOD AND PLASTICS		
061053	MISCELLANEOUS ROUGH CARPENTRY	8
061600	SHEATHING	9
DIVISION 7 – THERMAL AND MOISTURE PROTECTION		
072100	THERMAL INSULATION	3
073113	ASPHALT SHINGLES	9
076200	SHEET METAL FLASHING AND TRIM	10
078413	PENETRATION FIRESTOPPING	8

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

TABLE OF CONTENTS
000110

079200	JOINT SEALANTS	12
--------	----------------	----

DIVISION 8 – DOORS AND WINDOWS

081113	HOLLOW METAL DOORS AND FRAMES	9
081416	FLUSH WOOD DOORS	6
083213	SLIDING FIBERGLASS-FRAMED GLASS DOORS	6
085413	FIBERGLASS WINDOWS	7
087100	DOOR HARDWARE	16
088000	GLAZING	12

DIVISION 9 – FINISHES

090000	SCHEDULE OF FINISHES	5
092900	GYPSUM BOARD	8
093000	TILING	12
095113	ACOUSTICAL PANEL CEILINGS	7
096513	RESILIENT BASE AND ACCESSORIES	5
096519	RESILIENT TILE FLOORING	6
096816	CARPETING	6
099123	PAINTING	9

DIVISION 10– SPECIALTIES

101100	VISUAL DISPLAY SURFACES	7
102600	WALL AND DOOR PROTECTION	7
102800	TOILET ACCESSORIES	5

DIVISION 11– EQUIPMENT

113100	RESIDENTIAL APPLIANCES	7
--------	------------------------	---

DIVISION 12– FURNISHINGS

122113	HORIZONTAL LOUVER BLINDS	6
122116	VERTICAL LOUVER BLINDS	6
123000	RESIDENTIAL CASEWORK	11

DIVISION 22– PLUMBING

220500	COMMON WORK RESULTS FOR PLUMBING	21
220523	GENERAL-DUTY VALVES FOR PLUMBING PIPING	6
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	8
220719	PLUMBING PIPING INSULATION	14
221116	DOMESTIC WATER PIPING	10
221119	DOMESTIC WATER PIPING SPECIALTIES	6
221125	NATURAL GAS PIPING	11
221316	SANITARY WASTE AND VENT PIPING	7
221319	SANITARY WASTE PIPING SPECIALTIES	6
223400	FUEL-FIRED DOMESTIC WATER HEATERS	5
224000	PLUMBING FIXTURES	17

DIVISION 23– HEATING VENTILATING AND AIR CONDITIONING

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

TABLE OF CONTENTS
000110

230500	COMMON WORK RESULTS FOR HVAC	18
230511	ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT	5
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	3
230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING	3
230523	GENERAL DUTY VALVES FOR HVAC PIPING	10
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	9
230548	VIBRATION CONTROLS FOR HVAC	5
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	5
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC	13
230719	HVAC PIPING INSULATION	17
230900	INSTRUMENTATION AND CONTROL FOR HVAC	6
230993	SEQUENCE OF CONTROLS	4
235400	FURNACES	10
238113	PACKAGED TERMINAL AIR CONDITIONERS	7

DIVISION 26– ELECTRICAL

260500	COMMON WORK RESULTS FOR ELECTRICAL WORK	5
260503	EQUIPMENT WIRING CONNECTIONS	3
260519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	8
260526	GROUNDING & BONDING FOR ELECTRICAL SYSTEMS	3
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	2
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS	7
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING	5
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS	2
262416	PANELBOARDS	6
262716	ELECTRICAL CABINETS AND ENCLOSURES	3
265100	INTERIOR LIGHTING	5

DIVISION 28– ELECTRONIC SAFETY AND SECURITY

283100	UFAS APARTMENT FIRE ALARM INTERFACE	6
--------	-------------------------------------	---

DIVISION 32– SITE

311000	SITE PREPARATION	7
321216	ASPHALT PAVING	9
321313	CONCRETE PAVING	15
321723	PAVEMENT MARKINGS	3
323123	EXTRUDED VINYL FENCE SYSTEMS	5

END OF TABLE OF CONTENTS

GENERAL

G-100	COVER SHEET
G-101	BERNICE CRAWLEY HIGH RISE UNIT INFO
G-102	FAMILY COMMUNITY UNIT INFO
G-110	CODE REFERENCE SHEET

LANDSCAPE

L-001A	MDA SITE INSTRUCTIONS
L-002A	MDA/ MISTICK SITE QUANTITIES
L-101A	MDA SITE PLAN
L-102A	MDA SITE PLAN
L-103A	MDA SITE PLAN
L-201A	MDA SITE IMAGE REFERENCES
L-202A	MDA SITE IMAGE REFERENCES
L-203A	MDA SITE IMAGE REFERENCES
L-204A	MDA SITE IMAGE REFERENCES
L-301A	MDA SITE DETAILS
L-001B	PRIVACY FENCING AND MECHANICAL EQUIPMENT PADS
L-002B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-101B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-102B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-103B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-104B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-105B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-106B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-107B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-108B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-109B	PRIVACY FENCE AND MECHANICAL EQUIPMENT PAD LOCATION PLAN
L-101C	ADD ALTERNATIVE/ MISTICK SITE PLAN
L-102C	ADD ALTERNATIVE/ MISTICK SITE PLAN
L-103C	ADD ALTERNATIVE/ MISTICK SITE PLAN
L-104C	ADD ALTERNATIVE/ MISTICK SITE DETAILS
L-105C	ADD ALTERNATIVE/ MISTICK SITE DETAILS
L-106C	ADD ALTERNATIVE/ MISTICK SITE DETAILS

ARCHITECTURAL

A-001	SYMBOLS AND STANDARD MOUNTING HEIGHTS
A-101	BERNICE CRAWLEY HIGH RISE – FIRST FLOOR PLAN
A-102	BERNICE CRAWLEY HIGH RISE – SECOND FLOOR PLAN
A-103	BERNICE CRAWLEY HIGH RISE – THIRD - SEVENTH FLOOR PLAN
A-104	BERNICE CRAWLEY HIGH RISE – EIGHTH FLOOR PLAN
A-105	BERNICE CRAWLEY HIGH RISE – SMALL & LARGE ONE BEDROOM ENLARGED PLANS
A-106	BERNICE CRAWLEY HIGH RISE – UFAS ONE & TWO BEDROOM ENLARGED PLANS
A-107	BERNICE CRAWLEY HIGH RISE – FINISH PLANS

A-111	FAMILY COMMUNITY – TYPE A
A-112	FAMILY COMMUNITY – TYPE B
A-113	FAMILY COMMUNITY – TYPE C
A-114	FAMILY COMMUNITY – TYPE D
A-115	FAMILY COMMUNITY – TYPE E
A-116	FAMILY COMMUNITY – TYPE F UFAS
A-117	FAMILY COMMUNITY – TYPE G
A-118	FAMILY COMMUNITY – TYPE H UFAS
A-119	FAMILY COMMUNITY – TYPE J
A-120	FAMILY COMMUNITY – TYPE K
A-121	FAMILY COMMUNITY – TYPE L
A-122	FAMILY COMMUNITY – TYPE M
A-201	BERNICE CRAWLEY HIGH RISE – EXTERIOR ELEVATIONS
A-211	FAMILY COMMUNITY – TYPE A EXTERIOR ELEVATIONS
A-212	FAMILY COMMUNITY – TYPE B EXTERIOR ELEVATIONS
A-213	FAMILY COMMUNITY – TYPE C EXTERIOR ELEVATIONS
A-214	FAMILY COMMUNITY – TYPE D EXTERIOR ELEVATIONS
A-215	FAMILY COMMUNITY – TYPE E EXTERIOR ELEVATIONS
A-216	FAMILY COMMUNITY – TYPE F UFAS EXTERIOR ELEVATIONS
A-217	FAMILY COMMUNITY – TYPE G EXTERIOR ELEVATIONS
A-218	FAMILY COMMUNITY – TYPE H UFAS EXTERIOR ELEVATIONS
A-219	FAMILY COMMUNITY – TYPE J EXTERIOR ELEVATIONS
A-220	FAMILY COMMUNITY – TYPE K EXTERIOR ELEVATIONS
A-221	FAMILY COMMUNITY – TYPE L EXTERIOR ELEVATIONS
A-222	FAMILY COMMUNITY – TYPE M EXTERIOR ELEVATIONS
A-223	FAMILY COMMUNITY – COMMUNITY ROOM BUILDING EXTERIOR ELEVATIONS
A-401	BERNICE CRAWLEY HIGH RISE – ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-402	BERNICE CRAWLEY HIGH RISE – ENLARGED UFAS/ACCESSIBLE PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-411	FAMILY COMMUNITY – TYPE A ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-412	FAMILY COMMUNITY – TYPE B ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-413	FAMILY COMMUNITY – TYPE C ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-414	FAMILY COMMUNITY – TYPE D ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-415	FAMILY COMMUNITY – TYPE E ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-416	FAMILY COMMUNITY – TYPE F UFAS ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-417	FAMILY COMMUNITY – TYPE G ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-418	FAMILY COMMUNITY – TYPE H UFAS ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-419	FAMILY COMMUNITY – TYPE J ENLARGED PLANS AND ELEVATIONS, SCHEDULES,

	TYPES AND DETAILS
A-420	FAMILY COMMUNITY – TYPE K ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-421	FAMILY COMMUNITY – TYPE L ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-422	FAMILY COMMUNITY – TYPE M ENLARGED PLANS AND ELEVATIONS, SCHEDULES, TYPES AND DETAILS
A-601	EXTERIOR WINDOW DETAILS
A-602	PORCH AND RAILING DETAILS

HVAC

M-102	BERNICE CRAWLEY HIGH RISE – SECOND FLOOR HVAC PLAN
M-105	BERNICE CRAWLEY HIGH RISE – SMALL & LARGE ONE BEDROOM ENLARGED HVAC PLAN
M-106	BERNICE CRAWLEY HIGH RISE – UFAS ONE & TWO BEDROOM ENLARGED HVAC PLANS
M-107	BERNICE CRAWLEY HIGH RISE – ROOF TOP PLAN
M-108	BERNICE CRAWLEY HIGH RISE - ELEVATIONS
M-111	FAMILY COMMUNITY – TYPE A
M-112	FAMILY COMMUNITY – TYPE B
M-113	FAMILY COMMUNITY – TYPE C
M-114	FAMILY COMMUNITY – TYPE D
M-115	FAMILY COMMUNITY – TYPE E
M-116	FAMILY COMMUNITY – TYPE F UFAS
M-117	FAMILY COMMUNITY – TYPE G
M-118	FAMILY COMMUNITY – TYPE H UFAS
M-119	FAMILY COMMUNITY – TYPE J
M-120	FAMILY COMMUNITY – TYPE K
M-121	FAMILY COMMUNITY – TYPE L
M-122	FAMILY COMMUNITY – TYPE M

PLUMBING

P-101	BERNICE CRAWLEY HIGH RISE – FIRST FLOOR PLUMBING PLAN
P-105	BERNICE CRAWLEY HIGH RISE – SMALL & LARGE ONE BEDROOM ENLARGED PLUMBING PLAN
P-106	BERNICE CRAWLEY HIGH RISE - UFAS ONE & TWO BEDROOM ENLARGED PLANS
P-111	FAMILY COMMUNITY – TYPE A
P-112	FAMILY COMMUNITY – TYPE B
P-113	FAMILY COMMUNITY – TYPE C
P-114	FAMILY COMMUNITY – TYPE D
P-115	FAMILY COMMUNITY – TYPE E
P-116	FAMILY COMMUNITY – TYPE F UFAS
P-117	FAMILY COMMUNITY – TYPE G
P-118	FAMILY COMMUNITY – TYPE H UFAS
P-119	FAMILY COMMUNITY – TYPE J
P-120	FAMILY COMMUNITY – TYPE K

P-121 FAMILY COMMUNITY – TYPE L
P-122 FAMILY COMMUNITY – TYPE M

ELECTRICAL

E-101 BERNICE CRAWLEY HIGH RISE – FIRST FLOOR ELECTRICAL PLAN
E-102 BERNICE CRAWLEY HIGH RISE – SECOND FLOOR ELECTRICAL PLAN
E-103 BERNICE CRAWLEY HIGH RISE – THIRD – SEVENTH FLOOR ELECTRICAL PLAN
E-104 BERNICE CRAWLEY HIGH RISE – EIGHTH FLOOR ELECTRICAL PLAN
E-105 BERNICE CRAWLEY HIGH RISE – SMALL & LARGE ONE BEDROOM ENLARGED
ELECTRICAL PLANS
E-106 BERNICE CRAWLEY HIGH RISE – UFAS ONE & TWO BEDROOM ENLARGED
ELECTRICAL PLANS
E-107 BERNICE CRAWLEY HIGH RISE – ROOF TOP PLAN
E-111 FAMILY COMMUNITY – TYPE A
E-112 FAMILY COMMUNITY – TYPE B
E-113 FAMILY COMMUNITY – TYPE C
E-114 FAMILY COMMUNITY – TYPE D
E-115 FAMILY COMMUNITY – TYPE E
E-116 FAMILY COMMUNITY – TYPE F UFAS
E-117 FAMILY COMMUNITY – TYPE G
E-118 FAMILY COMMUNITY – TYPE H
E-119 FAMILY COMMUNITY – TYPE J
E-120 FAMILY COMMUNITY – TYPE K
E-121 FAMILY COMMUNITY – TYPE L
E-122 FAMILY COMMUNITY – TYPE M

END OF LIST OF DRAWINGS

SECTION 011000 - SUMMARY

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. Project information.
- 2. Work covered by Contract Documents.
- 3. Phased construction.
- 4. Access to site.
- 5. Coordination with occupants.
- 6. Work restrictions.
- 7. Specification and drawing conventions.

B. Related Requirements:

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

1.3 PROJECT INFORMATION

- A. Project Identification: Housing Authority of the City of Pittsburgh, ARMDC Task Order Contract No. 33 – Glen Hazel RAD

1. Project Location:

- a. Bernice Crawley High Rise: 945 Roselle Court, Pittsburgh, PA 15207
- b. Family Community Low Rise: Refer to Drawing G-110 for all Building Numbers and Addresses

- B. Owner: (HACP) Housing Authority of the City of Pittsburgh, 206 Ross Street, 9th Floor, Pittsburgh, PA 15219

- 1. HACP Contact: Jerome Frank

- C. Developer: Allies and Ross Management and Development, 100 Ross Street, 2nd Floor Suite 200, Pittsburgh, PA 15219

1. HACP Contact: Jerome Frank
- D. Architect: Renaissance 3 Architects, PC; 48 South 14th Street, Pittsburgh, PA 15203
 1. R3A Contact: Carla Worthington
- E. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 1. Landscape Architect, Site Engineer: Moore Design Associates; 130 Heaven Lane, Mars, PA 16046
 - a. Representative: Sara Moore
 2. Mechanical, Electrical and Plumbing Engineer: Tri-State Design & Development; 9 East Main Street, Carnegie, PA 15106
 - a. Representative: Larry J. Schultz
- F. Contractor: To be determined.
- G. Project Web Site: A project Web site administered by General Prime Contractor will be used for purposes of managing communication and documents during the construction stage.
 1. See Section 013100 "Project Management and Coordination." for requirements for establishing administering and using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. All work is to comply with all applicable codes, ICC/ANSI A117.1, PHFA Requirements, PHFA's Enterprise Green Communities Criteria for Preservation Projects, HUD Requirements and Section 504/UFAS requirements.
- B. There is no removal of any asbestos containing materials. If any contractor becomes aware of any friable materials during construction HACP's Representative and the Architect are to be notified. A Hazardous Materials Survey has been completed, asbestos and hazardous materials have been identified, and is on file at HACP Offices and will be made available to all upon request. Lead paint was identified within the building and the Contractor and all his Subcontractors are to comply with all applicable codes and requirements including OSHA standards. A Phase 1 Environmental Site Assessment has also been completed and is on file at HACP Offices and will be made available to all upon request.
- C. Radon Testing has been completed and radon was detected at (4) four Glen Hazel Family Community Low Rise Apartment Units and will require a Specialized Design Build System for Remediation under the Plumbing Prime Contractor. Test Results are on file at HACP Offices and will be made available to all upon request.

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

1. The Scope of Work Area includes selective demolition and construction on the interior and exterior of the existing IBC Classified R-2 (Residential), multiple story, Type 1B construction of the Bernice Crawley High Rise Building, with ninety seven apartment units, and varied one to two story, Type VB construction for one hundred and twenty eight (128) Family Community Low Rise buildings. The site, the High Rise and the Low Rise buildings will be occupied during demolition and construction. The project is Multiple Prime General, Mechanical, Plumbing and Electrical and coordination is required with the Owner's Relocation Consultant.
2. Each Prime Contractor is to refer to the **Entire set of Contract Documents** for coordination of scope of work an additional detailed requirements with all other Prime Contractors and Owner Requirements and scope of work as described in the pertinent specification sections and/or shown on the drawings.
3. All associated fees for permits and inspections required to complete the scope of work described above.

4. **General Prime Contractor:**

In general for the Bernice Crawley High Rise : The Exterior Scope of work includes, but not limited to: Parking lot paving seal and stripe; temporary erosion control; concrete repairs at steps and walkways; exterior building painting; removal and replacement of all unit windows. The Interior Scope of work includes, but not limited to: Replacement of all floor, wall and ceiling finishes, throughout the entire building and units, as indicated in the contract documents; (2) First Floor Restroom Countertops; and blinds. Specific, but not limited to (97) High Rise Units: all unit kitchen cabinets and countertops; all refrigerators; all bathtub surrounds, accessories, vanities and integral sink countertops in Standard Units Only; all bathroom cabinetry and sinks in UFAS Units Only with UFAS/Accessible Compliant sinks provided by Plumbing Prime Contractor; blinds; patching of drywall; and all as indicated on the Construction Documents.

In General for all the one hundred and twenty eight (128) Family Community Low Rise Buildings and Units: The Exterior Scope of work includes, but not limited to Parking lot paving seal and stripe; temporary erosion control; concrete repairs at pads, steps and walkways; replacement of handrails; removal and replacement of shingle roofing system, roof vents and accessories, gutters and downspouts; all windows; all exterior swing doors and hardware; limited number of sliding glass doors; and all as indicated on the Construction Documents. The Interior Scope of work within all the one hundred and twenty eight (128) Building Units includes, but not limited to: Replacement of all floor, wall and ceiling finishes, as indicated in the contract documents; all unit kitchen cabinets and countertops; all refrigerators; all bathtub surrounds, accessories, vanities and integral sink countertops in Standard Units Only; patching of drywall; blinds, and all as indicated on the Construction Documents; and all as indicated on the Construction Documents.

5. **Mechanical Prime Contractor:**

In general for all for all ninety-seven (97) Bernice Crawley High Rise Units and Roof: 2nd through 8th Floors: The Scope of work includes, but not limited to removal and replacement of through-the-wall air conditioners, recirculating range hoods, exhaust grilles, and all as indicated on the Construction Documents. Roof: Replacement of exhaust fans on the rooftop; and all as indicated on the Construction Documents.

In General for all the one hundred and twenty eight (128) Family Community Low Rise Units: The Scope of work includes, but not limited to removal and replacement of gas fired heating furnaces with heating/air conditioning units, condensers and concrete pad; bathroom exhaust fans, and thermostats; removal of all range hoods and replacement with recirculating range hoods; furnishing and installing a concealment system for added refrigerant piping at ceilings; duct cleaning and all as indicated on the Construction Documents.

6. Plumbing Prime Contractor:

In general for all for all ninety-seven (97) Bernice Crawley High Rise Units: 2nd through 8th Floors: The Scope of work includes, but not limited to furnishing and installing UFAS/Accessible compliant wall mounted sinks, faucets, plumbing, pipe protection and wall carrier in all UFAS/Accessible Units; removal and replacement of vanity faucets, piping and p-traps in all Standard Units; removal, salvaging and reinstalling of waterclosets; replacement of shower faucet and heads at tub surrounds in all Standard Units only; replacing kitchen sinks; removal and replacement of kitchen sink faucets, piping and p-traps; replacement of nonfunctioning valves; replacement of plumbing as indicated on drawings. 1st Floor Restrooms: furnish and install sinks, faucets and plumbing; and all as indicated on the Construction Documents.

In General for all the one hundred and twenty eight (128) Family Community Low Rise Units: The Scope of work includes, but not limited to furnishing and installing UFAS/Accessible compliant faucets and plumbing in all UFAS/Accessible Units; removal and replacement of vanity faucets, piping and p-traps in all Standard Units; removal, salvaging and reinstalling of waterclosets in all Standard Units only; replacement of shower faucet and heads at tub surrounds in Standard Units only; replacing kitchen sinks; removal and replacement of kitchen sink faucets, piping and p-traps; removal and replacement of all gas fired water heaters; replacement of flexible gas hose to all ranges; replacement of nonfunctioning valves; and all as indicated on the Construction Documents.

7. Electrical Prime Contractor:

In general for all (97) Bernice Crawley High Rise Units: 1st Floor through 8th Floors: The Scope of work includes, but not limited to removal and replacement of all residential unit's lighting fixtures, and Common Area light fixtures as indicated, with LED fixtures; removal and replacement of unit load centers, all smoke detectors, exterior building lighting fixtures; electrical deenergizing and reenergizing of all connections required by other prime contractors;

In General for all the one hundred and twenty eight (128) Family Community Low Rise Units: The Scope of work includes, but not limited to removal and replacement of all residential unit's interior lighting fixtures and building exterior light fixtures with LED fixtures; removal and replacement of unit load centers, all smoke detectors; electrical deenergizing and reenergizing of all connections required by other prime contractors; power and wiring for air cooled condensing units by Mechanical Prime Contractor; and all as indicated on the Construction Documents.

E. Type of Contract:

1. Project will be constructed under coordinated, concurrent multiple contracts. Refer to Division 01 Section "Multiple Contract Summary for a description of work included under each of the multiple contracts and for the responsibilities of the Project Coordinator. Contracts for this Project include the following:
 - a. General Construction Contract (General Prime Contractor or G.C.)
 - b. Mechanical Construction Contract (Mechanical Prime Contractor or H.C.)
 - c. Plumbing Construction Contract (Plumbing Prime Contractor or P.C.)
 - d. Electrical Construction Contract (Electrical Prime Contractor or E.C.)

1.5 PHASED CONSTRUCTION AND OCCUPANT DISRUPTION

- A. The Work shall be conducted in several phases and will be required to be coordinated and sequenced by the General Prime Contractor, with each phase substantially complete as indicated:
 1. General Prime Contractor is responsible for the Demolition and Construction Phasing and Occupant Disruption Schedule, (DCPOD Schedule), coordination with the Owners' Relocation Consultant and all Other Prime Contractors and disciplines and providing an update on a weekly bases during the Construction Phase. All Mechanical, Electrical and Plumbing Prime Contractors and disciplines are required to coordinate and provide detailed Demolition and Construction Phasing and Occupant Disruption Schedules, for their disciplines scope of work, to the General Prime Contractor, to be incorporated into the comprehensive schedule. All milestones and occupancy disruptions shall be identified within the schedule, and shall be provided at least 1 week prior to occupant disruptions, to allow HACP's Representative to coordinate with occupants.
 - a. General Phasing and Occupant Disruption Schedule Milestones to be Minimally Identified: Start and End dates of specific scope of work milestones, occupant milestones, substantially complete milestones, ready for occupancy milestones, and other associated milestones for approval from HACP and the Architect minimally for the each floor, each individual Apartment, each Public Area, each Employee Occupied Area, and all other Interior Scope of Work. Schedules to be inclusive of all required Occupant Disruption and Displacement time frames for each scope of work Weekly and Daily. Listing all

types of disruption. IE: Noise, Light, Odors, Displacement of Occupant, Dust, etc.

2. General Prime Contractor to Schedule a Demolition and Construction Phase Occupant Disruption Meeting within 7 calendar days of receiving the Notice to Proceed.
 3. Demolition and Construction Phasing Occupant Disruption Schedule (DCPOD Schedule) shall be provided by each Contractor/Discipline to the General Prime Contractor within 14 calendar days from Notice to Proceed.
 4. General Prime Contractor is to provide the initial DCPOD Schedule within 28 calendar days after the Notice to Proceed.
 5. Phases can include multiple areas of scope of work simultaneously.
 6. No Demolition or Construction shall start until the DCPOD Schedule has been provided and approved by HACP's Representative to Proceed.
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

1.6 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as coordinated with the HACP.
- B. Use of Site: Limit use of Project site to work zones delineated in General Prime Contractor's approved DCPOD Plan and Schedule. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits: Confine construction operations to HACP approved limits of work per construction plan.
 2. HACP Occupancy: Allow for HACP resident and employee occupancy of Project site.
 3. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to HACP, HACP's employees, and emergency vehicles at all times. Each Prime Contractor will be responsible for providing offsite parking, offsite storage of materials, and offsite placement of trailer.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations and minimize space and time requirements for materials and equipment onsite.
- C. Condition of Existing Building: Maintain existing buildings in a weathertight condition throughout all phases of the demolition and construction period. Repair damage caused by construction operations. Protect building and its occupants at all times during construction period. Daily cleaning and disposal of debris shall be maintained.

1.7 COORDINATION WITH OCCUPANTS

- A. Full HACP Resident and Employee Occupancy: HACP employees and residents will occupy the site and existing building during entire construction period. HACP's Relocation Specialist will work with Contractors, Management and Residents for full relocation on a temporary basis. Cooperate with HACP Representative during construction operations to minimize conflicts and facilitate HACP usage. Perform the Work so as not to interfere with HACP's day-to-day operations and to have minimal daily disruption to each apartment resident. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from HACP and approval of authorities having jurisdiction.
 - 2. Notify HACP not less than 120 hours in advance of activities that will affect HACP's operations.
 - 3. Contractor will have limited hours daily at coordinated apartment units to complete work and shall be indicated within the DCPOD Schedule and coordinated with the HACP and the Tenant's Representative.
- B. Owner Limited Occupancy of Completed Areas of Construction: HACP reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of furniture and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to HACP acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited HACP occupancy.
 - 3. Before limited HACP occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, HACP will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, HACP will assume responsibility for maintenance and custodial service for occupied portions of Work.
- C. Access to Occupied Building and Occupied Areas of the Building during Construction: HACP shall require access to occupied buildings and occupied areas of the building during the entire construction period. The Contractor shall provide temporary access and cooperate with HACP and HACP's contractors to provide access for the duration of the Work. Any temporary entrances shall be accessible as determined by UFAS standards and meet HACP's requirements for secure access to the buildings.
 - 1. General Prime Contractor (G.C.) shall provide
 - a. Demolition to accommodate temporary entrances and the reinstallation or replacement in like kind of materials removed or damage during the work.

- b. Temporary security Door & frame
 - 1) Door to be insulated hollow metal painted black to match existing frame, with half wire glass for security. Door to be UFAS compliant.
 - 2) Frame to be hollow metal
- c. Wall area adjacent to opening to be in filled. Interior- drywall, exterior with material to maintain building weather tightness.
- d. Any ramp and landing required to provide temporary access to the entrance area shall be removed without visible signs or have areas replaced in kind.

1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated or directed by HACP's Representative.
 - 1. Weekend Hours: Only upon receipt of written approval from HACP.
 - 2. Early Morning Hours: None without prior approval of HACP.
 - 3. Hours for Utility Shutdowns: None without prior approval of HACP.
 - 4. Hours for noisy activity: 8:00 a.m. to 5:00 p.m.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by HACP or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify HACP's Representative and Architect not less than 7 calendar days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without HACP's written permission.
 - 3. Interruptions shall be scheduled such that current tenants are not without service for more than 2 hours.
 - 4. Schedule interruptions such that the minimum numbers of units are without heat, electricity, or water at any given time.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to HACP occupancy with HACP.
 - 1. Notify HACP and Tenant Representative not less than two days in advance of proposed disruptive operations.
 - 2. Obtain HACP's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with HACP's requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with HACP's Representative.

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.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
 - 4. Basis of Design does not restrict project materials to one manufacturer or model number. "Or Approved Equal", as indicated on the documents, applies to all products or equipment to be provided.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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 a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for work of each contract are also indicated in individual Specification Sections and on Drawings.
- C. Related Sections:
 - 1. Division 01 Section "Summary" for the Work covered by the Contract Documents, restrictions on use of the Project site, phased construction, coordination with occupants, and work restrictions, and continual fire protection systems.
 - 2. Division 01 Section "Project Management and Coordination" for general coordination requirements.

1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 PROJECT COORDINATION

- A. Project Coordinator shall be the General Construction Contractor, whom shall be responsible for coordination between the General Construction Contract, Plumbing Contract, Mechanical Contract, Electrical Contract, any hazardous remediation, and Owner's telecommunication and security departments.
- B. Each Prime Contractor is required to assign a Project Manager/Coordinator within their discipline to ensure coordination between all other Prime Contractors, the Owner, and within their own discipline.

1.5 COORDINATION ACTIVITIES

- A. Each Prime Contractor is responsible for each of the following coordination activities, but are not limited to the following:
1. Provide overall coordination of the Work.
 2. Coordinate shared access to workspaces.
 3. Coordinate product selections for compatibility.
 4. Provide overall coordination of temporary facilities and controls.
 5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
 6. Coordinate construction and operations of the Work with work performed by each Contract and Owner's construction forces.
 7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.
 8. Coordinate sequencing and scheduling of the Work. Include the following:
 - a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with all Contractors and Owner's Representative for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
 - b. Prepare a combined Contractors' construction schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.
 - 1) Submit schedules for approval.
 - 2) Distribute copies of approved schedules to contractors.
 9. Provide quality-assurance and quality-control services specified in Division 01 Section "Quality Requirements."
 10. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
 11. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
 12. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
 13. Coordinate cutting and patching.
 14. Coordinate protection of the Work.
 15. Coordinate firestopping.
 16. Coordinate completion of interrelated punch list items.
 17. Coordinate preparation of Project record documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
 18. Print and submit record documents if installations by more than one contractor are indicated on the same contract drawing or shop drawing.
 19. Collect record Specification Sections from contractors, collate Sections into numeric order, and submit complete set.
 20. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

21. Coordinate the waste disposal plan for the project to include all communications with sub-contractors.
22. Verify provision of waste management facilities, to divert as much waste as possible from landfill and provide training to other prime contractors.
 - a. Evaluate facilities in enough time prior to removal from the site to ensure load complies with requirements or to require responsible prime to remove inappropriate items
 - b. Allow each prime a minimum of half a working day to correct improper disposal of waste items
23. Do not use on site trash collection for construction disposal

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 012100 - ALLOWANCES

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 administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Contingency allowances.
 - 2. Quantity Allowances
- C. Directions for the Contractor.
 - 1. The Contractor shall include in the Contract Sum all allowances as stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as ARMDC may direct, but the Contractor shall not be required to employ persons or entities that the Contractor makes a reasonable objection.
 - A. Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
 - B. Contractor's cost for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for the stated allowance amounts shall be included in the Contract Sum and not in the allowance;
 - C. Whenever the final agreed upon costs with the owner are more or less than the allowances, the Contract Sum shall be adjusted by Change Order. The amount of the Change Order shall reflect (a) the actual cost and the allowance under letter "A" above and (b) changes in the Contractors cost in letter "B" above.

1.3 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.

1.4 ACTION SUBMITTALS

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

1.5 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.

1.6 COORDINATION

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

1.7 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials selected by HACP and Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to HACP, after installation has been completed and accepted.

1.8 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for HACP's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by HACP under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to HACP by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

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.

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.

3.3 **GENERAL PRIME CONTRACTOR SCHEDULE OF ALLOWANCES
G-XXX (G-NUMBER)**

- A. **Allowance No. G-001:** Square Footage Allowance: Include replacing deteriorate or damaged gypsum drywall, inclusive of corner and J beads, taping, sanding, providing a level 1 finish. Includes up to 100 sq ft of gypsum board wall and ceiling repair per unit, as specified in Section 092900 "Gypsum Board.
- B. **Allowance No. G-002:** Square Footage Allowance: Include replacing deteriorate or damaged moisture resistant gypsum drywall, inclusive of corner and J beads, taping, sanding, providing a level 1 finish. Includes up to 30 sq ft of gypsum board wall and ceiling repair per unit, as specified in Section 092900 "Gypsum Board.
- C. **Allowance No. G-003:** Square Footage Allowance: Include 64 sq ft per Low Rise building replacing deteriorated or damaged roofing sheathing with APA rated plywood roof sheathing to match exiting thickness (existing drawings note roof sheathing at 1/2" - Contractor to verify) , as specified in Section 061600 Sheathing.
- D. **Allowance No. G-004: NOT USED**
- E. **Allowance No. G-005:** Square Footage Allowance: Include 64 sq ft per Low Rise unit replacing deteriorated or damaged underlayment with 5/8" tongue and groove plywood sheathing for LVT Flooring Finish, as specified in Section 061600 Sheathing.
- F. **Allowance No. G-006:** Square Footage Allowance: Include 64 sq ft per Low Rise unit to receive 1/4" underlayment to be placed over existing flooring, as specified in Section 061600 Sheathing.
- G. **Allowance No. G-007:** Linear Footage Allowance: Include 100 linear ft of interior wood trim at doors per Low Rise Unit. Match existing door trim profile and finish.

- H. **Allowance No G-008:** Square Footage Allowance: Include 100 linear ft of exterior window trim per Low Rise Unit by "Versatex". Match existing manufacturer, profile, texture and color.
- I. **Allowance No G-009:** Quantity Allowance: Removal of the identified underground inactive storage tank (UST) containing an undetermined amount of diesel fuel, with a 2,000-gallon capacity; and removal of any associated piping inclusive of fill port and vent pipe. The tank and piping are associated with a former emergency generator located adjacent to the Bernice Crawley High Rise. No report of leakage or spillage is on record per the report. The tank is not required to be registered with the Pennsylvania Department of Environmental Protection (PADEP). Removal shall be in accordance with applicable local, state and federal codes, regulations and law. Registration of the tank with the PADEP is not required; however, the tank should be removed per PADEP UST Tank Closure procedures, including proper confirmatory sampling. Preparation and submittal of a UST closure report is required. The report should be provided to HACP.

Any liquid inside the tank should be removed and properly disposed. If localized impacted soils are found during removal of the tank, they should be segregated from obvious non-impacted soils. The potentially impacted soils along with the excavation confirmatory samples shall be tested by the Owner's Consultant. The tank excavation pit should be properly backfilled and compacted with clean materials following removal of the tank. General Contractor is to verify dimensions and outline of the paved asphalt surface prior to removal, and that in which is removed as part of the UST removal process and shall be replaced in the same shape and grade. Include wedge curb. Refer to Bituminous Detail 6 on L-310A. General Contractor is to verify dimensions and outline of the landscaped surface area prior to removal, and that in which is removed as part of the UST removal process and shall be replaced in the same shape and grade and covered with mulch. Any plantings shall be removed, salvaged and protected, and replanted.

Underground Storage Tank (UST) is identified within the Phase 1 Environmental Site Assessment Report completed by PSI on March 27, 2017. A copy can be obtained from HACP upon request. Post-removal testing will be conducted by the Owner's Consultant PSI.

1. Allowance of \$15,000.
- J. Allowance No. G-010: Removal of Carpeting in the Bernice Crawley High Rise Units:
1. Allowance to include (55) Small Units at 400 sq ft Each, (25) Large Units at 675 sq ft each, (10) UFAS 1 Units at 675 sq ft each, and (7) UFAS 2 Units at 1,000 sq ft each. Refer to Drawing Sheet G-101 and G-110 for additional unit information.

**3.4 MECHANICAL PRIME CONTRACTOR SCHEDULE OF ALLOWANCES
H-XXX (H-NUMBER)**

A. Allowance No. H-XXX Title:

1. None at this time

3.5 PLUMBING PRIME CONTRACTOR SCHEDULE OF ALLOWANCES

- A. Allowance No. P-001:** Quantity Allowance: A Radon Remediation System for four (4) Low Rise Apartment Units, in the Glen Hazel Family Community Low Rise, shall be a Design Build System under the Plumbing Prime Contractor. Apartment Unit addresses requiring remediation are located at 657, 724, and 737 Johnston, and 360 Renova. A Design Build Radon Remediation System Allowance for the four units shall include design, demolition, construction and final testing by a State Certified Radon Mitigation Sub-Contractor with a minimum of 5 years experience; required to comply with all governing codes, regulations and governing authorities; and all fees for required permits, approvals and inspections.

1. Allowance of \$ 43,500.

**3.6 ELECTRICAL PRIME CONTRACTOR SCHEDULE OF ALLOWANCES
E-XXX (E-NUMBER)**

- A. Allowance No. E-001:** Title: Quantity Allowance: Electrical Contractor to furnish and install new load center and turn 180 degrees within same wall space due to electrical panel door not being able to open for access. Furnish and install 100 amp panel, with 16 breaker slots, and 3-1/2" deep flush panel box and breakers. Reconnect wiring to new breaker box and new circuit breakers. Patch drywall hole in Mechanical Closet smooth to match and prepare for paint.

1. Allowance of 17 panels

- B. Allowance No. E-002:** Title: Quantity Allowance: Electrical Contractor to furnish and install new load center in adjacent wall due to electrical panel door not being able to open for access. Furnish and install 100 amp panel, with 16 breaker slots, and 3-1/2" deep flush panel box and breakers. Reconnect wiring to new breaker box and new circuit breakers. Patch drywall hole in Mechanical Closet smooth to match and prepare for paint.

1. Allowance of 21 panels

- C. Allowance No. E-003:** Title: Quantity Allowance: Electrical Contractor to furnish and install new load center and lower to 48" AFF at same location to allow for UFAS Compliance. Furnish and install 100 amp panel, with 16 breaker slots, and 3-1/2" deep flush panel box and breakers. Reconnect wiring to new breaker box and new circuit

**TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B**

**ALLOWANCES
012100**

breakers. Patch drywall hole in Mechanical Closet smooth to match and prepare for paint.

1. Allowance of 1 panels

END OF SECTION 012100

SECTION 012300 - ALTERNATES

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 alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL PRIME CONTRACTOR SCHEDULE OF ALTERNATES
G-XXX (G-NUMBER)

A. Alternate No. G-001 Title: Repair / Rebuild Existing Site Walls less than 4' in height

1. Base Bid: Repair / Rebuild existing site walls as represented in L201A, L202A, L203A and described in Site Instruction L001A:J. Quantity: Approximately 980 square face feet. Lump Sum price to include all excavation, materials, labor and restoration.
2. Alternate: Repair / Rebuild existing site walls as represented in L101C, L102C, L103C and described in Site Instruction L001A:J. Quantity: Approximately 2,940 square face feet, including base bid quantity. Lump Sum price to include all excavation, materials, labor and restoration.

B. Alternate No. G-002 Title: Provide and install concrete sidewalk paving

1. Base Bid: Provide and install concrete sidewalk paving as represented in L201A, L202A, L203A and described in Site Instruction L001A:A. Quantity: Approximately 568 square feet. Lump Sum price to include all excavation, demolition, materials, labor and restoration.
2. Alternate: Provide and install concrete sidewalk paving as represented in L101C, L102C, L103C and described in Site Instruction L001A:A. Quantity: Approximately 5,334 square feet, including base bid quantity. . Lump Sum price to include all excavation, demolition, materials, labor and restoration.

C. Alternate No. G-003 Title: Provide and install concrete stair

1. Base Bid: Provide and install pour-in-place concrete stairs as represented in L201A, L202A, L203A and described in Site Instruction L001A:A. Quantity: Approximately 32 risers. Lump Sum price to include all excavation, demolition, materials, labor and restoration.
2. Alternate: Provide and install pour in place concrete stairs as represented in L101C, L102C, L103C and described in Site Instruction L001A:A. Quantity: Approximately 81 risers including base bid quantity. Lump Sum price to include all excavation, demolition, materials, labor and restoration.

D. Alternate No. G-004 Title: Site Handrail Replacement

1. Base Bid: Provide and install galvanized steel handrails as represented in L201A, L202A, L203A and described in Site Instruction L001A:E. Quantity: Approximately 392 Linear Feet. Lump Sum price to include all demolition, materials, labor and restoration.
2. Alternate: Provide and install galvanized steel handrails in as represented in L101C, L102C, L103C and described in Site Instruction L001A:E. Quantity: Approximately 1,235 Linear Feet including base bid quantity. Lump Sum price to include all demolition, materials, labor and restoration.

E. Alternate No. G-005 Title: Provide / Install 6' tall Vinyl Privacy / Screen Fence

1. Base Bid: Provide and install 6'H X 8'L vinyl privacy fence as represented in L201B, L202B, L203B and described in Site Instruction L001B:1. Quantity: 67count, 6'H x 8'L panels, 2 posts with concrete foundation per panel (Approximately 536 LF fence). Lump Sum price to include all demolition, materials, labor and restoration.
2. Alternate: Provide and install additional 6'H Vinyl privacy and trash screen fence, locations to be provided by Mistick Construction. Quantity: Approximately 573 Linear Feet in excess of Base Bid quantity. Lump Sum price to include all demolition, materials, labor and restoration.

F. Alternate No. G-006 Title: Repair / Replace Concrete Deep Curb

1. Base Bid: NO REPAIR / REPLACE DEEP CURB IN BASE BID.
2. Alternate: Provide and install concrete deep curb as represented in L101C, L102C, L103C and detailed on L104C. Final locations to be provided by Mistick Construction. Quantity: Approximately 280 linear feet in excess of Base Bid. Lump Sum price to include all permitting costs, demolition, excavation, materials, labor and restoration.

G. Alternate No. G-007 Title: ADA Curb Ramp Replacement

1. Base Bid: NO ADA CURB RAMP REPLACEMENT INCLUDED IN BASE BID.
2. Alternate: Provide and install ADA compliant concrete curb ramps as represented in L101C, L102C, L103C and detailed on L104C, L105C. Final locations to be provided by Mistick Construction. Quantity: Approximately 16 curb ramps in excess of Base Bid. Lump Sum price to include all permitting costs, demolition, excavation, materials, labor and restoration.

H. Alternate No. G- 008 Title: Replace Rear Stoops

1. Base Bid: NO REPLACEMENT OF REAR STOOPS INCLUDED IN BASE BID.

2. Alternate: Provide and install rear stoops as represented in L101C, L102C, L103C and detailed on L001A:A, A602. Final locations to be provided by Mistick Construction. Quantity: Approximately 22 stoops in excess of Base Bid. Lump Sum price to include demolition, excavation, materials, labor and restoration.

I. Alternate No. G-009 Title: Refinishing Existing Wood Doors

1. Base Bid: Remove, sand, prepare and paint existing wood doors and frames in all 97 Apartment Units of the Bernice Crawley High Rise is included in the Base Bid. Existing hardware to remain.
2. Alternate: Existing doors to remain as is.

J. Alternate No. G-010 Title: Replace Ceramic Tile Flooring

1. Base Bid: Existing ceramic tile flooring and base in the seven (7) Family Community Low Rise UFAS/ADA Unit Bathrooms to remain and be cleaned in the Base Bid.
2. Alternate: Remove existing ceramic tile, ceramic tile base, sub floor and replace with ceramic tile base, base and 5/8" tile backer board.

K. Alternate No. G-011 Title: Patching Wall and Floor at PC Tub Removal. Refer to P-001 for PC Scope of Work for Coordination

1. Base Bid: Existing to remain.
2. Alternate: After Plumbing Prime Contractor removes and replaces the bathtub within standard unit 517 of the Bernice Crawley High Rise, the General Contractor shall patch to match an area of 250 sq inches at each side or a total of 500 square inches of drywall walls adjacent to the tub, provide filler within the 2" x 60" width to provide a smooth and warrantable subfloor for new LVT finish.

L. Alternate No. G-012 Title: Patching Wall and Floor at PC Shower Removal. Refer to P-002 for PC Scope of Work for Coordination

1. Base Bid: Existing to remain.
2. Alternate: After Plumbing Prime Contractor removes and replaces the shower and accessories, but prior to floor ramp, within Low Rise UFAS Unit Type F, 1019 Johnston Avenue, the General Contractor shall patch to match an area of a total of 500 square inches of drywall walls adjacent to the shower, clean and prepare surface to install PC salvaged 2 1/2" (Or one Tile width) x 60" of ceramic floor tiles. Grout to match existing in color, texture and installation.

**3.2 MECHANICAL PRIME CONTRACTOR SCHEDULE OF ALTERNATES
H-XXX (H-NUMBER)**

A. Alternate No. H-XXX Title:

1. None at this time

3.3 PLUMBING PRIME CONTRACTOR SCHEDULE OF ALTERNATES
P-XXX (P-NUMBER)

A. Alternate No. P-001 Title: Bathtub - Refer to Alternate G-011 for GC Scope of Work for Coordination

1. Base Bid: Existing bathtub to remain.
2. Alternate: Replace (1) existing enameled steel bathtub and strainer in kind with HACP and Architect approved enameled steel bathtub within standard unit 517 of the Bernice Crawley High Rise. Replacement is due to crack or discoloration of existing bathtub. Plumbing Contractor responsible to remove sealant prior to tub removal from walls and floors. PC to include cutting drywall in level and straight lines to the face of the stud nearest to tub at an area of 250 sq inches at each side or a total of 500 square inches total for tub replacement. PC to cut existing VCT flooring in a straight line/parallel with the existing flooring seam and no more than 2" from the bathtub face along the entire 60" width, to allow removal of tub without lifting additional floor tiles being used as a sub-base. (No other bathtub replacements are within the base bid.)

B. Alternate No. P-002 Title: Shower - Refer to Alternate G-012 for GC Scope of Work for Coordination

1. Base Bid: Existing to remain.
2. Alternate: Replace 36" x 60" (1) existing acrylic (3) piece wall shower surround system with shelf for shampoo and soap, base and strainer in kind within Low Rise UFAS Unit Type F, 1019 Johnston Avenue. Remove, salvage and reinstall all shower accessories, grab bars, shower seat and floor ramp back in UFAS compliant locations as indicated on Drawing A-001. Replacement is due to crack in base of existing shower base. PC responsible to remove sealant prior to shower removal from walls and floors in a manner not to damage existing drywall. PC to include cutting out an area of drywall 500 square inches total in areas around shower as required for shower replacement. PC to protect existing ceramic tile floor to remain during removal. PC to include removal and salvaging to GC 2 1/2" (Or one Tile width) x 60" of ceramic floor tiles to allow for shower replacement. (No other shower replacements are within the base bid.)

3.4 ELECTRICAL PRIME CONTRACTOR SCHEDULE OF ALTERNATES
E-XXX (E-NUMBER)

A. Alternate No. E-001 Title: Bernice Crawley Smoke Detectors and Fire Alarm Strobes

1. Base Bid: Replacement of all existing smoke detectors with new smoke detectors.

2. Alternate: Bring entire High Rise Building up to current codes in accordance with all applicable codes and the local Fire Marshall / Authority Having Jurisdiction. Replacement of all existing smoke detectors and fire alarm strobes and add additional smoke and fire alarm strobes, additional wiring, conduit, and circuits as required for a complete system upgrade. Electrical Prime Contractor is responsible for designing the system, submission and costs for approvals and all fees associated with inspections required

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 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 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an Alternate.
 - 3. Section 016000 "Product Requirements" for requirements for submitting "equal" product submittals for products by listed manufacturers.
 - 4. Divisions 02 through 32 Sections for specific requirements and limitations for substitutions.

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 or HACP that are not required in order to meet other Project requirements but may offer advantage to Contractor or HACP.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. 012500.02 Substitution Request Form attached to this Section for substitutions after Contract Award.

3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by HACP and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution 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 and 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 substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

1.5 ARCHITECT'S ACTION

- A. Substitution: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 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.

1.6 QUALITY ASSURANCE

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

1.7 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
 - 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 offers HACP a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities HACP must assume. HACP's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by HACP, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. 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 3 - EXECUTION (Not Used)

END OF SECTION 012500

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B

SUBSTITUTION REQUEST
012500.2

Project: _____
R3A Project No.: _____
To: _____

Date: _____
"Equal" Product Evaluation Request Number: _____
Contract For: _____
"Equal" Product Proposer: _____
Address: _____

Contact: _____ Phone: _____

Specification Section: _____ Title: _____
Article, Paragraph & Page No. _____

Proposed "Equal" Product: _____ Trade Name: _____ Model No.: _____
Manufacturer: _____ Address: _____ Phone: _____

1. Attached data shall include product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request. Applicable portions of the data shall be clearly identified or request shall be returned without review.
2. Attached data also includes a description of changes to the Contract Documents that the proposed "Equal" product will require for its proper installation.

LEED Requirements Review (Not required if project is not pursuing Certification from GBCI.)

- | | |
|---|---|
| a. Is proposed product a salvaged material? <input type="checkbox"/> Yes <input type="checkbox"/> No | e. Is proposed product made from rapidly renewable material? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| b. Is proposed product manufactured within 500 miles of project site? <input type="checkbox"/> Yes <input type="checkbox"/> No | f. Does proposed product meet limits for VOC's? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| c. If yes, are raw materials extracted within 500 miles of project site? <input type="checkbox"/> Yes <input type="checkbox"/> No | g. Does proposed product contain FSC certified wood? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| d. Does proposed product contain recycled content <input type="checkbox"/> Yes <input type="checkbox"/> No
% Post % Pre | |

General Requirements Review

- | | |
|---|--|
| a. Will the proposed "Equal" product affect dimensions or connections to adjacent construction? <input type="checkbox"/> Yes <input type="checkbox"/> No | |
| b. Does the proposed "Equal" product Manufacturer guaranty that selection will not alter schedule? <input type="checkbox"/> Yes <input type="checkbox"/> No | |
| c. Does the proposed "Equal" product affect fire rating assemblies? <input type="checkbox"/> Yes <input type="checkbox"/> No
If yes, provide comparative UL, WHI, (or other) Listing/Rating of proposed. _____ | |
| d. Will proposed "Equal" product effect any of the following? | |
| Aesthetics? <input type="checkbox"/> Yes <input type="checkbox"/> No | Structural Frame? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Mechanical? <input type="checkbox"/> Yes <input type="checkbox"/> No | Plumbing? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Electrical? <input type="checkbox"/> Yes <input type="checkbox"/> No | Other? _____ <input type="checkbox"/> Yes <input type="checkbox"/> No |
- If yes to any of the above, provide attachment to this Request detailing impact on project design, scope and schedule.

The Undersigned certifies:

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

Submitted by: _____ Signed by: _____

Architect's and Consultant's Review

Signed by: _____

Date: _____

- ☐ "Equal" Product approved - Make submittals in accordance with Specification Section 01330.
☐ "Equal" Product approved as noted - Make submittals in accordance with Specification Section 01330.
☐ "Equal" Product rejected - Use specified materials.
☐ "Equal" Product Request received too late - Use specified materials.

Comments: _____

Attached: ☐ Product vs Proposed Product Comparison ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

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 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. HACP's General Conditions for Construction Contracts – Public Housing Programs governs supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

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 time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change to the HACP's Contracting Officer.
 - 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 times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Include all required by HACP's General Conditions for Construction Contracts – Public Housing Programs to the Contracting Officer.
- 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 HACP's Contracting Officer.
 - 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. Include all required by HACP's General Conditions for Construction Contracts – Public Housing Programs to the Contracting Officer.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On HACP's Contracting Officer's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of HACP and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Work Change Directive: On HACP's Contracting Officer's approval, Architect may issue a Construction Work Change Directive on AIA Document G714. Construction Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Work Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B

CHANGE ORDER PROPOSAL FORM
SECTION 012600.01

Note: This form shall be used to establish minimum requirement for change order requests.

Change Order Proposal Number: _____

Date: _____

Contract: _____

Submitted By: _____

(Include Contact person and Company name)

Submitted to Owner: _____

(Include Contact person and Company name)

Copy to ☐ Architect ☐ Construction Manager Attn: _____

Description of Proposed Work: _____

Reason for Change: Unforeseen condition ☐ Owner Requested change ☐ Error or Omission on drawing ☐

Description of reason: _____

1. Does proposed change involve a change in contract sum? ☐ Yes ☐ No Add \$ _____ Deduct \$ _____

2. Does proposed change involve a change in Contract Time? ☐ Yes ☐ No Add _____ days. Deduct _____ days

Is copy of updated Construction Schedule including the effect of proposed Change attached? ☐ Yes ☐ No

3. What effect will proposed change have on other Trades or Prime Contractors? Please describe: _____

Table of Change Order Items									
Item #	Description	Material				Labor			Subtotal
		Quant	Unit	\$Rate	Sub total	Hrs	\$Rate	Sub total	
1.					\$			\$	\$
					\$			\$	\$
					\$			\$	\$
					\$			\$	\$
					\$			\$	\$
					\$			\$	\$
Note: Add additional sheets as required to schedule Change Order Items							SUBTOTAL		
	Delivery Charges								\$
	Equipment Rental								\$
	TAX on Subtotal								\$
	BONDS on Subtotal								\$
	OVERHEAD on subtotal								\$
	PROFIT on Subtotal								\$
TOTAL									\$

- Labor rates shall include; Base wages, Benefits, and Insurance.
- Proposal includes Taxes, Permits, Overhead, Profit, and all other fees associated with the described work.
- Vendor/ subcontractor shall submit all supporting documentation labeled with Item # shown in upper right corner of submission.

Attached? ☐ Vendor supporting documentation ☐ Subcontractor supporting documentation ☐ Photographic documentation
☐ Supporting drawings ☐ Reports ☐ Testing data ☐ Updated Construction Schedule

For Architect's use:

☐ Accepted ☐ Accepted as noted ☐ Not accepted ☐ Incomplete Information Reviewed _____
by/date:

Reviewer's signature: _____ Dat _____

e:
Owner's acceptance signature: _____ Date: _____

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 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 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 012300 "Alternates" for scope of work Alternates.
 - 4. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 5. 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. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.

- b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 2. Submit the schedule of values to Architect through Construction Manager/HACP's Representative at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
 5. Subschedules for Separate Design Contracts: Where HACP has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 011000 "Summary."
- B. 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. HACP's Project number
 - e. Contractor's name and address.
 - f. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. 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.
 - 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 one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.

- 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate HACP payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

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 Construction Manager/HACP's Representative and reviewed and paid upon approval of HACP's Contracting Officer.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between HACP and Each Prime Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Project Manger/HACP's Representative by the 21st day of the month, unless indicated otherwise. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Construction Manager/HACP's Representative and the Architect.
- D. Application for Payment Forms: Use forms provided by HACP for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Application will be returned without action if incomplete.
 - 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.
 - 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.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to HACP, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager/HACP's Representative and Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. HACP reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to HACP.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. HACP reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to HACP.
- J. 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. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 - 5. Products list (preliminary if not final).
 - 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.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire HACP's insurance.
- K. Interim Application for Payment: Administrative actions and submittals that are scheduled at regular intervals to coincide with Application submission.
1. Updated Schedule of Values.
 2. Schedule of salvaged, refurbished, and reused materials.
 3. Schedule of recycled product content.
 4. Schedule of regional material compliance.
 5. Schedule of certified wood products used on the project.
- L. 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 HACP occupancy of designated portions of the Work.
- M. 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. AIA Document G706 or approved HACP form, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A or approved HACP form, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707 or approved HACP form, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when HACP took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B

PAYMENT PROCEDURES
012900

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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 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. Administrative and supervisory personnel.
 - 3. Coordination drawings.
 - 4. Requests for Information (RFIs).
 - 5. Project Web site.
 - 6. Project meetings.
- B. Contractor shall participate in coordination requirements for all work proceeding on site, not just work included in this contract. Certain areas of responsibility are assigned to a specific contractor.
- C. Reference to "Contractor" on the drawings and the specifications shall refer to the each separate Prime Contractor, unless noted otherwise, with coordination responsibilities specified within this Section.
- D. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- A. Coordination: The contractors shall coordinate their construction operations with those of the HACP's Contractors and Construction Manager/HACP's Representative and entities to ensure efficient and orderly installation of each part of the Work and the work by other HACP's Contractors.
- B. 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.
 - 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.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
 - 5. Maintain safe access to all Apartment units.
 - 6. Coordinate access to Apartments that will be concurrently under construction with other contractors.
- C. 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 HACP and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with construction activities and activities of other contractors to ensure orderly progress of the Work. Activities include:
 - 1. Preparation of Contractors' construction schedule.
 - 2. Preparation of Contractors' Demolition and Construction Phasing Occupant Disruption Schedule (DCPOD)
 - 3. Preparation of the schedule of values.
 - 4. Preparation of the submittal schedule
 - 5. Installation and removal of temporary facilities and controls.
 - 6. Delivery and processing of submittals.
 - 7. Progress meetings.

8. Preinstallation conferences.
9. Project closeout activities.
10. Startup and adjustment of systems.
11. Project closeout activities.
12. All RFI's logged and coordinated through General Construction contractor.

- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.5 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Locate existing utilities that enter the building.
 - c. Locate existing Building Automation System (BAS) lines that enter the building.
 - d. Indicate required installation sequences.
 - e. Indicate functional and spatial relationships for components of systems.
 - f. Show location and size of access doors required for access to concealed controls.
 - g. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Sheet Size: At least 11 by 17 inches but no larger than 30 by 42 inches.
3. Submit Digitally to Architect through General Contractors project web site: PDF electronic files.
4. After return from Architect, mark up and provide one printed copy to be located in trailer as a Project Record Drawing, and provide HACP with five printed copies.
5. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

- B. 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 2010, operating in Microsoft Windows operating system.
3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
4. File Submittal location: All digital files shall be uploaded to the General Prime Contractor's project web site. Method and format for uploading digital files to the website will follow the Sites format as specified.
5. Architect will furnish the Contractor one set of digital data files of Drawings for use in preparing coordination digital data files. Refer to associated fees.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Refer to Division 01 Section Summary for requirements for using Architect's digital files.
 - c. Files shall be made available on General Prime Contractors Website.
 - d. Digital Data Software Program: Drawings are available in Autodesk AutoCAD and or Revit 2015.
 - e. General Prime Contractor shall execute, and pay for two years in advance, a data licensing agreement in the form of Agreement included in this Project Manual.

1) See licensing agreement for fee.

- C. Key Personnel Names: Within 7 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
1. Include special personnel required for coordination of operations with other contractors.

1.7 PROJECT MEETINGS

- A. General: Construction Manager/HACP's Representative will schedule and conduct meetings and conferences at Project site. Prepare the meeting agenda. Distribute agenda, record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including HACP and Architect, within three days of the meeting.

- B. Preconstruction Conference: Construction Manager/HACP's Representative will schedule and conduct a preconstruction conference before starting construction, at a time convenient to HACP and Architect, but no later than 7 days after execution of the Agreement. Hold the conference at Project site. Conduct the meeting to review responsibilities and personnel assignments.
- C. Progress Meetings: Construction Manager/HACP's Representative will Schedule and conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
 - 1. Attendees: In addition to representatives of HACP, Architect and Construction Manager/HACP's Representative, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. 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. Review schedule for next period.
 - b. Cutting and Patching: Review requirements for cutting and patching work for each prime contract. Assign responsibility for each prime contractor to identify areas requiring cutting for the general to execute. Periodic meetings shall be held until the requirement for cutting and patching has been satisfied. Cutting and patching for all prime contractors shall be performed by the General Construction Contractor based upon locations as identified by the Prime Contractors.
 - 3. Minutes: Construction Manager/HACP's Representative will record the meeting minutes.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present, via email in digital format with-in 3 days of the meetings date.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Construction Manager of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.

- b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Project Closeout Conference: Construction Manager/HACP's Representative will schedule and conduct a project closeout conference, at a time convenient to HACP and Architect, but no later than 10 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 HACP, Construction Manager/HACP's Representative, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.

- b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing sustainable design documentation.
 - 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. Coordination of separate contracts.
 - l. HACP's partial occupancy requirements.
 - m. Installation of HACP's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

1.8 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
- 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 - a. RFI's should be submitted through the coordinating contractor.
 - b. Uploaded to the project web site
 - 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 interpretation and the following:
- 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Architect and Construction Manager/HACP's Representative.
 - 5. RFI number, numbered sequentially.
 - 6. Specification Section number and title and related paragraphs, as appropriate.
 - 7. Drawing number and detail references, as appropriate.
 - 8. Field dimensions and conditions, as appropriate.
 - 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 10. Contractor's signature.

11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Format of RFIs:
 1. RFI's shall be submitted electronically via email on standard RFI form. Paper copies may be substituted in addition.
 2. Identify each page of attachments with the RFI number and sequential page number.
 3. To expedite the RFI answering process, the Contractor shall process RFIs electronically through – web-based construction administration software.
 4. Newforma Project Cloud shall provide a training session via web conference.
 5. Additional PDF mark-up software may be required for electronic processing. Contact Newforma Project Cloud at 1.603.625.6212 / 1-877-442-3713 or answers@newforma.com.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 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 Division 1 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager/HACP's Representative in writing within 7 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager/HACP's Representative within seven days if Contractor disagrees with response.

- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. RFI Log shall be submitted electronically via email and web site. Submit log weekly. Use CSI Log Form 13.2B. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Construction Manager/HACP's Representative.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Construction Manager's/HACP's Representative response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- G. The Architect shall maintain the RFI log between the Architect and Contractor through Website's RFI software. It is recommended that the Contractor maintain a separate RFI log with subcontractors.

1.9 PROJECT WEB SITE

- A. General Prime Contractor is to set up and maintain Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. General Prime Contractor is responsible for all fees associated with the Project Web Site and is required to pay for two (2) years in advance. Project Web site shall include the following functions:
1. Project directory.
 2. Project correspondence.
 3. Meeting minutes.
 4. Contract modifications forms and logs.
 5. RFI forms and logs.
 6. Photo documentation.
 7. Schedule and calendar management.
 8. Submittals forms and logs.
 9. Payment application forms.
 10. Drawing and specification document hosting, viewing, and updating.
 11. Archiving functions.
- B. Provide unlimited Project Web site user licenses for use of HACP, Architect, Architect's consultants and Electrical Prime Contractor. Provide eight hours of software training at Architect's office for Project Web site users.
- C. Upon completion of Project, provide one complete archive copy of Project Web site files to HACP and to Architect in a digital storage format acceptable to the Architect.
- D. Provide the following "Basis of Design" Project Web site software package under its current published licensing agreement:

1. Newforma Project Cloud <http://www.newformaprojectcloud.com/>
- E. Contractors, subcontractors, and other parties granted access by the Contractor to project Web site shall execute a data licensing agreement in the form of an Agreement acceptable to HACP and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

[INSERT R3A PROJECT NAME]

[INSERT R3A PROJECT NO.]

[INSERT DATE]

In accepting and using digital files, provided by Renaissance 3 Architects, P. C., the undersigned recognizes and accepts that:

1. Renaissance 3 Architects, P. C., is providing these digital files for the undersigned's sole convenience, and does not assume any responsibility for the accuracy or suitability of information contained therein for the use intended by the undersigned; and
2. the undersigned is fully and solely responsible to verify the accuracy of the digital files and the actual built conditions, as it may affect the undersigned's work; and
3. the digital files are an instrument of service of Renaissance 3 Architects, P. C. who shall be deemed the author of the digital files and shall retain all common law, statutory and other reserved rights, including the copyright; and
4. under no circumstances shall the transfer of the digital files, or other instruments of service, for use by the undersigned be deemed to be a sale by Renaissance 3 Architects, P. C., and Renaissance 3 Architects, P. C. makes no warranties, express or implied, of merchantability or of fitness for a particular purpose; and
5. the digital files shall not be used in whole or part for any project or purpose, other than *[INSERT SCOPE OF WORK, E.G., PREPARATION OF DUCTWORK SHOP DRAWINGS]*; and
6. to the fullest extent permitted by law, the undersigned hereby indemnifies and holds harmless Renaissance 3 Architects, P. C. and its officers, directors, employees and consultants from and against all claims, damages, losses and expenses, including, but not limited to, attorney's fees arising out of, relating to and resulting from use of any information provided by Renaissance 3 Architects, P.C.
7. a service and administrative fee of \$100 for each digital file is payable to Renaissance 3 Architects, P.C. prior to transfer of the requested files.

The Undersigned:

Signature

Name and Title (Print Clearly)

Company Name (Print Clearly)

Date

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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractors' Construction Schedule.
 - 3. DCPOD: Contractors' Demolition and Construction Phasing Occupant Disruption Schedule
 - 4. Construction schedule updating reports.
 - 5. Daily construction reports.
 - 6. Material location reports.
 - 7. Site condition reports.
 - 8. Special reports.
 - 9. Draft and final waste management plan
 - 10. Draft and final construction-indoor air quality management plan
- B. Related Requirements:
 - 1. Section 013100 "Project Management and Coordination" for report and schedule formats and inclusion of project web site in document management.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 PURPOSE

- A. The Construction Progress Schedule ("CPS") shall be utilized to track job progress, analyze potential delays, identify potential progress problems early, determine the project completion date, issue progress payments, determine validity of time extension requests, and complete cost projections and analysis.

1.4 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either HACP or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.
- H. Submittal Packages: a group of submittals packaged together for submission and approval by Architect and consultants. Refer to Division 01 Section "Submittal Procedures."
- I. Mandatory Project Schedule and Submittals Meeting: This is a meeting prior to the Pre-construction Job conference.

1.5 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.
 2. After return from Architect provide HACP with five paper copies.
- B. Startup construction schedule.
1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. DCPOD: Initial schedule integrated with the Contractors' Construction Schedule, of size required to display entire schedule for entire construction period. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
1. Coordination with Owners' Relocation Consultant is required.
- F. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
- G. Field Condition Reports: Submit at time of discovery of differing conditions.
- H. Special Reports: Submit at time of unusual event.
- I. Qualification Data: For scheduling consultant.
- 1.6 FORMAT
- A. The CPS shall be in time scale CPM Gantt Chart format

- B. The CPS shall provide graphical (horizontal bar chart) representations for each major portion of work or operation (Summary Tasks)
- C. The CPS shall provide a graphical representation for each of the activities/tasks and events that will occur during the performance of the work
- D. The CPS shall show the complete sequence of construction by activity/task, with dates for beginning and completion of each element of construction
- E. Activities shall be listed in a logical, sequential order, and shall use proper precedence logic (Chronological/Sequential System)
- F. Each activity shall have predecessor and/or successor ties. The CPS shall show the interrelations/interdependencies of all activities/tasks
- G. No onsite activity shall have a duration of greater than ten (10) working days
- H. The Critical Path shall be clearly identified
- I. All CPSs', CPS revisions, preliminary submissions, and associated backup documentation shall be submitted in hard copy and electronic formats. Six (6) hard copies of each document shall be submitted to the Housing Authority, and one (1) hard copy of each document shall be submitted to the A/E.
- J. Sheet Size: Minimum 8.5 x 14 inches

1.7 CONTENTS

- A. The CPS shall begin at the Notice to Proceed ("NTP") date. The initial CPS shall be based on the anticipated NTP date as provided by the Housing Authority.
- B. The CPS shall identify each phase/stage of demolition, construction, occupancy/relocation, and other logically grouped activities (Summary Tasks).
- C. The CPS shall set forth milestone dates and deadlines, including substantial completion of ALL work, i.e., the entire project.
- D. The CPS shall identify all project constraints.
- E. The CPS shall identify work for each building unit/apartment (unless authorization is obtained in writing from the Contracting Officer allowing the CPS to only identify work for each floor or building). Each task for each unit/apartment shall be identified on the CPS.
- F. The CPS shall identify all Housing Authority, governmental and/or regulatory review periods.
- G. CPS duration shall not exceed contractual construction period.

- H. The CPS shall indicate submittal package submission dates for review and approval.
- I. The CPS shall indicate decision dates for selection of finishes.
- J. The CPS shall clearly identify order dates and lead times for all specified products, particularly long lead time items, items requiring fabrication, and major equipment.
- K. The CPS shall indicate delivery dates for Housing Authority furnished products.
- L. The contractor(s) shall coordinate the CPS content with the Schedule of Values (Schedule of Amounts). All progress payment amounts will be derived from, and tied to, the Schedule of Values and the CPS; therefore all activities on the CPS shall be consistent with the information contained in the Schedule of Values.

1.8 SUBMITTALS AND APPROVALS

- A. The Building Work Area –General Contractor is responsible for consolidating the work efforts of other Contractors for the Scope of Work into one realistic, aggressive CPS, and for submitting the CPS to the Housing Authority for approval.
 - 1. General Prime Contractor will also be responsible for submitting to Electrical Prime Contractor, that will be performing work on site, in a timely manner, to aid in their preparation of realistic, aggressive CPS, and for submitting the CPS to the Housing Authority for approval.
- B. Failure of any contractor to submit required information in a timely manner shall be a default in accordance with the terms of this contract.
- C. If any contractor is found to be in default by the Contracting Officer for failure to submit schedule information in a timely manner, the Contracting Officer may terminate the contractor's right to proceed with the schedule preparation and may elect to complete the contractor's schedule information in his stead, in which case the contractor will be bound by any approved CPS as if the schedule information was prepared/developed by the contractor's own personnel. The contractor and its surety shall then be liable for any damage to the Housing Authority resulting from the contractor's failure to submit the schedule information within the specified timeframe.
- D. All CPSs' submitted to the Contracting Officer for approval shall be dated and signed by a representative of all prime contractors involved in the project. The signatures shall represent an acknowledgement that all prime contractors are in agreement with the submitted schedule. The General Contractor shall be responsible for obtaining all signatures.
- E. Submittal of the initial CPS and subsequent updates/revisions for approval shall be understood to be the contractors' representation that the submitted CPS meets all of the conditions of the contract documents, accurately reflects work to be completed, and that the work will be executed in the sequence indicated on the submitted CPS.

- F. In no event shall any adjustment proposed in a progress report or corrective plan constitute an adjustment in the CPS, contract time, or any milestone date unless any such adjustment is agreed to and authorized in writing by the Contracting Officer.
- G. All contractors shall be aware that time is of the essence when submitting CPS information and when completing the Work in the timeframes established in the approved CPS.

1.9 INITIAL CPS SUBMITTAL AND APPROVAL

- A. The General Construction Contractor shall submit at the Mandatory Project Schedule and Submittals Meeting the proposed CPS to the Construction Manager and HACP for review.
- B. The proposed CPS shall not be saved as a baseline until written approval is received from the Contracting Officer. Upon approval, the General Contractor shall be responsible for saving the baseline schedule, and monitoring and maintaining the CPS.
- C. The Contracting Officer shall review the initial CPS submission, (and any required resubmission), and respond with comments, recommendations, requests, or acceptance within five (5) working days of receipt.
- D. If the proposed CPS is not accepted by the Contracting Officer, the CPS shall be revised by the contractor(s) in accordance with the comments, recommendations, or requests of the Contracting Officer and resubmitted for acceptance within three (3) working days of receipt of said comments, recommendations, or requests. The contractor shall be required to make the changes as directed by the Contracting Officer to arrive at a reasonable, realistic, and acceptable CPS.
- E. The NTP will not be issued and the project shall not begin without a CPS approved in writing by the Contracting Officer. The NTP will be issued within five (5) working days of written CPS approval provided all required back up documentation is received by the Housing Authority in the timeframe required in the contract.
- F. Upon acceptance by the Contracting Officer of the proposed CPS, the accepted schedule shall be deemed the "Construction Project Schedule" and will be considered part of the contract.
- G. The Housing Authority's approval or acceptance of the CPS shall not impose on the Housing Authority any responsibility for the CPS, for timely submittals of complete and project-conforming shop drawings, for work sequencing, scheduling milestones, or progress of the work, nor shall acceptance interfere with or relieve the Contractor from the contractor's full responsibility to complete all work in accordance with the contract. Contractors are solely responsible for the development and performance of the means, methods, and execution of performance reflected in the CPS.
- H. A separate submittal schedule shall be submitted along with the initial CPS. The submittal schedule shall include and identify dates for shop drawing submittal and approval, product data, and samples, including Housing Authority furnished products. The

submittal schedule must include dates reviewed submittals will be required from the Housing Authority. Contractors are required to relate submittal tasks to construction activities/tasks. The submittal schedule may be incorporated into the CPS provided written authorization is obtained from the Contracting Officer.

- I. The General Contractor shall keep the submittal schedule current. The submittal schedule shall be coordinated with the CPS, and shall allow for reasonable time for Housing Authority submittal review as documented in the contract.

1.10 MONTHLY UPDATED CPS SUBMITTAL AND APPROVAL

- A. A preliminary updated CPS and all associated backup documentation shall be submitted by the General Contractor for review along with the "pencil copy" of the application for payment. The preliminary updated CPS should be submitted to the Housing Authority and the A/E no later than three (3) working days before the pay application progress meeting, with the site walk occurring no later than one (1) working day before the pay application progress meeting.
- B. Backup documentation shall include a narrative discussion of the progress to date, forecasted work for next period, problem areas, and anticipated delays. If applicable, the narrative shall document schedule slippage, provide a detailed explanation concerning the reason(s) for the slippage, how each prime contractor is affected, and shall include a written recovery plan for getting the project back on schedule. The written recovery plan shall include any necessary overtime or additional labor and what steps are being taken to recover the original schedule, and/or what logic changes occurred and why said changes occurred. The plan shall indicate the date by which the progress of the work will comply with the current approved CPS.
- C. The preliminary updated CPS and the pencil copy of the application for payment shall be reviewed by all contractors, Housing Authority representative(s), and the A/E during the site walk meeting.
- D. The General Prime Contractor shall make any revisions as noted during the site walk meeting, and shall submit the formal/finalized updated CPS and all associated backup documentation along with the finalized monthly application for payment at the pay application progress meeting.
- E. The formal/finalized updated CPS and associated backup documentation shall be considered part of the application for payment submission. Failure to submit an accurate updated CPS and all associated backup documentation with the application for payment will be cause for rejection of the application for payment.

1.11 CRITICAL PATH, LOGIC, or TASK CHANGES CPS UPDATE SUBMITTAL

- A. The General Prime Contractor shall immediately submit a revised CPS and a written recovery/corrective action plan to the Contracting Officer any time a critical path item is

three (3) working days behind the current approved CPS, if a non-critical activity becomes critical, or if there are changes in schedule logic and/or tasks.

- B. The Contracting Officer shall review the updated CPS submission and respond with comments, recommendations, requests, or acceptance within three (3) working days of receipt.
- C. If the revised/updated CPS is not accepted by the Contracting Officer, the schedule shall be revised by the contractor(s) in accordance with the comments, recommendations, or requests of the Contracting Officer and resubmitted for acceptance within five (5) working days of receipt of said comments, recommendations, or requests.
- D. The contractor(s) shall be required to make the changes as directed by the Contracting Officer to arrive at a reasonable, realistic, and acceptable CPS.

1.12 CHANGE ORDER OR DIRECTED WORK CPS SUBMITTALS

- A. Any contractor submitting a Request For Change Order ("RFCO") shall submit as backup documentation along with said RFCO a proposed CPS outlining how the change would impact the current approved CPS. The proposed CPS shall show in detail the work involved in the proposed change, how the proposed change will be incorporated into the current approved CPS, and the impact on other work caused by the adjustment to the current approved CPS.
- B. Within three (3) working days of receipt of any executed change order(s), change directive, or proceed order that affects the CPS, the contractor to whom the change order, directive, or proceed order was issued shall submit to the General Contractor a proposed revised CPS. The General Contractor shall then incorporate the changes into the current approved schedule and within three (3) working days of receipt of the proposed revised CPS from the contractor to whom the change order, directive, or proceed order was issued, issue a proposed CPS to the Contracting Officer for review and approval.
- C. Along with the proposed CPS, the General Contractor shall submit a written narrative outlining the change and how it affects the current, approved CPS.
- D. The Contracting Officer shall review the proposed CPS submission and respond with comments, recommendations, requests, or acceptance within three (3) working days of receipt.
- E. If the proposed CPS is not accepted by the Contracting Officer, the proposed CPS shall be revised by the contractor(s) in accordance with the comments, recommendations, or requests of the Contracting Officer and resubmitted for acceptance within three (3) working days of receipt of said comments, recommendations, or requests.
- F. The contractor(s) shall be required to make the changes as directed by the Contracting Officer to arrive at a reasonable, realistic, and acceptable CPS.

1.13 AS-BUILT CPS SUBMITTAL

- A. As a condition precedent to the release of final retention, the last update of the CPS submitted shall be identified by the General Contractor as the "As-Built" CPS. The As-Built CPS shall reflect the exact manner in which the project was actually constructed (including actual start and finish dates, activities, sequences, and logic), and shall be certified in writing by all contractors as being a true reflection of the way the project was actually constructed. The As-Built CPS shall be submitted with final close-out documents.

1.14 REVISIONS TO CONSTRUCTION PROGRESS SCHEDULES

- A. All revised CPSs' should be saved with the project # and revision # clearly noted.
- B. The lead contractor shall be responsible for updating/revising the current approved CPS.
- C. All revised/updated CPSs' shall include but not be limited to the following information:
 - 1. Actual and baseline construction start and finish dates
 - 2. Actual and baseline procurement start and finish dates
 - 3. Graphical representation of the baseline and actual task start and finish dates
 - 4. Logic revisions – any revised sequences
 - 5. Added or changed work, including change order work and RFI submittals that affect the work
 - 6. Activity duration projections/revisions
 - 7. Activity percent complete – actual percent complete of each activity not based on cost
 - 8. Current events that affect construction progress – adverse weather, strikes, differing site conditions

1.15 TIME EXTENSIONS & DELAY CLAIMS

- A. Time extensions will only be granted for delays that will demonstratively delay the contractual project completion date as of the date of the delay and are authorized by executed change orders from the Contracting Officer. Please note that the delay MUST affect the contract completion date at the time of the delay.
- B. Contractors may not request additional compensation and/or time from the Housing Authority unless the cause of any delay is attributable to the act or failure to act of the Housing Authority or its representative, or to other causes beyond the contractors' control for which time extensions are available per the contract.

1.16 FLOAT

- A. ALL Float shall be recognized as a shared resource that is available for reasonable use by all parties under contract for this project, and by the Housing Authority if necessary. Float shall not be considered for the exclusive use of the Housing Authority or any single

contractor. This includes but is not limited to any float generated due to the efficiencies of any party, or efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated adverse weather are fewer than expected.

- B. Any submission, coupled with subsequent approval, of a CPS showing an early completion will have the effect of adding float to the project. This float shall be utilized as necessary and shall be recognized as outlined in Section 01310 Item 1.09 A. No compensation shall be due any contractor or HACP for failure of any party to meet the early end date. No time extensions will be granted nor delay damages paid unless a delay occurs which impacts the project's critical path, consumes all available float or contingency time, and extends the work beyond the contract completion date. If a CPS submitted shows early completion, but after analysis and review by the Contracting Officer the CPS is determined not to reflect a reasonable plan for performance, the CPS shall be rejected and returned to the contractor for revision and resubmission per the guidelines of this section.

1.17 DISTRIBUTION

- A. The General Contractor shall distribute all reviewed and approved CPS's to all project participants within one (1) working day of approval by the Contracting Officer.
- B. The General Contractor shall keep a copy of all approved (past and current) CPS's on the project site at all times.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. 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.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by HACP.
 4. 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.
 5. 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.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
 1. Refer to 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.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 1. Use Microsoft Project, for Windows XP operating system.
 2. Compatible with project Web site software.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for commencement of the Work.

- 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: HACP may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractors' Construction Schedule Updating: At two week intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Contractors' Demolition and Construction Phasing Occupant Disruption Schedule (DCPOD): At weekly intervals, update DCPOD to reflect actual construction occupant disruptive activities and durations of activities for the following week. Issue schedule one week before each regularly scheduled progress meeting to allow time for HACP Representative and On Site Manager to coordinate and approve. Close coordination with is required to mineralize disruption to occupants and Contractors' are not to proceed without approval.
- D. Distribution: Distribute copies of approved schedule to Architect, HACP, 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.

TASK ORDER CONTRACT NO. 33

GLEN HAZEL RAD

ALLIES & ROSS MANAGEMENT AND DEVELOPMENT

R3A PROJECT NO. 15074B

CONSTRUCTION PROGRESS DOCUMENTATION

013200

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

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 administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Periodic construction video recordings.
 - 6. Web-based construction photographic documentation.
- B. Related Requirements:
 - 1. Section 0123000 " Alternates" for scope of work Alternates.
 - 2. Section 013300 "Submittal Procedures" for submitting photographic documentation.
 - 3. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of HACP's personnel.
 - 5. Section 024119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 ALLOWANCES

- A. Costs: Photographic documentation services are included under the cash allowance for construction photographic services established in Section 012100 "Allowances."

1.4 UNIT PRICES

- A. Basis for Bids: Base number of digital construction photographs on average of 30 photographs per week over the duration of Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within three days of taking photographs to Contractors Project Website and notify HACP and Architect.
 - 1. Digital Camera: Minimum sensor resolution of 16 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- D. Video Recordings: Submit video recordings within seven days of recording.
 - 1. Submit video recordings in digital video disc format acceptable to HACP and Architect by posting to Project Web site.
 - 2. Identification: With each submittal, provide the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.
 - 3. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, three-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as corresponding video recording. Include name of Project and date of video recording on each page.

1.6 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.7 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to HACP for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 16 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to HACP and Architect.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

- A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by HACP and the Architect.
 - 1. Provide one 2 fixed-location camera(s), with the following characteristics:
 - a. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tilt, and optical zoom of 500 percent minimum.
 - b. Capable of producing minimum 10 megapixel pictures.
 - c. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Web-Based Image Access: Password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
 - 1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and HACP.
 - 1. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 2. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
 - 1. Do not include date stamp.

3.2 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- E. Preconstruction Video Recording: Before starting demolition, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
 - 1. Flag construction limits before recording construction video recordings.
 - 2. Show existing conditions adjacent to Project site before starting the Work.
 - 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of demolition.
 - 4. Show protection efforts by Contractor.
- F. Periodic Construction Video Recordings: Record video recording weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

3.3 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

- A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from viewer-controlled location camera(s), updated at 15 minute intervals during daytime operation.
- B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed-location camera to show status of construction and progress.
 - 1. Frequency: Record one frame of video recording every 15 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.

2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
- C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION 013233

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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of HACP's personnel.

1.3 DEFINITIONS

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

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
 - 1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. After return from Architect review, Each Prime Contractor is to mark up and make 5 copies of each submittal and provide to HACP Representative for record purposes.
 - 2. Action Submittals: Submit nine paper copies of each submittal, unless otherwise indicated. Architect will return two copies.
 - a. Paper copies are required when submitting via Web-base software
 - 3. Informational Submittals: Submit eight paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
 - a. Paper copies are required when submitting via Web-base software
Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 4. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 5. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 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. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
1. Submittals shall be "packaged" together by the due date they are needed by.
 - a. Contractor shall allow time for resubmission of items
 - b. Contractor shall prioritized submissions with-in packages
 2. Submittal Packages shall be submitted at time indicated on the agreed upon schedule.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 7 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's Consultants, HACP, or other parties is indicated, allow 21 days for initial review of each submittal.
 - a. Sequential review shall be required for Submittals specified in the HVAC, Plumbing and Electrical disiplines.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect .
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01).

Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

- i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- F. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Submit one copy of submittal to Architect in addition to specified number of copies to concurrent reviewer.
 - 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. ELECTRONIC SUBMITTAL DELIVERY
 - 1. Submittals shall be processed and delivered electronically through web-based submittal processing software. Review comments and sketches by the Architect shall be delivered to the Contractor electronically via web-based software.
 - 2. The following types of submittals included in, but not limited to, the list below shall be delivered to the architect electronically:
 - a. Product Data
 - b. Certifications
 - c. Test Data
 - d. Schedules
 - e. Calculations
 - f. Mix Designs
 - g. Warranty Information
 - 3. All submittals which are 11"X17" or smaller shall be delivered electronically through web-based software. The Contractor shall contact the Architect regarding delivery method for submittals larger than 11"X17".
 - 4. Shop Drawings may be delivered through web-based software as a PDF with permission from the Architect. The Shop Drawings shall be packaged to assist the electronic review process on a computer screen. This includes keeping the number of pages to a minimum. Shop Drawings shall be broken down into 20 page increments and issued under separate submittal numbers.
 - 5. All samples and color selections shall be delivered by mail or courier to the Architect for review. Samples and color selection shall not be reviewed electronically. See separate section of specifications for quantities and sample selection process. The Architect shall return review comments via web-based software.

- I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 - 1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title according to specifications.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number, numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 - 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- J. 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 "No Exception Taken."
- K. 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.
- L. Use for Construction: Use only final submittals with mark indicating "No Exception Taken" taken by Architect.
- M. Submittal Logs: The Architect shall maintain the submittal log between the Architect and Contractor through Web-based submittal software. It is recommended that the Contractor maintain a submittal log with subcontractors.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

- A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. The Architect will provide electronic files for a fee. Drawings or Electronic media requested by the Contractor on the Drawings/Electronic Media Request Form, as provided by the Architect can be purchased upon completion of the "Release for Use of Electronic Drawing Media" form, also available from the Architect. Fees associated with a request are limited to administrative expenses incurred in satisfying a request and are set at \$100 per file request.

PART 2 - PRODUCTS

2.1 SUBMITTAL SCHEDULE

- A. Contractor must submit to the architect for review a submittal schedule that is included as part of the construction schedule. The specific requests for review of product data; shop drawings for product and systems must be identified with critical timing requirements, both for submission and review.
1. Contractor to submit a draft to Architect for agreement with require approval dates with submission time and submission packages.
 2. Architect will review for items that will require earlier than scheduled review to meet required approval dates.
 3. Submittals shall be "packaged" together by the due date the contractor will need approval by in order to timely order material.
 - a. Contractor shall allow time for resubmission of rejected items
 - b. Contractor shall prioritized submissions with-in packages
 4. Submittal Packages shall be submitted at time indicated on the agreed upon schedule.
 5. See Division 1 Section "Construction Progress Schedules" for additional requirements.
- B. Timing of submittals will adhere to the submitted agreed upon schedule.
1. Contractor will prioritized groups of submittals together in packages as defined in the contract for review and approval by architects and consulting engineers.
 2. Contractor shall schedule the submission packages to the Architect, return due times, and critical Lead times on the construction schedule. To aid the Architect in staffing large volume of submittals for review.
 - a. Contractor shall allow sufficient time for resubmission for items that may be rejected.

- b. The submittal packages and schedule shall be evaluated and items that have longer review times as determined by HACP, or Architect shall be submitted in and earlier package by the contractor.

2.2 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - a. Number of Copies: Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. After return from Architect review, Each Prime Contractor is to mark up and make 5 copies of each submittal and provide to HACP Representative for record purposes
 - c. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shop work manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 - a. Number of Copies: Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. After return from Architect review, Each Prime Contractor is to mark up and make 5 copies of each submittal and provide to HACP Representative for record purposes
 - c. Mark up and retain one returned copy as a Project Record Document.
 - d. Submit five copies where copies are required for operation and maintenance manuals.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.

- d. Number and title of appropriate Specification Section.
- 3. 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 HACP's property, are the property of Contractor.
- 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 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 one Sample set, provide HACP Representative with one Sample set and return one 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.
- E. Product Schedule or List: 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.
 - 2. Number and name of room or space.
 - 3. Location within room or space.

- a. Number of Copies: Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. After return from Architect review, Each Prime Contractor is to mark up and make 5 copies of each submittal and provide to HACP Representative for record purposes
 - c. Mark up and retain one returned copy as a Project Record Document.
 - d. Submit five copies where copies are required for operation and maintenance manuals. .
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation" .
- G. Submittals Schedule: Comply with requirements of this section and those specified in Division 1 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
- 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
 - 4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return copies.
- a. Mark up and retain one returned copy as a Project Record Document.

2.3 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
- a. Number of Copies: Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

- b. After return from Architect review, Each Prime Contractor is to mark up and make 5 copies of each submittal and provide to HACP Representative for record purposes
 - c. Mark up and retain one returned copy as a Project Record Document.
 - d. Submit five copies where copies are required for operation and maintenance manuals. Certificates and Certifications: Provide a notarized 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.
- 2. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. Installer Certificates: Prepare 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.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare 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.
- J. Product Test Reports: Prepare written reports indicating 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.

- K. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."
- L. Compatibility Test Reports: Prepare 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.
- M. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.
- N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service 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.
- R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- S. Material Safety Data Sheets (MSDSs): Do not submit information directly to HACP or Architect.
1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.4 DELEGATED-DESIGN

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. 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. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
1. "No Exception Taken": Proceed with work covered by submittal provided it complies with requirements of Contract Documents; final acceptance will depend upon that compliance.
 2. "Make Corrections Noted": Proceed with work covered by submittal provided it complies with notations or corrections on submittal and requirements of Contract Documents; final acceptance will depend on that compliance.
 3. "Revise and Resubmit": Do not proceed with work covered by submittal, including purchasing, fabrication, delivery, or other activity. Revise and/or prepare a new submittal in accordance with notations, and resubmit without delay. Repeat this procedure, if necessary, to obtain a different action mark. Do not use submittals marked "Revise and Submit" at Project site, or elsewhere where work is in progress.
 4. "Not Acceptable": Work covered by this submittal is completely unacceptable. Prepare new submittal and submit without delay.
 5. "Subject To Action By Architect's Consultant": Work covered by this submittal has been reviewed by the Architect but must also be reviewed by Architect's consultant before work covered by submittal can be purchased, fabricated, delivered, or used on this project.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

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 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 inspecting 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 -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, HACP, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements:
 - 1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 DEFINITIONS

- A. 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.
- B. 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. Services do not include contract enforcement activities performed by Architect .

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, 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 Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- E. 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, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- F. Experienced: When used with an entity or individual, "experienced" 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.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards 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 a decision 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.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 SUBMITTALS

- A. Qualification Data: 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.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 1. Specification Section number and title.
 2. Description of test and inspection.
 3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
 1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number 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 inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For HACP's records, 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.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, 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.
- C. 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.
- D. 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.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- 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 laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - e. When testing is complete, remove test specimens, assemblies, mockups, and laboratory 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, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

1. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests and inspections are the Contractor's responsibility. 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.
 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by HACP, unless agreed to in writing by HACP.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. 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 Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location 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 quality-control 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 any duties of Contractor.
- F. Associated Services: Cooperate with agencies 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 inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
 - 1. Distribution: Distribute schedule to HACP, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency 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 reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect 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 with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which 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 reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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 Division 01 Specification Sections, apply to this Section.

1.2 PROJECT CONDITIONS

- A. This Section is not intended to limit types and amounts of temporary construction facilities and controls required. Omission from this Section will not be accepted as an application that such temporary activity is not required for successful completion of the work and compliance with requirements of the Contract Documents.
- B. Provide and maintain each temporary construction facility and control when required for proper performance of the work. Terminate and remove when no longer needed or when permanent facilities, with proper authorization, are available for use.
- C. Obtain and pay for all required applications, fees, permits and inspections required for temporary construction facilities and controls.
- D. Install, operate, maintain and protect temporary construction facilities and controls in a manner and at locations which are safe, non-hazardous, sanitary and adequately protect project work, workmen and the public.
- E. The building will be occupied during construction. Provide temporary barriers to restrict access to the area(s) of construction for the health, safety and welfare of the Occupants and other members of the Public, to only those individuals that need for access to the area to complete the Work. Temporary barriers shall be required to coordinate with the Demolition and Construction Phasing and Occupant Disruption Schedule, provided by the General Prime Contractor, updated on a weekly bases and as approved by HACP. Access to individual apartment units on a daily bases is required. Maintain means of egress at all times.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. Provide and maintain all temporary facilities off-site in compliance with governing rules, regulations, codes, ordinances and laws of agencies and utility companies having jurisdiction over work involved in project.
- B. Be responsible for all temporary work provided, and obtain any necessary permits and inspections for such work.

- C. Confine equipment, storage of materials, and operation of workmen to the limits indicated or directed and shall abide by law, ordinances, conditions stated in permits and directions of the Construction Manager/HACP's Representative.
- D. Do not interfere with normal use of roads in vicinity of project site, except as absolutely necessary to execute required work, and then only after proper arrangements have been made with authorities having jurisdiction, including permits, approvals and temporary traffic control as applicable.

1.4 TEMPORARY FIELD OFFICES AND TRAILERS

- A. Each Prime Contractor to provide an off-site construction trailer for field office.
- B. Locate trailer in close proximity to site and as approved by HACP.
- C. Copies of permits, approved submittals, plans and specifications marked up-to-date with all revisions and all addenda shall be kept at said offices ready for use at all times.
- D. All expenses in connection with Contractor's field offices shall be borne by the Contractor, including utility installation costs to the field office.

1.5 TEMPORARY SANITARY FACILITIES

- A. No facilities are available on site. Provide temporary portable toilets, acceptable to public health authorities, as required to service the project. Maintain in a clean, sanitary condition; provide all supplies. Locate as directed by Construction Manager/HACP's Representative within secure construction area.

1.6 TEMPORARY LIGHT AND POWER

- A. Provide necessary temporary electrical service and temporary wiring and outlets as required to meet project needs for temporary lighting and power for the trailer.
- B. Extend temporary service from public utility service. Provide meter and extend service with disconnect to central location on site and to electric panel board location near Contractors' office trailer area. Provide system sized as required to service project construction needs.
- C. Remove temporary service when no longer required.
- D. Electrical work for construction purposes shall conform to Federal, State and local safety requirements, as well as requirements of the National Electrical Code. Obtain and pay for required applications, permits and inspections pertaining to this work.
- E. Pay all costs for installation, maintenance, supervision and removal of temporary light and power systems.

- F. Temporary use of on-site electrical power for construction shall be made available for use.

1.7 CONSTRUCTION AIDS

- A. Shoring and Bracing: Provide all shoring and bracing required for safety and proper execution of their work. Remove these items when the work is completed.
- B. Barriers: Provide protective barriers and fencing as required to protect the public from demolition operations, including demolition preparation work, and construction activities for the duration of the Work.
 - 1. Provide and maintain OSHA approved barriers where required by OSHA.
- C. First Aid Facilities: Provide a minimum of one (1) 16-unit first-aid kit (or equivalent) for each 25 persons (or fraction thereof) on the worksite.

1.8 WATCHMAN SERVICE

- A. If Contractor considers watchman services necessary or desirable for protection of their own interest, such services may be employed at their own complete expense.

1.9 SAFETY

- A. Safety requirements shall be in accordance with the General Conditions.
- B. Provide and maintain guard lights at all barricades, railings, obstructions in the roadways or sidewalks.
- C. Strict attention and full adherence must be given the Williams-Steiger Occupational Safety and Health Act of 1970, U.S. Department of Labor.

1.10 TEMPORARY SIGNS

- A. Temporary Signs: Provide as required to adequately direct traffic, personnel and the public regarding the project.

1.11 STREETS AND TRAFFIC

- A. Cleaning and Repair
 - 1. Contractors shall remove mud and spillage from public walks, streets and sewers without delay. Failure to clean areas promptly will result in areas being cleaned by HACP at the responsible Contractor's expense.

2. Damage to roads or other facilities on the grounds, resulting from hauling, storage of materials, or other activities in connection with the work shall be repaired or replaced, at no expense to HACP, by the Contractor causing the damage. Repairs or replacements shall be made to the satisfaction of the Construction Manager/HACP's Representative and the Architect.

B. Traffic

1. Notify City of Pittsburgh Police Department at least two weeks in advance of any anticipated work affecting traffic flow.
 - a. To assure maintenance of flow and to safeguard all parties involved in planning to maintain flow, a field inspection should be made jointly by the Construction Manager/HACP's Representative, the Architect and Contractor personnel before performing any work which would interrupt normal traffic patterns.
 - b. Re-routing of traffic shall be planned, as to route and direction, in cooperation with the City of Pittsburgh Police Department.

1.12 PARKING

- A. There are no on-site or assigned parking for employees of Contractors and subcontractors. Parking on streets or in restricted areas is prohibited. Specific parking plans will be discussed at the Pre-Construction Meeting.

1.13 USE CHARGES

- A. General: Shall be as dictated by the General Conditions for Construction Contracts – Public Housing Programs and agreed upon between HACP and each Prime Contractor.

1.14 INFORMATIONAL SUBMITTALS

- A. Off-Site Plans: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.

2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 3. 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.
- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. 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.

1.15 QUALITY ASSURANCE

- A. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 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 rails.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).
- E. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

- F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- G. Paint: Comply with requirements in Division 9 painting Sections.

2.2 TEMPORARY FACILITIES

- A. Common-Use Off-Site Field Office: Of sufficient size to accommodate needs of HACP, 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 15 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less 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. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
 - 7. Provide all required utilities (heat, electric, telephones, etc.).
 - 8. Security of field office, tools, equipment and materials and release the Authority of any liability in case of a breach of security.
 - 9. Provide janitorial services for the job site trailer on a weekly basis, for the duration of the project.
- B. Off-Site Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

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: 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. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities off-site in close proximity 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.
 - 1. Locate temporary facilities to limit site disturbance and that minimize disruption of daily activities of HACP and residents.
- 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.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Water Service: Use of HACP's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to HACP. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- C. Heating: Provide temporary heating 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. At all times during demolition and construction, Occupied Apartments are required to maintain a temperature as determined by HACP.
 - 2. All occupied apartments, offices and occupied areas are required by the end of the work day to be airtight, watertight, secure and able to be occupied at standard typical room temperatures of 72 degrees.
- D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

- a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices
 3. Contractors are required to continuously clean floor areas to keep areas not under demolition and construction clean.
 4. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Connect temporary service to HACP's existing power source, as directed by HACP.
- G. 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.
 2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide incombustible construction for temporary offices, shops, and sheds located off-site of the occupied building and construction area. Comply with NFPA 241.
 2. Maintain support facilities until Construction Manager/HACP's Representative schedules Substantial Completion inspection. Remove before Substantial Completion.
- B. 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.
- C. Parking: Use designated areas of HACP's existing parking areas for construction personnel.
- D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- E. 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.
- F. Existing Elevator Use: Use of HACP's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to HACP. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 1. Do not load elevators beyond their rated weight capacity.
 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- G. Existing Stair Usage: Use of HACP's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to HACP. At Substantial Completion, restore stairs to condition existing before initial use.
 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 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.
- 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. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to

adjacent properties and walkways, according to requirements of authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 2. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Tree and Plant Protection: Provide measures to prevent damage to existing tree and plants.
- E. Site Enclosure Fence: Before demolition and construction operations begin, furnish and install work area enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire portion determined sufficient to accommodate construction operations and public access to the tenant occupied areas.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to HACP.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- 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 Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. 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.
- J. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by HACP and Residents from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 2. Construct dustproof partitions with two layers of 3-mil polyethylene sheet on each side. Cover floor with two layers of 3-mil polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover

- floor with fire-retardant-treated plywood. This shall occur in the existing lobbies where adjacent to the units under construction.
 - 3. Insulate partitions to control noise transmission to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Provide walk-off mats at each entrance through temporary partition.
- K. Existing exterior wall mural:
- 1. Protect temporary protection for existing exterior wall mural during cleaning of building and demolition and construction with materials and methods as required.
- L. Temporary Fire Protection: Maintain existing fire-protection systems.
- 1. Smoking is prohibited on site and within construction areas.
 - 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.
- 3.5 MOISTURE AND MOLD CONTROL
- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: 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. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: 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, replace, or clean stored or installed material that begins to grow mold.

7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

3.6 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. 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. HACP reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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 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 equal products.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for requests and reviews of substitutions.
 - 2. Division 01 Section "Allowances" for products selected under an allowance.
 - 3. Division 01 Section "Alternates" for products selected under an alternate.
 - 4. Division 01 through 32 for specific product requirements.

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. "Equal" Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service 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 specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and

other characteristics for purposes of evaluating "Equal" products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. "Equal" Product Requests: Submit request for consideration of each "Equal" product. Identify 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 "'Equal' Products" Article.
 - 2. Include any previously submitted Substitution Request Forms whether for "during Bid phase" (form 012500.01) or "after Bid phase" (012500.02) with Architect's approval verification.
 - 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a "Equal" product request. Architect will notify Contractor of approval or rejection of proposed "Equal" 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 Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a "Equal" 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.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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 weathertight 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 off-site for storage of materials and equipment by HACP's construction forces. Coordinate location with HACP.

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 HACP.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for HACP.
- 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. Refer to 02 through 49. 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. HACP reserves the right to limit selection to products with warranties not in conflict with 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.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Equal" Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 1. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. "Equal" products or substitutions for Contractor's convenience will not be considered.
 2. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. "Equal" products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Equal" Products" Article for consideration of an unnamed product.
 3. Manufacturers:

- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. "Equal" products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "'Equal' Products" Article for consideration of an unnamed manufacturer's product.
4. 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 "Equal" 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 "'Equal' Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- 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 "EQUAL" PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for equal 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, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.

**TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B**

**PRODUCT REQUIREMENTS
016000**

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 4. Section 024119 "Selective Structure Demolition" for demolition and removal of selected portions of the building.
 - 5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 3. Dates: Indicate when cutting and patching will be performed.
 - 4. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 - 2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased

maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

- a. Equipment supports.
 - b. Piping, ductwork, vessels, and equipment.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of utilities and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems, and other construction affecting the Work.

- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect and Construction Manager/HACP's Representative when deviations from required lines and levels exceed allowable tolerances.
- C. Building Lines and Levels: Locate and lay out control lines and levels for exterior wall systems against existing structures and floor levels.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. 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.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required,

- and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 3. Floors and Walls: Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, existing drywall bulkheads and prepare and paint ceiling grids.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

- A. Provide access to Project site for HACP's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by HACP's construction personnel.
 1. Construction Schedule: Inform HACP of Contractor's preferred construction schedule for HACP's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify HACP if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include HACP's construction forces at preinstallation conferences covering portions of the Work that are to receive HACP's work. Attend

preinstallation conferences conducted by HACP's construction personnel if portions of the Work depend on HACP's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017329 - CUTTING AND PATCHING

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 procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 01 Section "Selective Structure Demolition" for demolition of selected portions of the building.
 - 2. Divisions 02 through 32 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be

relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Equipment supports.
 4. Piping, ductwork, vessels, and equipment.
 5. Noise- and vibration-control elements and systems.
 6. Structural members not specifically noted to be modified.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding. Mechanical and electrical contractors shall clearly identify

locations requiring cutting with the general contractor present. Mechanical and electrical prime contractors shall make every effort to minimize area of cutting required. Multiple conferences may be required to identify all areas requiring cuts and patches.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space.

Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

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 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 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017300 "Execution" for progress cleaning of Project site.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements for instructing HACP's personnel.

1.3 CLOSEOUT SUBMITTALS

- A. Divisions 02 through 32 Sections for specific closeout and special cleaning requirements for the Work

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following:
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise HACP of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting HACP unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by HACP. Label with manufacturer's name and model number where applicable.
 7. Make final changeover of permanent locks and deliver keys to HACP. Advise HACP's personnel of changeover in security provisions.
 8. Complete startup testing of systems.
 9. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 10. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by HACP. Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 11. Submit test/adjust/balance records.
 12. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 13. Advise HACP of changeover information related to HACP's occupancy, use, operation, and maintenance.
 14. Submit changeover information related to HACP's occupancy, use, operation, and maintenance.
 15. Complete final cleaning requirements, including touchup painting.
 16. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection to determine Substantial Completion. On receipt of request, Architect and Construction Manager/HACP's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect

will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

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

1.6 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Instruct HACP's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a list and written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager/HACP's Representative 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 of items that must be completed or corrected before certificate will be issued.
 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:

- a. Project name.
- b. Date.
- c. Name of Architect and Construction Manager.
- d. Name of Contractor.
- e. Page number.

1.8 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- 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 HACP during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

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 portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- I. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste material. Do not bury debris or excess materials on HACP's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

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

END OF SECTION 017700

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 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. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for 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 SUBMITTALS

- A. Initial Submittal: Submit draft copy through Project Web Site and (1) draft copy of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return digital copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 5 copies of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of HACP.
 4. Date of submittal.

5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. 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.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-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. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. 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 diskettes for computerized electronic equipment.
 4. Supplementary Test: 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.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of HACP's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information where applicable:
1. System, subsystem, and equipment descriptions.
 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.
- B. Descriptions: Include the following:
1. Product name and model number. Manufacturer's name.

2. Equipment identification with serial number of each component.
3. Equipment function.
4. Operating characteristics.
5. Limiting conditions.
6. Performance curves.
7. Engineering data and tests.
8. Complete nomenclature and number of replacement parts.

C. 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.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. 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.

B. 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.

C. 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.

D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, 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 warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
 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.
- D. 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.

- E. 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.
- F. 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.
- 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 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by HACP's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 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 HACP's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component 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.

1. 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.
- E. 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 operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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 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.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal: Submit one set of PDFs from corrected Record CAD Drawings and Record PDF Specifications through the Project Web Site. Architect will initial and date each and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return digitally.
 - b. Final Submittal: Submit one set of marked-up Record Prints, one set of Record CAD Drawing files, one set of Record CAD Drawing plots, and three (3) copies printed from record plots. Plot and print each Drawing, whether or not changes and additional information were recorded.
 - 1) Electronic Media: DVD.

- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each Product Data submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 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 prepare the 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.
 - 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. Actual equipment locations.
 - d. Changes made by Change Order or Construction Change Directive.
 - e. Changes made following Architect's written orders.
 - f. Details not on the original Contract Drawings.
 - g. Field records for variable and concealed conditions.
 - h. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record 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 CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
 1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, Version AutoCad 2010, Microsoft Windows operating system.
 3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 5. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 - a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
 - b. CAD Software Program: The Contract Drawings are available in AutoCad 2010.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect and Construction Manager for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record CAD Drawings: Organize CAD 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 CAD file.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.

- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect and Construction Manager.
- e. Name of Contractor.

2.2 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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. 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.

2.4 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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- 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. Maintenance of Record Documents and Samples: Store record documents and Samples 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 and Construction Manager's reference during normal working hours.

END OF SECTION 017839

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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Instruction Program: Submit two (2) copies of instructional program for demonstration and training, including 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. At completion of training, submit one complete training manual for HACP's use.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. 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.

1.5 COORDINATION

- A. Coordinate instruction schedule with HACP's operations. Adjust schedule as required to minimize disrupting HACP's operations.
- 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 has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 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:
 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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.
 - 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.
 - l. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and HACP for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct HACP's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. HACP will furnish an instructor to describe HACP's operational philosophy.
 2. HACP 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 HACP with at least seven days' advance notice.

- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to HACCP. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 024119 - SELECTIVE 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 selected portions of building or structure.
- 2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
- 2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to HACP ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

- A. Qualification Data: For demolition firm.
- B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Locations of proposed dust- and noise-control temporary partitions and means of egress
 6. Coordination of HACP's continuing occupancy of portions of existing building.
 7. Means of protection for items to remain and items in path of waste removal from building.
- C. Inventory: After selective demolition is complete, submit a list of items to be removed and salvaged.
- D. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
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 PROJECT CONDITIONS

- A. HACP employees and residents will occupy the site and existing buildings during entire construction period. Conduct selective demolition so HACP's operations and residents will be minimally disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by HACP as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- 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 and provide additional extinguishers during selective demolition operations.
 - 2. Maintain Apartment clean air conditions and heating and cooling conditions, as if no demolition or construction were occurring.

1.7 WARRANTY

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

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated HVAC, plumbing, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

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 during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Service/System Requirements:
 - 1. If services/systems are required to be removed or relocated, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems.

3.3 PREPARATION

- A. 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.
 - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary vehicular access at areas where existing street/road is to be demolished.
 - 3. Provide barricades at all excavated areas or sidewalks that have been demolished to ensure the public's safety at these areas.

3.4 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. All demolition quantities are approximates. Contractor to verify quantities based on the areas indicated on drawings.
 - 2. Neatly perform cuts plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

- Use hand tools or small power tools designed for sawing or grinding, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly.
- B. Do not demolish site elements beyond what is indicated on Drawings without Architect's approval.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to HACP.
 4. Transport items to HACP's storage area as designated by HACP.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain HACP's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
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.
- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials and dispose of at designated spoil areas on HACP's property.
- D. Coordination: Coordinate disposal with other contractor's performing work concurrently on site.

3.6 CLEANING

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

END OF SECTION 024119

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 hydraulic-cement-based underlayment for use below interior floor coverings.
- B. Related Sections include the following:
 - 1. Division 09 Sections for patching and leveling compounds applied with floor coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.
- C. Manufacturer Certificates: Signed by manufacturers of both underlayment and floor covering system certifying that products are compatible.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.
 - 1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.8 COORDINATION

- A. Coordinate application of underlayment with requirements of floor covering products, including adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ardex; K-15 Self-Leveling Underlayment Concrete.
 - b. Bonsal, W. R. Company; Self-Leveling Underlayment.
 - c. ChemRex; Thoro Underlayment, Self-Leveling.
 - d. Conspec, a Dayton Superior Company; Conflow.
 - e. Dayton Superior Corporation; Levelayer I.
 - f. Dependable Chemical Co., Inc.; Skimflow ES.
 - g. L&M Construction Chemicals, Inc.; Levelex.
 - h. MAPEI Corporation; Ultraplan 1.
 - i. Maxxon Corporation; Level-Right.
 - j. US Mix Products Company; US SPEC Self - Leveling Underlayment.Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Water: Potable and at a temperature of not more than 70 deg F.

- C. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
 - 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
 - 1. Feather edges to match adjacent floor elevations.

- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.5 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

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 in walls.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPAA: Western Wood Products Association.

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.

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.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

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. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Per 2009 IBC, Building Construction Type is 1B therefore all blocking materials are to be fire-retardant-treated materials complying 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. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-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.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Concealed blocking.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

- D. 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.
- E. 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.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.6 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cleveland Steel Specialty Co.
 2. KC Metals Products, Inc.
 3. Phoenix Metal Products, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. USP Structural Connectors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength 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.
- D. Stainless-Steel Sheet: ASTM A 666, Type 316.
1. Use for exterior locations and where indicated.

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 to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.

- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- G. 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) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- H. Sort and select lumber so that natural characteristics will 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.
- I. 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.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. 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.
- 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 where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

- 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 PROTECTION

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

END OF SECTION 061053

SECTION 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. Roof sheathing .
 - 2. Subflooring.
 - 3. Underlayment.
 - 4. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for allowances.
 - 2. Section 012200 "Unit Prices" for unit prices.

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 a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-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.

1.6 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-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory." or GA-600, "Fire Resistance Design Manual."

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet 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. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.

- 2. Hardboard underlayment.
- C. Plywood: DOC PS 1.
- D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- E. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 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. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated 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 plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.
- C. Kiln-dry material 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.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.
 - 1. Roof sheathing within 48 inches (1220 mm) of fire or party walls each side of wall.
 - 2. Roof sheathing.
 - 3. Subflooring and underlayment for raised platforms.

2.4 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exterior, Structural sheathing.
 - 1. Span Rating: Not less than 48/24.
 - 2. Nominal Thickness: Not less than 1/2 inch (13 mm). Match existing.

2.5 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Underlayment single-floor panels.
 - 1. Span Rating: Not less than 16 o.c.
 - 2. Nominal Thickness: Not less than 5/8" tongue and groove plywood.
 - 3. Edge Detail: Square.
 - 4. Edge Detail: Tongue and groove.
 - 5. Surface Finish: Fully sanded face.
- B. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.
- C. Plywood Underlayment for LVT Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
- D. Underlayment for Ceramic Tile: Bases of Design "James Hardie" or approved for ceramic tile set in EGP (exterior glue plywood) latex-portland cement mortar.
- E. Plywood Underlayment for Carpet: DOC PS 1, Interior, Underlayment.
- F. Hardboard Underlayment: ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded.

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. For roof 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: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- F. 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, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 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.

2.7 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."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives 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."

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. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 3. 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."
- 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 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 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

- B. Fastening Methods: Fasten panels as indicated below:
1. Combination Subfloor-Underlayment:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 2. Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 3. Underlayment:
 - a. Nail to subflooring.
 - b. Space panels 1/32 inch (0.8 mm) apart at edges and ends.
 - c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with nails.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- 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 boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel 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 boards.
 2. For sheathing under stucco cladding, boards 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 board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board 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 boards.
 - 2. For sheathing under stucco cladding, boards 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 silicone emulsion 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.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 FIBERBOARD SHEATHING INSTALLATION

- A. Comply with ASTM C 846 and with manufacturer's written instructions.
- B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch (9.5 mm) from edges and ends.
- C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch (3-mm) open space between edges and ends of adjacent units. Stagger horizontal joints if any.
- D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.6 FOAM-PLASTIC SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions.

- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.7 HARDBOARD UNDERLAYMENT INSTALLATION

- A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 - 1. Fastening Method: Nail underlayment to subflooring.

END OF SECTION 061600

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. Spray polyurethane foam insulation between window frames and rough openings and door frames and rough openings.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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.

PART 2 - PRODUCTS

2.1 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. BaySystems NorthAmerica, LLC.
 - c. Dow Chemical Company (The).
 - d. ERSystems, Inc.
 - e. Gaco Western Inc.
 - f. Henry Company.
 - g. NCFI; Division of Barnhardt Mfg. Co.
 - h. SWD Urethane Company.
 - i. Volatile Free, Inc.
 - 2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections that interfere with insulation.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Fill insulation to envelop entire area to be insulated between frames and rough openings. Spray in around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 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 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

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

2.2 SUMMARY

- A. Section Includes:
 - 1. Asphalt shingles.
 - 2. Underlayment.
 - 3. Ridge Vents
 - 4. Metal Flashing and Trim
- B. Related Sections:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood framing.
 - 2. Section 061600 "Sheathing" for roof sheathing.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings, flashings, gutters and downspouts.

2.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

2.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of asphalt shingle ridge and hip cap shingles, ridge vent and exposed valley lining indicated.
 - 1. Include similar Samples of trim and accessories involving color selection.

- C. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
 - 1. Asphalt Shingle: Full size.
 - 2. Ridge and Hip Cap Shingles: Full size.
 - 3. Ridge Vent: 12-inch- (300-mm-) long Sample.
 - 4. Exposed Valley Lining: 12 inches (300 mm) square.
 - 5. Self-Adhering Underlayment: 12 inches (300 mm) square.

2.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- C. Research/Evaluation Reports: For each type of asphalt shingle required, from the ICC.
- D. Warranties: Sample of special warranties.

2.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

2.7 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. Asphalt Shingles: 100 sq. ft (9.3 sq. m) of each type, in unbroken bundles.

2.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain ridge and hip cap shingles, ridge vents, felt underlayment and self-adhering sheet underlayment] from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.

2.9 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

2.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles 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. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

2.11 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 - 2. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first five years nonprorated.
 - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 100 mph (45 m/s) for 10 years from date of Substantial Completion.
 - 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.
- B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.

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

PART 3 - PRODUCTS

3.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Multitab-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. CertainTeed Corporation.
 - c. GAF Materials Corporation.
 - d. IKO.
 - e. Malarkey Roofing Products.
 - f. Owens Corning.
 - g. PABCO Roofing Products.
 - h. TAMKO Roofing Products, Inc.
 2. Tab Arrangement: Three tabs, regularly spaced.
 3. Cutout Shape: Square.
 4. Butt Edge: Straight cut.
 5. Strip Size: Manufacturer's standard.
 6. Algae Resistance: Granules treated to resist algae discoloration.
 7. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

3.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Coatings & Waterproofing, Inc.
 - b. Grace, W. R. & Co. - Conn.
 - c. Henry Company.
 - d. Johns Manville.
 - e. Owens Corning.
 - f. Polyguard Products, Inc.

g. Protecto Wrap Company.

- B. Granular-Surfaced Valley Lining: ASTM D 3909, mineral-granular-surfaced, glass-felt-based, asphalt roll roofing; 36 inches (914 mm) wide.

3.3 RIDGE VENTS

- A. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Owens Corning VentSure RidgeCat Rolled Ridge Vent, or comparable product by one of the following:

- a. GAF Materials Corporation.
- b. Obdyke, Benjamin Incorporated.
- c. TAMKO Roofing Products, Inc.

- 2. Minimum Net Free Area: 15 sq. in./LF.
- 3. Width: 11 inches.
- 4. Thickness: 5/8 inches.

3.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, [barbed] [smooth] shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

3.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.

1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches (100 mm) over and 4 inches (100 mm) beyond each side of downslope asphalt shingles and up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 2 inches (50 mm) and a minimum extension of 4 inches (100 mm) over the underlying asphalt shingle and up the vertical surface.
 3. Cricket Flashings: Fabricate with concealed flange extending a minimum of 18 inches (450 mm) beneath upslope asphalt shingles and 6 inches (150 mm) beyond each side of chimney and 6 inches (150 mm) above the roof plane.
 4. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (250 mm).
 5. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (9.6-mm) drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches (100 mm) from pipe onto roof.

PART 4 - EXECUTION

4.1 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.
1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- 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.

4.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

- B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 2. Eaves: Extend from edges of eaves 24 inches (600 mm) beyond interior face of exterior wall.
 3. Rakes: Extend from edges of rake 24 inches (600 mm) beyond interior face of exterior wall.
 4. Valleys: Extend from lowest to highest point 18 inches (450 mm) on each side.
 5. Hips: Extend 18 inches (450 mm) on each side.
 6. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot.
 7. Sidewalls: Extend beyond sidewall 18 inches (450 mm), and return vertically against sidewall not less than 4 inches (100 mm).
 8. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches (450 mm), and return vertically against penetrating element not less than 4 inches (100 mm).
 9. Roof Slope Transitions: Extend 18 inches (450 mm) on each roof slope.
- C. Concealed, Closed-Cut Valley Lining: Comply with NRCA's recommendations. Install a 36-inch- (914-mm-) wide felt underlayment centered in valley. Fasten to roof deck with felt underlayment or roofing nails.
1. Lap roof-deck felt underlayment over valley felt underlayment at least 6 inches (150 mm).
 2. Install a 36-inch- (914-mm-) wide strip of granular-surfaced valley lining centered in valley, with granular-surface face up. Lap ends of strips at least 12 inches (300 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten to roof deck with roofing nails.

4.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches (50 mm) and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.

- D. Cricket Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- F. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

4.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch (13 mm) over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
- E. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
 - 1. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots after fastening with additional roofing nails.
 - 2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
 - 3. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.
- F. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches (300 mm) beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (50 mm) short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

1. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
 2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.
- G. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- H. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 073113

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. This Section includes the following sheet metal flashing and trim:
 - 1. Gutters and downspouts.
 - 2. Formed steep-slope roof flashing and trim.
- B. Related Sections include the following:
 - 1. Division 7 Section "Asphalt shingles," for roof shingles, installing valley and hip flashing and trim integral with roofing.
 - 2. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - 1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation 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.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 1. Identify material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials.

2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 SHEET METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA.
 - 1) Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
- B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- D. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and 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.
 - 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 Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. 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.
- 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 complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. 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.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 GUTTERS AND DOWNSPOUTS

- A. Provide aluminum gutter and downspout system to remove rainwater from the sloped roof areas and direct it to the underground storm drainage system. Provide the following components to a fully functional rain removal system.
1. 6" heavy duty OG style aluminum gutter of nominal .032" thickness in maximum lengths to suit project, with combination hangers, expansion joint sections, eave tubes and other accessories.
 2. 2" x 3" heavy duty rectangular corrugated aluminum of nominal .024" thickness in maximum lengths to suit project.
 3. Rectangular elbows in style as required for condition encountered.
 4. End caps, outside and inside miters, and downspout anchor clips as required.
- B. Manufacturer: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Alcoa Building Products; "Traditional Select S-6"
 2. Atas: "K Gutter"
 3. Petersen Aluminum Corporation; OG Gutter.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Drip Edges: Fabricate from the following material:

1. Aluminum: 0.0320 inch (0.8 mm) thick.
- B. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted 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.

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 work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- E. 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.
1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. 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 (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 2. Aluminum: Use aluminum or stainless-steel fasteners.
 3. Copper Use copper or stainless-steel fasteners.
 4. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
1. Where sealant-filled joints are used, 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 moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either 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 Division 7 Section "Joint Sealants."

- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.
 - 1. Do not solder aluminum sheet.
 - 2. Stainless-Steel Soldering: Prein edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 - 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 - 3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
 - 4. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.24 m) apart. Install expansion joint caps.
 - 5. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 - 1. Provide elbows at base of downspout to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set

units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

3.6 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 and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. 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.

3.7

END OF SECTION 076200

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 other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations of existing fire-resistance-rated constructions, including both empty openings and openings containing penetrating items

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory. "
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products. "
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grace Construction Products.
 - 2. Hilti, Inc.
 - 3. Johns Manville.
 - 4. Nelson Firestop Products.
 - 5. Specified Technologies Inc.
 - 6. 3M Fire Protection Products.
 - 7. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 8. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist 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.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping 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. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping 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. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. 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 metallic sleeve lined with an intumescent strip, a radial extended 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 elastomeric sheet bonded to galvanized-steel sheet.

- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- 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.
- 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 of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping 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: Clean out openings immediately before installing penetration firestopping 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.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: 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.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping 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 fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 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 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

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 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 is 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 and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING 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 ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO'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."
- A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."
- C. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.
- D. Firestop Systems with No Penetrating Items:
 - 1. Available UL-Classified Systems: C-AJ-0012.

2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
- E. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
 1. UL-Classified Systems: C-AJ-1235; CA-J-1402; F-C-1005, 1020, 2082 and 2087; F-E-1005.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
- F. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:
 1. UL-Classified Systems: F-E.1020, 2008 and 2009.
 2. Available OPL-Classified Systems: FS W, Penetrating Item Type B.
 3. Available ITS-Listed Systems:
 4. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Firestop device.
- G. Firestop Systems for Electrical Cables:
 1. UL-Classified Systems: F-C-3020; F-E-3006; W-L-3005 and 3116.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.

END OF SECTION 078413

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. Latex joint sealants.
3. Preformed joint sealants.
4. Acoustical joint sealants.

B. Related Sections:

1. Section 088000 "Glazing" for glazing sealants.
2. Section 092900 "Gypsum Board" for sealing perimeter joints.

1.3 PRECONSTRUCTION TESTING

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

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

- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (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.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system 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."
- D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - b. Pecora Corporation; 301 NS, 311 NS, 890 890FTS.
 - c. Tremco Incorporated; Spectrem 1, Spectrem 800.
- B. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Corning Corporation; 999-A.
- b. Pecora Corporation; 860.
- c. Tremco Incorporated; Proglaze, Tremsil 200.

C. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Corning Corporation; 786 Mildew Resistant.
- b. GE Advanced Materials - Silicones; Sanitary SCS1700.
- c. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Bostik, Inc.; Chem-Calk 600.
- b. Pecora Corporation; AC-20+.
- c. Tremco Incorporated; Tremflex 834.

2.4 PREFORMED JOINT SEALANTS

A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Tremco Super Seal
- b. GE Advanced Materials - Silicones; UltraSpan US1100.
- c. Pecora Corporation; Sil-Span

B. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. NonAsphaltic. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Tremco Illmod 600
- b. EMSEAL Joint Systems, Ltd.; Emseal 25V.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Tremco Acoustical Sealant
 - b. Pecora Corporation; AC-20 FTR, AIS-919.
 - c. USG Corporation; SHEETROCK Acoustical Sealant.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include 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.
 - 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 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 passes sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces .
1. Joint Locations:
 - a. Perimeter joints between doors, windows and louvers.
 - b. Other joints as required.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.

- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Urethane Joint Sealant: Single component, pourable, traffic grade
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Vertical joints on exposed surfaces of walls.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Latex Acrylic based TREMFLEX 834 or equal.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Joints as required or indicated.
 - 2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing Tremsil 200 or approved equal.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Location:
 - a. Acoustical joints where required.
 - b. Other joints as required.
 - 2. Joint Sealant: Acoustical.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

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:

- 1. Hollow-metal doors in existing frames.
- 2. Hollow-metal frames (For allowance and unit pricing purposes)

B. Related Requirements:

- 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
- 2. Section 088000 "Glazing" for glazing in doors. Refer to Drawings for locations.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/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.

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.
- 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.
- C. 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.

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.

1.8 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amweld International, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Curries Company; an Assa Abloy Group company.
 4. Karpen Steel Custom Doors & Frames.
 5. Pioneer Industries, Inc.
 6. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY 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 and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 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. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: 6 panel as indicated in the Door Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

- 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Face welded.
4. Exposed Finish: Factory Prime. Field Painted Finish
5. Glazing: Insulated Lights. Refer to Drawings and Glazing Specification.

2.4 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. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) 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.

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.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- C. 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.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

2.6 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) o.c. 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. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 5. 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.
 6. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

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. Compression Type: Not less than two anchors in each frame.
 - c. 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.
 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.
- 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 nontemplated, 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.

2.7 STEEL FINISHES

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

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

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 nontemplated, 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 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 antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. 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: 3/4 inch (19.1 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.

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. 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 other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Fire-Rated Doors
- B. Related Sections:
 - 1. Division 08 Section "Door Hardware" for door hardware for flush wood doors and wood frames.
- C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A or AWS classifications. Include factory finishing specifications.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the wood door supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- D. Samples for Verification: For factory-finished doors.

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C (neutral pressure testing according to UL 10B where specified).
 1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
 2. Temperature Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - 1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

4. Blocking: When through-bolts are not to be used, indicate size and location of blocking in 45, 60 and 90 minute mineral core doors.

D. Preinstallation Conference: Conduct conference at Project site.

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 bottom rail with opening number used on Shop Drawings.

1.7 PROJECT 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 the remainder of the construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which 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 (1067-by-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 Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

- A. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.

1. Category A Edge Construction: 60 fire rated doors edge construction with intumescent seals concealed by outer stile (Category A). Comply with specified requirements for exposed edges.
2. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Where required or specified, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

B. Interior Solid-Core Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eggers Industries: Premium.
 - b. Graham: GPD
 - c. VT Industries
 - d. Marshfield Doors
2. Grade: Premium, with Grade A faces.
3. Species: Match Existing
4. Cut: Match Existing
5. Match between Veneer Leaves: Book match.
6. Assembly of Veneer Leaves on Door Faces: Balance match.
7. Pair and Set Match: Provide for doors hung in same opening.
8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Exposed Vertical and Top Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
10. Core: Asbestos free incombustible material (Mineral Core) at 45 minute rated doors or higher.
11. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
12. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
13. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.2 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 requirements in NFPA 80 for fire-rated doors.

- 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, DHI A115-W series standards, 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: Cut and trim openings through doors in factory.
 - 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."
 - 3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.3 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 top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI conversion varnish or catalyzed polyurethane Insert finish designation system.
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores as standard to Basis of Design.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- 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.

SECTION 083213 - SLIDING FIBERGLASS-FRAMED GLASS DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass sliding doors.
- B. Flexible Flashing: Typical Around Sliding Doors being installed at Existing Openings

1.2 RELATED SECTIONS

- A. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.
- B. Section 088000 Glazing

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 - 2. AAMA 623 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 1036 - Flat Glass.
 - 2. ASTM C 1048 - Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
 - 3. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 - 4. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 - 5. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
- C. Screen Manufacturers Association (SMA):
 - 1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swing-ing Doors.
- D. Window and Door Manufacturers Association (WDMA):
 - 1. ANSI/AAMA/NWWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

1.4 PERFORMANCE REQUIREMENTS

- A. Doors shall meet Rating SGD-LC-45 specifications in accordance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08.

- B. Door Air Leakage, ASTM E 283: Door air leakage when tested at 1.57 psf (25 mph) shall be 0.10 cfm/ft² of frame or less.
- C. Door Water Penetration, ASTM E 547: No water penetration through door when tested under static pressure of 6.75 psf (51 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.5 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of door illustrating glazing system, quality of construction, and color of finish.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Store materials off ground and under cover.
 - 3. Protect materials from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Local Contact: Rick Funk Phone (412) 874-6036.
- B. Alternate manufacturers must be approved by the architect and HACP 10 days prior to the bid date.

2.2 FIBERGLASS SLIDING DOORS

- A. Sliding Doors: Pella Impervia.
 - 1. Factory-assembled door with sash installed in frame.

2. Frame and Sash Material: Duracast. 5-layer, pultruded-fiberglass material, reinforced with interlocking mat.

B. Frame:

1. Type: Block frame.
2. Interior and Exterior Frame: Pultruded, fiberglass composite with foam inserts.
3. Overall Frame Depth: 4-3/4 inches.
4. Nominal Wall Thickness of Fiberglass Members: 0.070 inch to 0.115 inch.
5. Frame Corners:
 - a. Mitered.
 - b. Joined and bonded with thermoset polyurethane adhesive, nylon corner lock, and mechanically fastened.
6. Head and Jambs: Factory-drilled, counter-bored, installation screw holes.

C. Door Panels:

1. Interior and Exterior Panel: Pultruded, fiberglass composite [with foam inserts].
2. Vent Panel: Removable for cleaning exterior glass.
3. Panel Corners:
 - a. Mitered.
 - b. Bonded and sealed with injected thermoset polyurethane adhesive.

D. Glazing:

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6.
 - a. Type: Polyurethane reactive (PUR) hot-melt glazed, 1 1/16-inch thick, insulating glass, multi-layer Low-E coated with argon, tempered.
 - b. Provide Solarban 60 by PPG Industries, inc., or equal

E. Weather Stripping:

1. Frame: Welded gasket on frame.

2.3 OPTIONS

A. Sliding Insect Screens: Standard.

1. Compliance: ASTM D 3656 and SMA 1201.
2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
3. Extruded-Aluminum Frame: Color to match the door.
4. Rollers: Top hung on 2 adjustable nylon rollers, room side of door panels.
5. Strike: Frame-mounted strike.
6. Hardware: Complete with necessary hardware.
7. Interior and Exterior Handle Finish: Match interior door handle finish.

2.4 HARDWARE

- A. Handles:
 - 1. Interior Handle and Thumb Lock:
 - a. Finish: Powder-coat paint to match door color.
 - 2. Latch: Inside locking on screens.
 - a. Color: To match door color.
- B. Locking System:
 - 1. Multiple-Point Lock Hardware: Stainless steel with adjustable strike.
- C. Vent Panel Rollers:
 - 1. Two adjustable, permanently sealed, electroplated steel with organic coating, ball-bearing rollers, set on stainless steel track.
- D. UFAS COMPLIANT HARDWARE
 - 1. UFAS Complaint hardware to be furnished and installed at all UFAS Units in the Bernice Crawley Highrise and Family Community Low Rise Units. Refer to Drawing G-110 for locations.

2.5 TOLERANCES

- A. Doors shall accommodate the following opening tolerances:
 - 1. Horizontal Dimensions Between High and Low Points: Plus 1/4-inch, minus 0 inch.
 - 2. Width Dimensions: Plus 1/4-inch, minus 0 inch.
 - 3. Building Columns or Masonry Openings: Plus or minus 1/4-inch from plumb.

2.6 FINISH

- A. Exterior and Interior Duracast Finish: Factory-applied powder-coat paint, comply with AAMA 623.
 - 1. Color: As selected by the architect from all available finishes. Exterior and interior colors shall match.

2.7 FLEXIBLE FLASHING AT WINDOWS TO BE INSTALLED AT EXISTING OPENINGS.

- B. Flexible Flashing: Basis of Design is DuPont, Tyvek, FlexWrap NF or approved equal.
 - 1. Description: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber adhesive compound, bonded to a textured polyethylene laminate face material.
 - 2. Dimensions: 64 mil minimum, 7" wide
 - 3. Performance Characteristics:

- a. Water intrusion: No leakage at 75 Pa, when tested in accordance with ASTM E331
- b. Water Vapor Permeability: < 1 perm, when tested in accordance with ASTM E96

2.8 INSTALLATION ACCESSORIES

- A. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- B. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.
- C. Block Frame Installation Accessories: Vinyl installation fin.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate door system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with door manufacturer's instructions.
- F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
- G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave doors closed and locked.

3.3 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates

3.4 FLEXIBLE FLASHING INSTALLATION

B. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates

3.5 CLEANING

- A. Clean door frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish or glass.
- C. Remove labels and visible markings.

3.6 PROTECTION

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass sliding, single-hung, and fixed windows.
- B. Flexible Flashing: Typical Around Windows being installed at Existing Openings

1.2 RELATED SECTIONS

- A. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.
- B. Section 088000 Glazing

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 - 2. AAMA 623 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 1036 - Flat Glass.
 - 2. ASTM C 1048 - Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
 - 3. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 - 4. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 - 5. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
- C. Screen Manufacturers Association (SMA):
 - 1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swing-ing Doors.
- D. Window and Door Manufacturers Association (WDMA):
 - 1. ANSI/AAMA/NWWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

1.4 PERFORMANCE REQUIREMENTS

- A. Sliding windows in the High Rise shall meet Rating HS-LC-PG 40 specifications in accord-
ance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08 where required. Double-hung win-

dows shall meet Rating H-LC-PG 40 specifications in accordance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08.

- B. Window Air Leakage, ASTM E 283: Window air leakage when tested at 1.57 psf (25 mph) shall be 0.3 cfm/ft² of frame or less.
- C. Window Water Penetration, ASTM E 547: No water penetration through window when tested under static pressure of 4.5 psf (42 mph) for sliding and double-hung windows, after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.5 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.

1.6 QUALITY ASSURANCE

- A. Mockup:
 - 1. Provide sample installation to determine acceptability of window installation methods.
 - 2. Approved mockup shall represent minimum quality required for the Work.
 - 3. Approved mockup shall remain in place within the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Store materials off ground and under cover.
 - 3. Protect materials from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Local Contact: Rick Funk Phone (412) 874-6036.
- B. Alternate manufacturers must be approved by the architect and HACP 10 days prior to the bid date.

2.2 FIBERGLASS SLIDING WINDOWS

- A. Sliding Windows: Pella Impervia.
 - 1. Factory-assembled window with sash installed in frame.
 - 2. Frame and Sash Material: Duracast. 5-layer, pultruded-fiberglass material, reinforced with interlocking mat.
- B. Frame:
 - 1. Type: Block frame.
 - 2. Interior and Exterior Frame: Pultruded, fiberglass composite with foam inserts.
 - 3. Overall Frame Depth: 3 inches.
 - 4. Nominal Wall Thickness of Fiberglass Members: 0.050 inch to 0.070 inch.
 - 5. Frame Corners:
 - a. Mitered.
 - b. Joined and bonded with thermoset polyurethane adhesive, nylon corner lock, and mechanically fastened.
 - 6. Sill: Fitted with weep valve assemblies.
- C. Sash:
 - 1. Interior and Exterior Sash: Pultruded, fiberglass composite with foam inserts.
 - 2. Vent Sash: Removable for cleaning exterior glass.
 - 3. Sash Corners:
 - a. Mitered.
 - b. Bonded and sealed with injected thermoset polyurethane adhesive.
- D. Glazing:
 - 1. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6
 - 2. Type: Tape-glazed, 11/16-inch thick, insulating glass, multi-layer Low-E coated with argon -tempered. Provide Solarban 60 by PPG Industries, inc., or equal.
 - 3. where required by code and obscure tempered in the bathrooms.
- E. Weather Stripping:
 - 1. Vent Sash: Dual weather-stripped around perimeter with fin-type, dual-pile, weather stripping.

2.3 SLIDING WINDOW HARDWARE

- A. Rollers:
 - 1. Vents: Equip with 2 nylon roller housings containing 2 acetal rollers each.
 - 2. Rollers: Remove for cleaning and maintenance.

- B. Lock:
 - 1. Type: Self-aligning, cam-action lock.
 - 2. Windows 37 Inches High or Greater: 2 locks.
 - 3. Standard Finish: Match window interior.

2.4 FIBERGLASS SINGLE-HUNG WINDOWS

- A. Single-Hung Windows: Pella Impervia.
 - 1. Factory-assembled window with sash installed in frame.
 - 2. Frame and Sash Material: Duracast. 5-layer, pultruded-fiberglass material, reinforced with interlocking mat.
- B. Frame:
 - 1. Type: Block frame and New construction frames depending on location.
 - 2. Interior and Exterior Frame: Pultruded, fiberglass composite with foam inserts.
 - 3. Overall Frame Depth: 3 inches for Block frame and New Construction frame
 - 4. Nominal Wall Thickness of Fiberglass Members: 0.050 inch to 0.070 inch.
 - 5. Frame Corners:
 - a. Mitered at head and jamb on 10 degree sill.
 - b. Joined and bonded with nylon corner lock, with thermoset polyurethane adhesive and mechanically fastened.
 - 6. Jamb: Factory-drilled, counter-bored, installation screw holes.
- C. Sash:
 - 1. Interior and Exterior Sash: Pultruded, fiberglass composite with foam inserts
 - 2. Lower Sash: Lower sash vent, tilts for cleaning exterior glass.
 - 3. Upper Sash: Upper sash vent, tilts for cleaning exterior glass.
 - 4. Sash Corners:
 - a. Mitered.
 - b. Bonded and sealed with injected thermoset polyurethane adhesive.
- D. Glazing:
 - 1. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6
 - 2. Type: Tape-glazed, 11/16-inch thick, insulating glass, multi-layer Low-E coated with argon -tempered. Provide Solarban 60 by PPG Industries, inc., or equal.
 - 4. where required by code and obscure tempered in the bathrooms.
- E. Weather Stripping:
 - 1. Vent Upper Sash: Fin-type pile on jambs, top rail and stile.
 - 2. Vent Lower Sash: Vinyl-wrapped foam at sill on frame and bottom rail.

2.5 SINGLE-HUNG HARDWARE

- A. Balances: Galvanized steel block-and-tackle balances.

- B. Lock:
 - 1. Type: Self-aligning, cam-action lock.
 - 2. Windows 37 Inches Wide or Greater: 2 locks.
 - 3. Finish: Match window finish.
- C. Tilt Latches:
 - 1. Glass reinforced Nylon 6
 - 2. Integrated into sash corner
 - 3. Finish is matte gray
- D. Lower Sash Lift: Integrated into Duracast checkrail.
- E. Upper Sash Lift: Color-in ABS Resin.
- F. UFAS COMPLIANT HARDWARE
 - 1. UFAS Complaint hardware to be furnished and installed at all UFAS Units in the Bernice Crawley Highrise and Family Community Low Rise Units. Refer to Drawing G-110 for locations.

2.6 OPTIONS

- A. Insect Screens:
 - 1. Compliance: ASTM D 3656 and SMA 1201.
 - 2. Screen Cloth: Black Vinyl-coated fiberglass, 18/16 mesh.
 - 3. Set in aluminum frame fitted to window.
 - 4. Complete with necessary hardware.
 - 5. Screen Frame Finish: Baked enamel.
 - a. Color: To match window frame.

2.7 TOLERANCES

- A. Windows shall accommodate the following opening tolerances:
 - 1. Horizontal Dimensions Between High and Low Points: Plus 1/4-inch, minus 0 inch.
 - 2. Width Dimensions: Plus 1/4-inch, minus 0 inch.
 - 3. Building Columns or Masonry Openings: Plus or minus 1/4-inch from plumb.

2.8 FINISH

- A. Exterior and Interior Duracast Finish: Factory-applied powder-coat paint, comply with AAMA 623.
 - 1. Color: As selected by the architect from all of manufacturers available colors. Interior finish to match exterior color.

2.9 FLEXIBLE FLASHING AT WINDOWS TO BE INSTALLED AT EXISTING OPENINGS.

- A. Flexible Flashing: Basis of Design is DuPont, Tyvek, FlexWrap NF or approved equal.

1. Description: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber adhesive compound, bonded to a textured polyethylene laminate face material.
2. Dimensions: 64 mil minimum, 7" wide
3. Performance Characteristics:
 - a. Water intrusion: No leakage at 75 Pa, when tested in accordance with ASTM E331
 - b. Water Vapor Permeability: < 1 perm, when tested in accordance with ASTM E96

2.10 INSTALLATION ACCESSORIES

- A. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- B. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

2.11 SOURCE QUALITY CONTROL

- A. Factory Testing: Factory test individual standard operable windows for air infiltration in accordance with ASTM E 283, to ensure compliance with this specification.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's instructions.

- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating foam sealant.
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave windows closed and locked.
- I. UFAS Complaint Hardware: Install hardware at all UFAS Units in the Bernice Crawley Highrise and Family Community Low Rise Units. Refer to Drawing G-110 for locations. Install according to UFAS/ADA requirements.

3.3 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates

3.4 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish or glass.
- C. Remove labels and visible markings.

3.5 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

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.
 - b. Sliding exterior doors.
 - c. Sliding interior doors.
 - d. Bifold doors.
 - e. Other doors to the extent indicated.
- 2. Cylinders specified for doors in other sections.

B. Related Sections:

- 1. Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.

1.3 REFERENCES

A. Fire/Life Safety

- 1. NFPA – National Fire Protection Association
 - a. NFPA 80 – Fire Doors and Windows.
 - b. NFPA 101 – Installation of Smoke Door Assemblies
 - c. NFPA 105 – Smoke and Draft Control Door Assemblies

- 2. State Fire Safety Code.

B. UL – Underwriters Laboratories

- 1. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
- 2. UL 10C – Positive Pressure Fire Tests of Door Assemblies

- C. Accessibility
 - 1. ADA – Americans with Disabilities Act
 - 2. ANSI A117.1 – Accessible and Usable Building and Facilities.
 - 3. UFAS
 - 4. HUD's "Fair Housing Accessibility Guidelines"
- D. ANSI – American National Standards Institute
 - 1. ANSI/BHMA Certified Product Standards – A156 Series

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
- C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
 - 1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. 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.

- b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing HACP'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. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For electrified door hardware, from the manufacturer.
 - 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.7 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 Hardware: Two Sets of each type of hardware.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and HACP about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are 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, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
- E. 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.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, HUD's "Fair Housing Accessibility Guidelines" and UFAS.
 - 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.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. 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 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- G. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Construction Manager/HACP's Representative Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Requirements for access control.
 5. Address for delivery of keys.
- H. 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. Inspect and discuss preparatory work performed by other trades.
 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 4. Review sequence of operation for each type of electrified door hardware.
 5. Review required testing, inspecting, and certifying procedures.
- 1.9 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 HACP.
 - D. Deliver keys and permanent cores to HACP by registered mail or overnight package service.

1.10 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. 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.
- C. Security: Coordinate installation of door hardware, keying, and access control with HACP's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
 - a. Electromagnetic and Delayed-Egress Locks: Two years from date of Substantial Completion.
 - b. Exit Devices: Five years from date of Substantial Completion.
 - c. Manual Closers: 25 years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for HACP's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six 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. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or products equivalent in function and comparable in quality or equal to named products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using 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 Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Existing System:
 - a. Master key or grand master key locks to HACP's existing system.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE." or Information to be furnished by HACP.
 - 2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Top Master Key: One.

- b. Cylinder Change Keys (per Cylinder): Two.
- c. Master Keys (per Master Key Group): Two.
- d. Grand Master Keys (per Grand Master Key Group): Two.
- e. Construction Keys (where required): Ten.

2.3 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Baldwin
 - b. Emtek
 - c. Richelieu
 - d. Hager Companies.
 - e. IVES Hardware; an Ingersoll-Rand company.
 - f. Rockwood Manufacturing Company.

2.4 HEAVY DUTY HINGES

- A. Heavy Duty Hinges: BHMA A156.8.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Baldwin
 - b. Emtek
 - c. Glynn-Johnson; an Ingersoll-Rand company.
 - d. Rockwood Manufacturing Company.
 - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.5 HINGES

- A. Hinges: BHMA A156.8.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Baldwin
 - b. Emtek
 - c. Glynn-Johnson; an Ingersoll-Rand company.
 - d. Rockwood Manufacturing Company.

- e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
- f. Mckinney

2.6 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Baldwin
 - b. Emtek
 - c. Glynn-Johnson; an Ingersoll-Rand company.
 - d. Rockwood Manufacturing Company.
 - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.7 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. National Guard Products.
 - b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - c. Reese Enterprises, Inc.

2.8 THRESHOLDS

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

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. National Guard Products.
 - c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

2.9 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Baldwin
 - b. Emtek
 - c. Burns Manufacturing Incorporated.
 - d. IVES Hardware; an Ingersoll-Rand company.
 - e. Rockwood Manufacturing Company.

2.10 ENTRY DOOR PEEPHOLE VIEWER

- A. Entry Door Peephole Viewer: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Schlage
 - b. Emtek
 - c. Burns Manufacturing Incorporated.
 - d. IVES Hardware; an Ingersoll-Rand company.

2.11 SLIDING DOOR TRACK- SLIDING DOORS

- A. Sliding Door Track: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Schlage
 - b. Burns Manufacturing Incorporated.
 - c. IVES Hardware; an Ingersoll-Rand company.
 - d. Stanley Hardware

2.12 SLIDING DOOR TRACK- BIFOLD DOORS

- A. Sliding Door Tracks: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Schlage
 - b. Burns Manufacturing Incorporated.
 - c. IVES Hardware; an Ingersoll-Rand company.
 - d. Stanley Hardware

2.13 BUMPER

- A. Bumpers: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on specification schedule below and in drawing door schedule or comparable product by one of the following:
 - a. Schlage
 - b. Burns Manufacturing Incorporated.
 - c. IVES Hardware; an Ingersoll-Rand company.
 - d. Stanley Hardware

2.14 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-rated labels and as otherwise approved by Architect.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. 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. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.15 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.

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.

- 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. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

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.
- 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. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Boxed Power Supplies: Existing locations concealed.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- 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: HACP 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

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 DEMONSTRATION

- A. Engage a factory-authorized service representative to train HACP's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
1. PE – Pemko
 2. SA – Sargent
 3. HS – HES
 4. BD- Baldwin
 5. MK- Mckinney
 6. SG- Schlage
 7. RL- Richelieu
 8. ST- Stanley
- C. Hardware Sets: Contractor to confirm and match existing door hardware.

Hardware Set No. 01 Apartment Interior Door Privacy Set

3	Hinges	MK	Bearing Hinges		US26D
1	Lever Privacy Set	BD	Lakeshore	5162 Lever	056
1	Lever Trim Rose	BD		5160.xxx	
1	Bumper	BD	Flush Bumper	4252	056

Hardware Set No. 02 Apartment Interior Door Passage Set

3	Hinges	MK	Bearing Hinges		US26D
1	Lever Passage Set	BD	Lakeshore	5162 Lever	
1	Lever Trim	BD	Estate Rose	5056.150	
1	Bumper	BD	Flush Bumper	4252	056

Hardware Set No. 03 Apartment Entry Door

3	Heavy Duty NRP Hinge	MK	Template 030-17		US26D
1	Peep Hole	SG	Ives Brass Door Viewer	698B26D	US26D
1	Kick Plate	BD	Estate Rose	2000.150	056
1	Entrance Lever Set	BD	Lakeshore 5162 Lever	ELA01.003.ENTR	056
1	Bumper	BD	Flush Bumper	4252	056
1	Door Sweep		Brush		US26D

NOTE: ALL UFAS/ADA UNIT ENTRY DOORS WILL HAVE AN ADDITIONAL PEEP HOLE. REFER TO DRAWINGS.

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT
R3A PROJECT NO. 15074B

DOOR HARDWARE
087100

Hardware Set No. 04 Apartment Mechanical Set

3	Heavy Duty Hinges	MK	Template 030-17		US26D
1	Storage Lever Set	BD	Lakeshore	SLA01.003.PRIV 5162 Lever	056

Hardware Set No. 05 Apartment Closet Sliding Door Set

2	Metal Pull	RL	3" Contemporary Pull	BP10743900	Matte Black
			107		
1	Sliding Door Track Kit				
1	Floor Guide		Metal Floor Guide		

Hardware Set No. 06 Apartment Exterior Sliding Door Set

1	Sliding Door Privacy Set	BD	Contemporary L026 Lever Screen Door	L026.056.MR SD005 Backplate	056
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Hardware Set No. 07 Bifold Closet Door Set

1	Bifold Door Track Kit				
1	Metal Pull	RL	3" Contemporary Pull	BP10743900	Matte Black
			107		

NOTE: WITHIN ALL UFAS/ADA UNITS WHERE THE DOORS/HARDWARE ARE BEING REPLACED. ALL DOOR HARDWARE IS TO BE UFAS/ADA COMPLIANT. ADDITIONAL HARDWARE MAY BE REQUIRED FOR COMPLIANCE.

END OF SECTION 087100

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Hollow Metal Doors.
 - 2. Sliding Glass Doors
 - 3. Windows

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. Interspace: Space between lites of an insulating-glass unit.

1.4 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
 - 1. Insulated glass units.
 - 2. Coated glass.
- C. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants and glazing gaskets.
 - 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. Warranties: Sample of special warranties.

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 and certified 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.
- E. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- I. 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.

1.9 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- A. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for project Wind Zone when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
 - 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 - 2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.
 - 3. Large-Missile Test: For all glazing, regardless of height above grade.
- B. 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 insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 2. 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).
 - 3. 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.
 - 4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6.

2.3 INSULATING GLASS

- A. Basis-of-Design Product: Provide Solarban 60 by PPG Industries, inc., or equal. Approval by Architect and HACCP required.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene and silicone primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.

- C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. Silicone complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene or silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Sealants used inside the weatherproofing system 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."
 - 5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 890.
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.
 - e. Tremco Incorporated; Spectrem 1.

2.6 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.

2.7 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. 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. 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.

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.
- 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.

2.9 INSULATING-GLASS TYPES

- A. Glass Type GL-1: Low-e-coated, clear insulating tempered glass.
 - 1. Overall Unit Thickness: 1 inch (25 mm).
 - 2. Thickness of Each Glass Lite: 1/4 inch.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Low-E Coating: Sputtered on second surface.
 - 7. Visible Light Transmittance: 70 percent minimum.
 - 8. Winter Nighttime U-Factor: 0.29 maximum.
 - 9. Summer Daytime U-Factor: 0.27 maximum.
 - 10. Solar Heat Gain Coefficient: 0.39 maximum.
 - 11. Provide safety glazing labeling.

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 will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 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.
- 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 in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. 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.
- L. 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.
- M. Refer to other specification sections where glazing is factory installed, shop or field installed.

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. 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.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket 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.

3.6 SEALANT GLAZING (WET)

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

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. 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.

END OF SECTION 088000

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

FINISH SCHEDULE
090000

No.	Symbol	Product	Description	Remarks
1.	ACT-1	Acoustical Ceiling Tile	Manufacturer: Armstrong Style: Canyon Beveled Tegular 1494 Size: 24"x24" Color: White Grid: 9/16" Suprafine Grid Color: White	Acoustical Tile Ceilings
2.	CM-1	Cultured Marble	Manufacturer: North Coast Cultured Products Color: Single Carrera Bowl Style 22" Wave Bowl Style 17" Small Premier Contact: 412-206-0008	Apartment Vanity Tops
3.	CPT-1	Carpet Tile	Manufacturer: Mannington Commercial Entwined Collection Style: Ramie Size: 24"x24" Color: TBD Broom or Acorn Install: Monolithic	Office Carpet
4.	CT-1	Ceramic Tile	Manufacturer: Crossville Style: Color By Numbers Size: 4"x12" Color: Edge Of Seventeen Finish: Gloss Install: Refer to Drawings for Pattern Base: Ceramic Tile to run to floor- no coved base	Restroom Wall Tile
5.	CT-2	Ceramic Tile	Manufacturer: Crossville Style: Color By Numbers Size: 4"x12" Color: Edge of Seventeen Finish: Matte Install: Refer to Drawings for Pattern Base: Ceramic Tile to run to Floor - no coved base	Restroom Wall Tile
6.	GR-1	Grout	Manufacturer: Laticrete Color: Dusty Grey 60	Grout @ Public Restroom Wall, Restroom Floor, Lobby Floor and Base
7.	LVT-1	Luxury Vinyl Tile	Manufacturer: Armstrong Commercial Style: Luxe Plank Size: 6"x48" Color: Tropical Oak A6712 Natural Install Pattern: Ashlar Installation: FasTak	Apartment Highrise and Lowrise Flooring; Main Flooring. See finish plans for typical Install pattern; Highrise Upper Corridor Flooring; Elevator Cabs
8.	LVT-2	Luxury Vinyl Tile	Manufacturer: Armstrong Commercial Style: Luxe Tile Size: 18"x18" Color: Tinley Park A6705	Apartment Highrise and Lowrise Flooring; Kitchen and Bath. See finish plans for typical Install pattern

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

FINISH SCHEDULE
090000

No.	Symbol	Product	Description	Remarks
9.	LVT-3	Luxury Vinyl Tile	Cream Monolithic Install: FasTak Manufacturer: Armstrong Commercial Style: Luxe Tile Lexington Slate Size: 18"x18" Color: Sahara Beige Install: Refer to Plan	Public Areas Highrise Flooring- Stone Look
10.	RB-1	Base	Manufacturer: Johnsonite/Tarkett Style: 4" Traditional Cove Base Color: Clay	Rubber Base @ Resilient- Public Areas
11.	RB-2	Base	Manufacturer: Johnsonite/Tarkett Style: 4" Traditional Toeless Base Color: Clay	Rubber Base @ Carpet - Public Areas, Offices
12.	RB-3	Base	Manufacturer: Johnsonite/Tarkett Style: 4" Traditional Cove Base Color: Pearl	Rubber Base @ Apartment
13.	PLAM-1	Plastic Laminate	Manufacturer: Wilsonart Style: Potter's Clay 5011K-22 Finish: Antique	Countertops in Apartments
14.	PLAM-2	Plastic Laminate	Bullnose: Ideal Edge - Ogee Wrap Manufacturer: Wilsonart Style: River Cherry Color: 7937-38 Finish: Fine Velvet Texture	Public Restroom Apron
15.	PLAM-3	Plastic Laminate	Manufacturer: Formica Style: White Twill Color: 9285-58 Finish: Matte	Elevator Cabs
16.	POR-1	Porcelain Tile	Manufacturer: Shaw Contract Style: Substance Color: Sterling Size: 12"x24" Install: Refer to Plan	Main Lobby Corridor Tile
17.	POR-2	Porcelain Tile	Base: Bullnose Manufacturer: Shaw Contract Style: Substance Color: Bark Size: 12"x24" Install: Refer to Plan	Main Lobby Corridor Tile
18.	POR-3	Porcelain Tile	Manufacturer: Shaw Contract Style: Substance Color: Fog Size: 12"x24" Install: Refer to Plan	Public Restroom Floor Tile

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

FINISH SCHEDULE
090000

No.	Symbol	Product	Description	Remarks
			Base: Bullnose Base at walls where CT-1 and CT-2 are not installed	
19.	PT-1	Paint	Manufacturer: Sherwin Williams Finish: Eggshell Color: Alabaster TBD Number: SW 7008	Corridor Field paint
20.	PT-2	Paint	Manufacturer: Sherwin Williams Finish: Flat Color: SW7006 Extra White	Ceiling paint.
21.	PT-3	Paint	Manufacturer: Glidden Pro Finish: Eggshell Color: Antique White Match Existing in Field with Architect	Match Existing Paint at Apartments
22.	PT-4	Paint	Manufacturer: Sherwin Williams Finish: Eggshell Color: Willow Tree TBD Number: SW 7741	Accent paint.
23.	PT-5	Paint	Manufacturer: Sherwin Williams Finish: Eggshell Color: Agreeable Gray Number: SW 7029	Public Toilet Room Paint
24.	PT-6	Paint	Manufacturer: Sherwin Williams Finish: Semi-Gloss Color: Nantucket Dune Number: SW 7527	Hollow metal door and frame - High Rise
25.	PT-7	Paint	Manufacturer: Sherwin Williams Finish: Eggshell Color: Nantucket Dune TBD Number: SW 7527	Office Accent Paint
26.	PT-8	Paint	Manufacturer: Sherwin Williams Finish: Semi-Gloss Color: Dorian Gray TBD Number: SW 7017	Interior Metal Handrail Paint
27.	PT-9	Paint	Manufacturer: Scuffmaster Finish: Solid Metal Color: Match Adjacent Stainless Color with Architect	Elevator Doors
28.	PT-10	Paint	Manufacturer: Sherwin Williams Finish: SemiGloss Color: TBD Number: TBD	Apartments- High Rise and Low Rise Interior Door Frames
29.	PT-11	Paint	Manufacturer: Sherwin Williams Finish: TBD Color: TBD Number: TBD	Low Rise Steel Door Paint And Exterior Trim

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

FINISH SCHEDULE
090000

No.	Symbol	Product	Description	Remarks
30.	PT-12	Paint	Manufacturer: Sherwin Williams Finish: TBD Color: TBD Number: TBD	Low Rise Window Sills
31.	SS-1	Solid Surface	Manufacturer: Formica Color: Bleached Concrete 601	Window Sills
32.	SS-2	Solid Surface	Manufacturer: LG HI Macs Color: G605 Umber Granite	Public Restroom Countertops
33.	ST-1	Wood Stain	Manufacturer: Sherwin Williams Finish: Interior Semi-Transparent Stain Color: Warm Chestnut TBD Number: SW 3114	Stained Interior Handrails @ Apartments
34.	TB-1	TackBoard	Manufacturer: Forbo Bulletin Board Finish: Framed Solutions Color: 2206 Oyster Shell Size (s): Varies Refer to Drawings	Framed Bulletin Board at Offices, Laundry Areas, Trash Areas
35.	TR-1	Flooring Transition	Manufacturer: Schluter Color: Anodized Aluminum Model: Reno V Size: 4mm Reducer	Flooring transition between LVT and existing floor
36.	TR-2	Flooring Transition	Manufacturer: Schluter Color: Anodized Aluminum Model: Reno U Size: 3/8" Tile to 3/8" Carpet	Flooring transition between Tile to Carpet
37.	TR-3	Flooring Transition	Manufacturer: Schluter Color: Anodized Aluminum Model: Reno U Size: 3/8" Tile to 4mm LVT	Flooring transition between LVT and tile floor
38.	TR-4	Wall Tile Transition	Manufacturer: Schluter Color: Anodized Aluminum Size: TBD Model: Jolly Size: Coordinate with Tile Size	Wall Tile Transition at Corners
39.	CG-1	Corner Guard	Manufacturer: Korogard Style: Bellagard Model: VS18 Size: 4'H x 1 1/2" Profile Color: Stainless Steel Pattern: S6	Corner Guards at lobby- See Plan for Locations
40.	WB-1	Horizontal Louver	Manufacturer: Bali	Apartment Windows

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

FINISH SCHEDULE
090000

No.	Symbol	Product	Description	Remarks
		Blinds	Style: 1" Vinyl Horizontal Blinds Size: Refer to Drawings Color: Gloss White Satin 5005	
41.	WB-2	Horizontal Louver Blinds	Manufacturer: Hunter Douglas Style: Everwood Alternative Wood Blinds Size: Refer to Plan Color: TBD	Common Areas
42.	WD-1	Wood Cabinets	Mounting: Jamb Mount with Fascia Manufacturer: Advanta Cabinetry Construction Series: Extreme Door Style: Trevant Slab 039TRE Species: Maple Finish: TBD Mocha, Cafe, Toffee Full Overlay Contact: Prosource Bridgeville	Wood Cabinets
43.	WP-1	Wall Protection	Manufacturer: Korogard Style: Wall Protection Systems Size: Refer to Elevations Thickness: .28" Color: Vapor	Lobby Area Wall Protection
44.	VB-1	Vertical Blinds	Manufacturer: Hunter Douglas Style: Vertical Blinds Size: Refer to Plan Color: Vinylscapes PVC Off White Valance to Match Covered End Caps	Apartment Sliding Doors

END OF SECTION 090000

SECTION 092900 - GYP SUM 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.(For Allowances and Unit Prices)

- B. RELATED REQUIREMENTS:

- 1. Section 012100 Allowances
 - 2. Section 012200 "Unit Prices"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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.

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. 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. CertainTeed Corp.
 - 2. Georgia-Pacific Gypsum LLC.
 - 3. National Gypsum Company.
 - 4. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.4 MOLD RESISTANT GYPSUM BOARD

- 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. CertainTeed Corp.
 2. Georgia-Pacific Gypsum LLC.
 3. National Gypsum Company.
 4. USG Corporation: Sheetrock Mold Tough Fire Code C.
- B. Gypsum Board, Type C: ASTM D 3273, score of 10 as rated according to ASTM D 3274
1. Thickness: 1/2 inch.
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.
 - c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
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. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:

1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use 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.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. 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 thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: As specified in Section 072100 "Thermal Insulation."
- E. Acoustical Joint Sealant: As specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- 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 of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. 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. Type X: As indicated on Drawings and at vertical surfaces unless otherwise indicated.

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

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-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.

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

3.4 APPLYING CEMENT BOARD PANELS

- A. Cementitious Backer Units:** ANSI A108.11, at locations indicated to receive tile.

- B. Where tile backing panels about 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 unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

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. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 1. Level 4: Where indicated on Drawings.
 - 2. Level 5: Where indicated on Drawings and at all areas of gypsum wall board infill.
 - a. Primer and its application to surfaces are specified in other Section 099123 "Interior Painting." Level 5 is suitable for surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting. It is considered a high-quality gypsum board finish.

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

END OF SECTION 092900

SECTION 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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Ceramic wall tile.
 - 2. Porcelain floor tile and base.
 - 3. Crack-suppression membrane for thin-set tile installations.
 - 4. Existing tile cleaning.
 - 5. Metal edge strips.
- B. Related Sections:
 - 1. Section 012300 "Alternates"
 - 2. Section 035416 "Hydraulic Cement Underlayment" for hydraulic cement to be trowel-applied to existing concrete slabs prior to installation of porcelain tile.
 - 3. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 4. Division 090000 Section "Schedule of Finishes"

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 "American National Standard 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.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- 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 for each color and finish required.
 - 3. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified 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, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.
- E. Maintenance Data: Submit manufacturer's recommendations for cleaning and sealing tile and grout.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one 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 one manufacturer and each aggregate from one source or producer.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Waterproof membrane.
 - 2. Crack-suppression membrane.
 - 3. Joint sealants.
 - 4. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

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.
- 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.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT 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 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 unless otherwise indicated.
- 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 TCA 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.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 CERAMIC TILE

- A. Ceramic Tile, (CT-1, CT-2):
 1. Porcelain Tile: 4" x 12" x 3/8" thick. Styles and colors per Section 090000 "Schedule of Finishes."
 2. Basis-of-Design Product: Provide Color By Numbers ceramic tile by Crossville or equal. Approval by Architect and HACP required.

2.3 PORCELAIN TILE

- A. Porcelain Tile, (POR-1, POR-2, POR-3):
 1. Porcelain Tile: 12" x 24" x 3/8" thick, 6"x12" base, standard grade porcelain tile conforming to ANSI 137.1. Styles and colors per Section 090000 "Schedule of Finishes."
 2. Basis-of-Design Product: Provide Substance porcelain tile by Shaw Contract or equal. Approval by Architect and HACP required.

2.4 CRACK-SUPPRESSION MEMBRANES FOR ALL THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.

1. Products:

- a. Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.
- b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
- c. MAPEI Corporation; Mapelastic HPG.
- d. Summitville Tiles, Inc.; S-9000.

2.5 MORTAR, GROUT AND ACCESSORIES

- A. See Tile Installation Systems in Part 3 of this Section. Setting mortar and grout to be from same manufacturer.
- B. Latex-Portland Cement Setting Mortar - Thin Set (for POR-1): Factory mixed mortar of Portland cement/sand, field gauged with undiluted latex admixture. Conform to ANSI A118.4, Latex-Portland Cement Mortar.

1. Provide products by one of the following:

- a. Bostik, Inc. - Durabond D-50 or D-60.
- b. TEC (H.B. Fuller Company) - Fullflex
- c. MAPEI Corporation - Kerabond or Keralastic
- d. Laticrete International, Inc. - 255 MultiMax

- 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.'

- D. Grout Sealer: Manufacturer's standard modified alkyl alkoxysilane product for sealing grout joints that does not change color or appearance of grout.

1. Provide products by one of the following:

- a. Innovative Technologies of Indiana, Inc. - Invincible Seal.
- b. Prosoco, Inc. - Stand Off SLX Water and Oil Repellant.
- c. TEC Specialty Products, Inc. (H.B. Fuller Company) - TA 256 Penetrating Silicone Grout Sealer.
- d. Equal products manufactured by Bostik, Inc., MAPEI Corporation, or Laticrete International, Inc.

- E. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.

2.6 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7 color as selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. C-Cure.
 - d. Custom Building Products.
 - e. Jamo Inc.
 - f. Laticrete International, Inc.
 - g. MAPEI Corporation.
 - h. Summitville Tiles, Inc.
1. Polymer Type: Ethylene vinyl acetate, in dry, re-dispersible form, prepackaged with other dry ingredients.
2. Polymer Type: Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.
3. Polymer Type: Either ethylene vinyl acetate, in dry, re-dispersible form, prepackaged with other dry ingredients, or acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Sanded grout mixture for joints 1/8 inch max.

2.7 METAL EDGE STRIPS (TR-1, TR-2, TR-3, TR-4)

- ### A. Manufacturers: Approved subject to requirements, provide products from manufacturers listed below; products specified establish level of quality.
1. Schluter Systems.
 2. Great Lakes Tile Products, Inc.
 3. Blanke Corp.
- ### B. Provide metal edge strips where exposed porcelain tile meets carpet, resilient, or concrete flooring, and at the exposed tops/sides of porcelain tile wall base.
1. Metal edge strip is not required where door threshold covers transition between dissimilar materials.
 2. Except as otherwise indicated, where trim is located across door openings, locate trim on the door side in line with the edge of the door stop, terminating at the rabbet.
 3. Provide stainless steel or aluminum products.

4. Metal Edge/Transition Schedule (Refer to Finish Schedule 090000 for additional details)
 - a. Resilient to Existing/Concrete Edge Strips:
 - 1) Schluter Systems: Reno-V
 - 2) Great Lakes Tile Products: Reducer.
 - 3) Blanke Corp.: Blanke Adjustable Transition Profile.
 - b. Tile-to-Carpet Edge Strips:
 - 1) Schluter Systems: Reno-U
 - 2) Great Lakes Tile Products: Reducer.
 - 3) Blanke Corp.: Blanke Adjustable Transition Profile.
 - c. Tile-to-Resilient Edge Strips:
 - 1) Schluter Systems: Reno-U.
 - 2) Great Lakes Tile Products: Reducer.
 - 3) Blanke Corp.: Blanke Adjustable Transition Profile.
 - d. Tile-to-Tile Wall Edge Strips:
 - 1) Schluter Systems: Jolly
5. Where edge/transition types are required for conditions other than those listed above, provide stainless steel type from the manufacturers listed to create a smooth transition or termination.

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 installed tile.
 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 thin-set 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 Professional.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces in a manner suitable for proper installation. Verify that slabs are free of curing membranes, oil, grease, wax, dust and other materials deleterious to tile installation..
- B. Prepare surfaces to receive tile as required to achieve proper bond and as recommended by the Tile Council of America.
- C. Fill cracks, low areas and pits in concrete with self-leveling fill of type recommended by tile manufacturer for substrate conditions encountered.
- D. When required, lightly grind concrete subfloors with a terrazzo grinder to remove trowel marks or other surface irregularities which will telegraph to the flooring surface.
- E. Primers or other preparations required or recommended in accordance with manufacturer's instructions.
- F. 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.
- G. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 FLOOR TILE INSTALLATION - SYSTEMS

- A. Prepare surfaces, fit, set or bond, grout, and clean in accordance with Tile Council of America, "Handbook for Ceramic Tile Installation", 2008 Edition; and as follows:
- B. Interior Floor - Thin Set, Waterproof Membrane: TCA Design F122, waterproofing, latex Portland cement bond coat and grout.

1. Install in strict conformance with waterproofing membrane manufacturer's written instructions and recommendations.
2. Tile: ANSI A108.5.
3. Grout: ANSI A108.10.

3.4 TILE INSTALLATION – PROCEDURES

- A. Crack-Suppression Membrane: Discontinue at control and expansion joints. Install in compliance with manufacturer's instructions and shop drawings. Seam joints as recommended by manufacturer.
- B. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. 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 that plates, collars or covers overlap tile.
- D. Placement Methods: Install tile using the hereinbefore specified setting beds and grouts.
- E. Jointing Pattern: Unless otherwise shown on drawings, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
 1. Avoid tile layout with less than half width tiles at room/area perimeters, unless otherwise indicated on the finish drawings. Notify Professional if layout not achievable per layout indicated on the drawings. Do not continue in room/area in question until approved by the Professional.
 2. Provide uniform joint widths, unless otherwise shown.
 - a. Provide 1/8" joints for porcelain floor tile and base.
- F. If offset pattern is required for tiles 18" or longer, it's recommended an offset of not greater than 33%.

3.5 FLEXIBLE JOINTS

- A. Locate flexible joints (expansion, control and isolation joints) prior to tile installation. See Quality Assurance in Part 1 herein.
- B. Provide flexible joints as specified herein, unless more stringent requirements are indicated on drawings. Provide as specified, regardless if not indicated on drawings.

- C. Joint to be continuous from face of tile to bottom of setting bed or leveling bed. Reinforcing to be discontinued at joint. Install continuous joint filler material in joint from setting or leveling bed to a point below face of tile adequate for proper placement of backing rod and sealant.
- D. Joint Design: TCA design EJ171 as applicable. See Section 07 92 00 for sealant. Provide at the following locations:
 - 1. Horizontal Surfaces
 - a. Directly over joints in structural floor, including cold joints, construction joints, control joints, and expansion joints.
 - b. Where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, etc.
 - c. Floor areas exceeding 24 feet in any direction.
 - d. Where indicated.
- E. Curing: Cure tile floor, base, and wall installations in accordance with manufacturer's recommendations, TCA recommendations, and in accordance with ANSI requirements.
- F. Metal Edge Strips: Install at where exposed edge of tile flooring meets carpet, wood, concrete or other flooring.

3.6 REPAIR, CLEAN AND PROTECT

- A. Repair, or remove and replace chipped, damaged or otherwise defective work to the satisfaction of the Professional.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Use methods and materials as recommended by tile manufacturer.
 - 2. Remove grout residue from tile as soon as possible.
 - 3. 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 from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 4. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 - 5. Replace tiles that cannot be satisfactorily cleaned.
- C. Seal porcelain tile surfaces and grout according to sealer manufacturer's written instructions.

- D. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- E. 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.
- F. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- G. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 REPAIR, CLEAN AND PROTECT EXISTING FLOOR AND WALL TILE

- A. Repair, or remove and replace chipped, damaged wall and floor tile scheduled to remain to the satisfaction of the Professional. All units with existing ceramic wall tile and porcelain floor tile will be repaired, cleaned, and patched/replaced to match where damaged.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Use methods and materials as recommended by tile manufacturer.
 - 2. Remove grout residue from tile as soon as possible.
 - 3. 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 from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 4. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 - 5. Replace tiles that cannot be satisfactorily cleaned.
- C. Seal porcelain tile surfaces and grout according to sealer manufacturer's written instructions.
- D. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- E. 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.

- F. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- G. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

- 1. Tile Installation F113: 3/8" Thin-set mortar; TCA F113.
 - a. Tile Type: Unglazed porcelain tile.
 - b. Thin-Set Mortar: Latex-portland cement mortar.
 - c. Grout: Polymer-modified unsanded 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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Related Requirements:
 - 1. Section 095123 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

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. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Structural members to which suspension systems will be attached.
 3. Size and location of initial access modules for acoustical panels.
 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 5. Perimeter moldings.
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

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

1.7 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. Acoustical Ceiling Panels: 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.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages 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.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 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: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.
- 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.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS (ACT-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated by Armstrong as listed in Schedule of Finishes, section 090000, or equal. Approval by Architect and HACP required.
- A. Basis-of-Design Product: (ACT-1) Subject to compliance with requirements the following:
 - 1. Armstrong World Industries, Canyon Beveled Tegular # 1494
 - 2. Type and Form: Type III, mineral base with painted finish, Form 2, water felted.
 - 3. Color: White.
 - 4. LR: Not less than 0.83.
 - 5. NRC: Not less than 0.50.
 - 6. CAC: Not less than 35.
 - 7. AC: N/A
 - 8. Edge/Joint Detail: Beveled Tegular.

- 9. Thickness: 5/8 inch.
- 10. Modular Size: 24 by 24 inches.
- 12. Grid: 9/16" Suprafine White

2.4 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.
- B. 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. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - 4. 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 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

2.5 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Commercial Ceilings, Suprafine XL 9/16" Exposed Tee System or equal. Approval by Architect and HACP required.
- A. 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 according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel cold-rolled sheet.
 - 5. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to 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. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures 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.
 - 3. 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.
 - 4. Do not attach hangers to steel deck tabs.

- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 2. 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. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
- B. Related Sections:
 - 1. Division 090000 Section "Schedule of Finishes"
 - 2. Section 096519 "Resilient Tile Flooring".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient 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 for every or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: 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.

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 or more than 90 deg F.

1.7 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, 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. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

- A. Resilient Base (RB-1, RB-2, RB-3)
 - 1. Manufacturers: Base of Design as indicated in Section 090000 Schedule of Finishes. Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johnsonite/ Tarkett
 - b. Armstrong World Industries, Inc.
 - c. Flexco, Inc.
 - d. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TV (vinyl, thermoplastic).

- 2. Manufacturing Method: Group I (solid, homogeneous).
- 3. Style: Cove (base with toe), and Coveless.
- C. Minimum Thickness: 0.080 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Finish: Satin.
- I. Colors and Patterns: As indicated in Section 09 00 00 "Schedule of Finishes." As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Reducer Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints. See 09 00 00 "Schedule of Finishes" for Model of Flooring Transition TR-1

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

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

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 practicable 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. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible.

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 carpet or resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of 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 surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Luxury Vinyl Floor Tile and Plank.
- B. Related Sections:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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 Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 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 indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: 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.

1.7 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, 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. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- 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. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Flooring system 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."

2.2 LUXURY VINYL FLOOR TILE AND PLANK (LVT-1, LVT-2, LVT-3)

- A. Basis of Design: Provide Luxe Plank and tile with Fastak Installation luxury vinyl tile by Armstrong Commercial Flooring per section 090000 Schedule of Finishes or equal. Approval by Architect and HACP required.
- B. Finish: M-Force Enhanced Urethane
- C. Texture: Wood Emboss.
- D. Wear Layer Thickness: 12 mill wear layer x 4 mm overall thickness, no wax.
- E. Size: 7 inches by 48 inches and 18 inches by 18 inches
- F. Edge: Pressed Bevel
- G. Colors, Sizes, and Patterns: As indicated in Section 090000 "Schedule of Finishes." Architect to select from Manufacturer's full range of colors and sizes.
- H. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

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.
- B. 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.

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

3.2 PREPARATION

- A. Prepare substrates according to 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 manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

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 in pattern as indicated on drawings.

- 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 running in one direction in pattern of colors and sizes indicated.
- 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, nonstaining marking device.
- G. 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.
- H. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.
- I. Roll resilient flooring as required by resilient flooring manufacturer.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of 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.
 - 4. Do not wash floor until after time period recommended by flooring manufacturer.
- C. Protect floor tile products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Drying Room Yellowing/Ambering: While Marmoleum® and linoleum products are maturing in the drying stoves, a yellow cast, called "drying room yellowing" or "ambering" may appear on the surface. This yellow cast is caused by the oxidation of linseed oil and is TEMPORARY. It occurs intermittently and with varying intensity. It is most noticeable on blue and grey shades of material. When the material is exposed to light, the drying room yellowing will disappear. The process may take as little as a few hours in bright sunlight or longer with artificial light. Because this is a natural occurrence

in the product, there is no set time frame for the yellowing to disappear. This is not a material defect. In regards to floor care, applying finish to the material before the drying room yellowing disappears will make no difference; it will still disappear with exposure to light.

Before retaining first paragraph below, verify manufacturer's floor polish recommendations. Floor polish is used with most vinyl composition floor tile and some solid vinyl floor tile.

- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Carpet Tile (CPT-1) installation and all glue, edge guards and accessories necessary.
 - 2. Work includes preparation of subsurfaces, cleaning, and protection of finished carpet.
- B. Related Requirements:
 - 1. Section 024119 "Selective Structure Demolition" for removing existing floor coverings.
 - 2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:
 - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

- B. Shop Drawings: Show the following:
 - 1. Seam locations, types, and methods.
 - 2. Type of installation.
 - 3. Type, color, and location of edge, transition, and other accessory strips.
 - 4. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12-inch- square Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, 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.

1.8 QUALITY ASSURANCE

- A. Installer: Firm with not less than 5 years of carpeting experience similar to work of this Section.
 - 1. Work not in compliance with the manufacturer's recommended standards and procedures shall be promptly corrected at the Contractor's expense.
- B. Manufacturer: Firm (carpet mill) with not less than 5 years of production experience with similar types specified in this section; and whose published product data clearly indicates compliance of product with requirements of this Section.
- C. General Standard: "Carpet Specifiers Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

1.9 PRODUCT DELIVERY AND STORAGE

- A. Deliver carpeting materials in original mill protective wrapping, and store inside protected from weather, moisture and soiling.
- B. Investigate and resolve access restrictions, including elevator capacity/availability, entrances and accessibility, to assure proper delivery and installation of materials.
- C. Protect materials against damage of any kind. Damaged products, including soiled fabrics, will be rejected.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.11 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Modular Carpet Tile, (CPT-1)

- A. Product: Mannington Commercial; Entwined Collection; Style Ramie; As specified in Schedule of Finishes, Section 090000, Monolithic Install.
- B. Primary Backing: 100% Synthetic
- C. Dye Method: Solution /Yard Dyed

- D. Total Weight: (Nominal Average): 22oz /Sq Yd
- E. Soil Release: Yes
- F. Installation: Monolithic
- G. Size 24 in x 24 in
- H. Color: As indicated in Section 090000 "Schedule of Finishes."
- I. Adhesives: Mannington Infinity Pressure Sensitive Adhesive

2.4 INSTALLATION ACCESSORIES

- A. Revise "Trowelable Leveling and Patching Compounds" Paragraph below to suit Project. Retain option for double-glue-down installations.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- C. Metal Edge/Transition Strips: Extruded aluminum with manufacturer's standard finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints. Refer to Section 090000 "Schedule of Finishes."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 4. Other Hard Surfaces (VCT/VAT) - Tiles must be well secured to the floor or removed. Broken, damaged or loose tiles must be replaced. Waxes and similar finishes must

be removed from VCT before applying adhesive. Existing sheet vinyl is not a suitable substrate for modular installation and must be removed.

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

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- E. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
- F. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- G. Do not bridge building expansion joints with carpet.
- H. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- I. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

- K. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.
- L. All carpet pieces measuring more than 3'-0" x 3'-0" are to be turned over to Institution.
- M. MODULE PLACEMENT - Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets the previously installed module. See specific product specifications for approved installation method(s).

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet 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 manufacturer and carpet adhesive manufacturer.
- D. To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. It is also required that sheets of plywood or hardboard be laid over the new modular surface when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.
- E. When entering, passing through, or working in any space in the building that contains finished materials, maintain proper protection for floors, walls, ceilings, fixtures, etc. Repair or replace damaged adjoining work as directed by the Professional at no additional cost to the Institution.

END OF SECTION 096816

SECTION 099123 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum board.
 - 2. Hollow metal doors and frames.
 - 3. Exterior steel doors/ frames.
- B. Related Requirements:
 - 1. Section 09 00 00 "Schedule of Finishes."

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and 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.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Products of Sherwin Williams (SW), are named in Schedule at end of this Section, to establish standards of quality required. Proprietary names used to designate materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers. Subject to compliance with requirements, products of following companies may be used:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. 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.
- D. Low-Emitting Materials: Interior paints and coatings 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."
- E. Colors: As indicated in Section 090000 "Schedule of Finishes."

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107.
- B. Cementitious Galvanized-Metal Primer: MPI #26.
- C. Waterborne Galvanized-Metal Primer: MPI #134.

2.6 LATEX PAINTS

- A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.
- B. Latex, Interior, (Gloss Level 2): MPI #44.
- C. Latex, Interior, (Gloss Level 3): MPI #52.
- D. Latex, Interior, (Gloss Level 4): MPI #43.
- E. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.
- F. Latex, Interior, Gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees): MPI #114.

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. Gypsum Board: 12 percent.
 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. 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 indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale and loose shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. 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.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- D. 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.
- E. 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 paint in accordance with manufacturer's written instructions and recommendations in the "MPI Manual."
 - a. Use applicators and techniques suited for paint and substrate indicated.
 - b. Provide finish coats, which are compatible with prime paints used.
 - c. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, cervices, welds, and exposed fasteners receive a dry-film thickness equivalent to that of flat surfaces.
 - d. Paint surfaces behind movable equipment and furniture to be same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime & base coat before final installation of equipment.
 - e. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat non-specular black paint.
 - f. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
 - g. Sand Slightly between each succeeding enamel or varnish coat.
 - h. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
 - i. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry-film thickness as indicated, or if not indicated, as recommended by coating manufacturer.
- C. Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of undercoat.
- D. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
 1. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. For pigmented (opaque) finished, completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- F. 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.
- G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance
- H. 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. Dry Film Thickness Testing: Engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Apply paint and finish materials to substrate surfaces indicated. Apply touch-up prime coats in addition to shop-applied prime coats. Provide additional job site prime coats when indicated.
- B. Gypsum Board – Walls
 - 1. SW
 - a. Primer: Harmony Low Odor Interior Latex Primer B11W900. One (1) coat at 1.3 mils dft. 31% to 35% volume solids.
 - b. Finish: Harmony Low Odor Interior Latex Eg-Shell (Semi-gloss) B9 Series. Two (2) coats at minimum 1.6 mil dft per coat. 37% to 41% volume solids.
 - 2. PPG
 - a. Primer: Pure Performance Interior Latex Primer 9-900 Series. One (1) coat at 1.4 mil dft. 34% to 38% solids.
 - b. Finish: Pure Performance Interior Eggshell (Semi-gloss) Latex 9-300 Series. Two (2) coats at minimum 1.5 mil dft per coat. 36% to 40% volume solids.
- C. Gypsum Board - Ceilings and Soffits
 - 1. SW
 - a. Primer: Harmony Low Odor Interior Latex Primer B11W900. One (1) coat at 1.3 mils dft. 31% to 35% volume solids.
 - b. Finish: Harmony Low Odor Interior Latex Flat B5 Series. Two (2) coats at minimum 1.7 mil dft per coat. 40% to 44% volume solids.
 - 2. PPG
 - a. Primer: Pure Performance Interior Latex Primer 9-900 Series. One (1) coat at 1.4 mil dft. 34% to 38% solids.
 - b. Finish: Pure Performance Interior Flat Latex 9-100 Series. Two (2) coats at minimum 1.6 mil dft per coat. 38% to 42% volume solids.
- D. Metals Finishes: Shop Primed and Unprimed
 - 1. SW

TASK ORDER CONTRACT NO. 33
GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B

PAINTING
099123

- a. Primer: DTM Acrylic Primer B66W1. 2.5 mils dft. 46% solids.
 - b. Finish: Harmony Low Odor Interior Latex Semi-Gloss B10 Series. Two (2) coats at minimum 1.6 mil dft per coat. 38% to 42% volume solids.
- 2. PPG
 - a. Primer: Pitt-Tech Interior/Exterior Primer DTM Industrial Enamel 90-712 Series. One (1) coat at minimum 2.0 mils dft. 37% to 41% solids.
 - b. Finish: Pure Performance Interior Semi-Gloss Latex 9-500 Series. Two (2) coats at minimum 1.3 mil dft per coat. 35% to 39% volume solids.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY SURFACES

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. Tackboards (Framed Bulletin Boards)
- B. Related Sections:
 - 1. Section 097723 "Fabric-Wrapped Panels" for tackable, fabric-covered wall surfaces.

1.3 DEFINITIONS

- A. Tackboard: Framed, tackable, visual display board assembly.

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 visual display surfaces
- B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of panel joints.
 - 2. Show locations of special-purpose graphics for visual display surfaces.
 - 3. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of tackboard assembly
 - 2. Include accessory Samples to verify color selected.
- D. Samples for Verification: For each type of visual display surface indicated.

1. Actual sections of tackboard assembly
2. Include accessory Samples to verify color selected.

E. Product Schedule: For visual display surfaces, as shown on drawings.

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 surface-burning characteristics of fabrics.
- C. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
- B. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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: 50 or less.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces 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 construction contiguous with visual display surfaces by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which 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: 5 years from date of Substantial Completion.
 - 3. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

- B. Fiberboard: ASTM C 208.
- C. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- D. Adhesives: Manufacturer's standard product that complies 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."

2.2 TACKBOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Forbo
- B. Natural-Cork Tackboard TB-1: 1/4-inch- (6-mm-) thick, natural cork sheet factory laminated to 1/4-inch- (6-mm-) thick particleboard backing.

2.3 TACKBOARD ACCESSORIES

- A. Wood Frames: standard size and shape.
 - 1. Factory-Applied Trim: Manufacturer's standard. Forbo Framed Solutions

2.4 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

2.5 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 not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

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

- B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

2.7 VISUAL DISPLAY SURFACE SCHEDULE

- A. Tackboard TB-1 Factory assembled.
 - 1. Tack Surface: Natural-cork tackboard assembly TB-1.
 - a. Color: As selected by Architect from full range of industry colors.
 - 2. Corners: Square
 - 3. Width: As indicated on Drawings
 - 4. Height: As indicated on Drawings
 - 5. Mounting: Wall
 - 6. Mounting Height: As indicated on Drawings
 - 7. Edges: Concealed by trim
 - a. Factory Applied Wood Trim: with transparent finish.

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 motor-operated, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- 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 that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

- 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 surfaces and wall surfaces.
 - 1. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - 2. Prepare surfaces to receive visual display wall coverings and test for moisture according to requirements specified in Section 097200 "Wall Coverings."
 - 3. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
 - b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - d. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - e. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces 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.

3.4 INSTALLATION OF BULLETIN BOARDS

- A. Display Rails: Install Bulletin Boards in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
 - 1. Mounting Height: As indicated on drawings.

3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100

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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Stainless steel corner guards.
 - 2. Wall Protection at Lobby.
- B. Related Sections:
 - 1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform load of 50 lbf/ft. applied in any direction.
 - 2. Concentrated load of 200 lbf applied in any direction.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
 1. Wall and Corner Guards: 12 inches long of each color specified. Include examples of joinery, corners, end caps, top caps, and field splices.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified Installer.
 - B. Product Data: Submit manufacturer's product data.
 - C. Retain first paragraph below for material certificates from manufacturers.
 - D. Material Test Reports: Submit manufacturer's test reports and certification indicating compliance with applicable building code requirements.
 - E. Warranty: Sample of special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of stainless steel covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.
- 1.7 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.
 - B.
 1. Corner-Guard Covers: Full-size stainless steel covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- long units.
 - C. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."
- D. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period materials are stored.
 - a. Store corner-guard covers in a vertical position, protected against damage of any kind.
 - b. Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly identifying product name and manufacturer.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 MATERIALS****2.2 CORNER GUARDS**

- A. Surface-Mounted, Stainless Steel Corner Guards (CG-1): Fabricated from 16 gauge Stainless Steel adhered to substrate corner; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide In Korogard, Bellagard Series 16-Gauge Stainless Steel Corner Guard or equal. Approval by Architect and HACP required.
 - 2. Material: Stainless Steel Type 304
 - 3. Wing Size: 1 1/2 "
 - 4. Height: 8 FT.
 - 5. Crown: Square (VS)
 - 6. Pattern: S6.
 - 7. Mounting: Construction Adhesive.
 - 8. Color and Texture: As selected by Architect from manufacturer's full range. Refer to section 090000.

2.3 Wall Protection

- A. Surface-Mounted, Wall Protection Sheet (WP-1): Fabricated from .28" thick sheet product adhered to substrate; to match wall condition.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide In Korogard, Wall Protection Systems .028"thick factory cut sheet or equal. Approval by Architect and HACP required.
 - 2. Material: Rigid high impact sheet
 - 3. Fire Rating: Class A

4. Thickness: .028"
5. Texture: Cashmere
6. Size: Refer to plan and elevation.
7. Mounting: Construction Adhesive.
8. Color and Texture: As selected by Architect from manufacturer's full range. Refer to section 090000.

2.4 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints 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.

2.5 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Remove tool and die marks and stretch lines, or blend into finish.
 2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 3. Run grain of directional finishes with long dimension of each piece.
 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall 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 impact-resistant wall protection units 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.
- D. Verify by examination that wall surfaces are acceptable to receive the specified guard systems. Notify the Architect in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install impact-resistant wall protection units 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.
 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Install corner guards to wall securely using mastic construction adhesive as specified.
 - c. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
 - d. Adjust end and top caps as required to ensure tight seams.
 - e. Install corner guards accurately in location, alignment, and elevation.

3.4 CLEANING

- A. Immediately after completion of installation, clean covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

TASK ORDER CONTRACT NO. 33

GLEN HAZEL RAD

ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION

R3A PROJECT NO. 15074B

WALL AND DOOR PROTECTION

102600

END OF SECTION 102600

**GLEN HAZEL RAD
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R3A PROJECT NO. 15074B**

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract", "Special Conditions", and "Division 1 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.
- B. Drawings and Division 01 Specification Sections, apply to this Section.
- C. Related Sections include the following:
 - 1. Division 09 Section "Tiling" for porcelain tile.
 - 2. Division 09 Section "Schedule of Finishes."

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Apartment bathroom accessories.
 - 2. Underlavatory guards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet accessories to include in maintenance manuals.

**GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B**

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 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.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. 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.

GLEN HAZEL RAD**ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION****R3A PROJECT NO. 15074B**

- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 APARTMENT BATHROOM ACCESSORIES

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. American Standard
 - 2. American Specialties, Inc.
 - 3. Bradley Corporation.
 - 4. Moen
 - 5. Kohler
 - 6. Amerock
- B. Toilet Tissue (Roll) Dispenser:
 - 1. Basis-of-Design Product: Moen Voss YB5108ORB
 - 2. Description: Single Roll Dispenser
 - 3. Mounting: Surface mounted.
 - 4. Finish: Oil Rubbed Bronze
- C. Shower Curtain Rod:
 - 1. Basis-of-Design Product: Bradley Concealed Mounting Stainless Steel Shower Curtain Rod 9538
 - 2. Description: Concealed Mounting Stainless Steel Shower Curtain Rod. 1" Diam.
Mounting: Surface mounted; concealed mounting.
Finish: Satin Finish Stainless Steel.
- D. Towel Bar:
 - 1. Basis-of-Design Product: Moen Voss Towel Bar
Description: Towel Bar
Mounting: Surface mounted; concealed mounting.
Finish: Oil Rubbed Bronze
Size(s): Refer to Plan 24", 18"
- E. Medicine Cabinet Unit:
 - 1. Basis-of-Design Product: Miseno Recessed Medicine Cabinet
 - 2. Frame: Frameless
 - 3. Model: MBC2620-BN Verify Recessed Size in Field
 - 4. Mirror: Beveled Edge

**GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B**

F. Robe Hook:

1. Basis-of-Design Product: Moen Voss Oil Rubbed Bronze Double Robe Hook YB5103ORB
2. Mounting: Surface mounted to back of door.
3. Material and Finish: Oil Rubbed Bronze

2.3 UNDERLAVATORY GUARDS

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

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard (K):

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

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying.

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.

**GLEN HAZEL RAD
ALLIES & ROSS MANAGEMENT AND DEVELOPMENT CORPORATION
R3A PROJECT NO. 15074B**

- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in 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 recommendations.

END OF SECTION 102800

SECTION 113100 - RESIDENTIAL 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. Refrigeration appliances.
 - 2. Cleaning appliances.

1.3 ALLOWANCES

- A. Furnish residential appliances as part of residential appliance allowance.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- C. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified manufacturer.
- B. Product Certificates: For each type of appliance, from manufacturer.
- C. Field quality-control reports.
- D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- C. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.
- D. Regulatory Requirements: Comply with the following:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
- E. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- F. Preinstallation Conference: Conduct conference at Project site.

1.8 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year from date of Substantial Completion.
- B. Refrigerator/Freezer, Sealed System: Limited warranty including parts and labor for first year and parts thereafter 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.

PART 2 - PRODUCTS

2.1 REFRIGERATOR/FREEZERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. Amana; a division of Whirlpool Corporation.
 2. BOSCH Home Appliances.
 3. BSH Home Appliances Corporation (Gaggenau).
 4. BSH Home Appliances Corporation (Thermador).
 5. Dacor, Inc.
 6. Electrolux Home Products (Frigidaire).
 7. Fisher & Paykel.
 8. General Electric Company (GE).
 9. General Electric Company (Hotpoint).
 10. Jenn-Air; a division of Whirlpool Corporation.
 11. KitchenAid; a division of Whirlpool Corporation.
 12. LG Appliances.
 13. Maytag; a division of Whirlpool Corporation.
 14. Samsung.
 15. Sears Brands LLC (Kenmore).
 16. Sub-Zero, Inc.
 17. Viking Range Corporation.
 18. Whirlpool Corporation.
- C. Refrigerator/Freezer [**RF-1**]: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.
1. Basis-of-Design Product: General Electric Company GTE18CTHWW
 2. Type: Freestanding.
 3. Dimensions:
 - a. Width: 28 inches
 - b. Depth: 30.5 inches
 - c. Height: 67 3/8 inches
 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 13.5 cu. ft.
 - b. Freezer Volume: 4 cu. ft.
 - c. Shelf Area: Three wire shelves
 5. General Features:

- a. Door Configuration: Overlay.
 - b. Dual refrigeration systems.
 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Compartment Storage: 2 compartments
 - c. Door Storage: 2 Fixed
 - d. Temperature-controlled meat/deli bin.
 7. Freezer Features: One freezer compartment(s) with door(s).
 - a. Frost Free
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
 8. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 9. Front Panel(s): Manufacturer's standard.
 - a. Panel Color: White.
 10. Appliance Color/Finish: White.
- D. Refrigerator/Freezer **[RF-2]**: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1. UFAS Unit Refrigerator.
1. Basis-of-Design Product: General Electric Company GPE16DTH
 2. Type: Freestanding.
 3. Dimensions:
 - a. Width: 28 inches
 - b. Depth: 25.75 inches
 - c. Height: 61.75 inches
 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 10.6 cu. ft.
 - b. Freezer Volume: 4 cu. ft.
 - c. Shelf Area: Three wire shelves
 5. General Features:
 - a. Door Configuration: Overlay.
 - b. Dual refrigeration systems.
 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.

- b. Compartment Storage: 2 compartments
 - c. Door Storage: 2 Fixed
 - d. Temperature-controlled meat/deli bin.
- 7. Freezer Features: One freezer compartment(s) with door(s).
 - a. Frost Free
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
- 8. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- 9. Front Panel(s): Manufacturer's standard.
 - a. Panel Color: White.
- 10. Appliance Color/Finish: White.

2.2 CLOTHES WASHERS AND DRYERS

- A. Owner's Appliance Leasing Company will coordinate project schedule with General Contractor to remove existing washers and dryers and furnish and install washers and dryers within the Bernice Crawley High Rise Common Laundry Room #208.
- B. Owner's Appliance Leasing Company to comply with all applicable codes, including but not limited to 2009 IBC, ANSI A117.1, UFAS, Fair Housing Act, HUD and PHFA. Furnish and Install (1) Compliant Front Loading Washer and (1) Compliant Side swing Dryer. All operable parts are to be on the front of the units.
 - 1. Bernice Crawley High Rise Property Management will clean existing hard piping and replace all flexible hot and cold water hoses and drain hoses for washers and ducting for dryers. BCHR Property Management to coordinate with Owner's Leasing Company and General Contractor's Schedule.

2.3 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.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance 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 INSTALLATION, GENERAL

- A. General: Comply with 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.
- D. Consult with Architect or Owner for door swing directions for each unit prior to completion.
- E. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- F. Utilities: Comply with plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:

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.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. 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 residential appliances.

END OF SECTION 113100

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.
- B. Refer to Section 012300 "Alternates" for conditions that apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Horizontal louver blinds with polymer slats at all apartment windows. (WB-1)
 - 2. Horizontal louver blinds with polymer slats at common areas. (WB-2)
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.
- D. Samples for Initial Selection: For each type and color of horizontal louver blind.
 - 1. Include similar 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 long.
 - 2. Tapes: Full width, not less than 6 inches long.
 - 3. Horizontal Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long.
 - 4. Valance: Full-size unit, not less than 12 inches wide.

- F. Window-Treatment Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of horizontal louver blind.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

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. 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.

1.7 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 wet 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS (WB-1, WB-2)

- 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. Hunter Douglas Contract.
 2. Levolor Contract; a Newell Rubbermaid company.
 3. Springs Window Fashions.
- B. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.
1. Formulation: Manufacturer's standard.
 2. Width: Refer to 090000 Schedule of Finishes
 3. Thickness: 0.125 inch.
 4. Spacing: Manufacturer's standard.
 5. Profile: Manufacturer's standard.
 6. 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.
 - b. Perforated Slats: Openness factor of 6 to 7 percent.
- D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrail fully encloses operating mechanisms on three sides and ends.
1. Capacity: One blind per headrail unless otherwise indicated.
 2. Manual Lift Mechanism:
 - a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within full operating range.
 - b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.

3. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 - a. Tilt: Full.
 - b. Tilt: Two-direction, positive stop or lockout limited at an angle of 20 degrees from horizontal, both directions.
 - c. Operator: Dual cord.
 - d. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.
4. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.
5. Manual Lift-Operator and Tilt-Operator Locations: Manufacturer's standard unless otherwise indicated.
- E. Bottom Rail: Secures and protects ends of ladders and lift cords.
 1. Type: Manufacturers standard.
- F. Lift Cord: Manufacturer's standard braided cord.
- G. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
 1. Type: Braided cord.
- H. Valance: Manufacturer's standard.
- I. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
 1. Type: As indicated.
 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
- K. Colors, Textures, Patterns, and Gloss:
 1. Slats: As selected by Architect from manufacturer's full range.
 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:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- 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, locations of connections to building electrical system, and other conditions affecting performance.
 - 1. 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. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. 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.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and 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 DEMONSTRATION

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

END OF SECTION 122113

SECTION 122116 - VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Vertical louver blinds with PVC vanes.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting vertical louver blinds and accessories.
2. Division 090000 Section "Schedule of Finishes"
3. Section 08520: Aluminum Windows

1.3 ALLOWANCES

- A. Vertical louver blinds are part of Window Covering Allowance

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for vertical louver blinds.
- 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 of vertical louver blind.
1. Include similar Samples of accessories involving color selection. From Manufacturer's full range of colors.
- E. Samples for Verification: For each type of vertical louver blind.
1. Vane: Not less than 12 inches (300 mm) long.
- F. Window-Treatment Schedule: For vertical louver blinds. Use same designations indicated on Drawings. Refer to Schedule of Finishes 090000.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of vertical louver blind.
- B. Product Test Reports: For each type of vertical louver blind, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For vertical louver blinds to include in maintenance manuals.

1.7 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. Vertical Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and finish indicated, but no fewer than two units.
 - 2. Vanes: Furnish quantity of full-size units equal to 5 percent of quantity installed for each type, size, texture, pattern, and finish indicated, but no fewer than two units.

1.8 QUALITY ASSURANCE

- 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. 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 undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, and location of installation using same designations indicated on Drawings.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install vertical louver blinds until construction and wet 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 vertical 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain vertical louver blinds from single source from single manufacturer.

2.2 VERTICAL LOUVER BLINDS, PVC VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. Basis-of-Design Product: (VB-1) Subject to compliance with requirements, provide Hunter Douglas Contract; Vertical Blinds or comparable product by one of the following:
1. Hunter Douglas Contract.
 2. Levolor Contract; a Newell Rubbermaid company.
 3. Springs Window Fashions.
- C. Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed.
1. Width: 3-1/2 inches (89 mm)
 2. Profile: Flat or Crowned
 3. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 4. Features:
 - a. Bottom chain.
- D. Headrail: Channel, formed steel or extruded aluminum with long edges returned or rolled and ends capped. Headrail encloses operating mechanisms including carrier-spacing mechanism that provides uniform vane spacing when blinds are traversed fully across headrail (closed).
1. Motorized Operator Control: Coordinate headrail with motorized operator requirements. Provide headrail acceptable to blind and motorized operator manufacturers and suitable for applications indicated.

2. Manual Traverse Control: Wand.
 3. Manual Rotation Control: Wand
 4. Manual Control Locations: Right
 5. Draw and Stack: Two way, center split
 6. If retaining "Stack Release" Subparagraph below, verify availability with manufacturers.
 7. Stack Release: Permitting stacked vanes to be moved away from stacking position for access to glazed opening.
 8. Cord-Tensioner Mounting: Wall
- E. Carriers: Engineered plastic with gears to align and synchronize vane rotation and stems that allow vane removal and replacement. Lead carriers have self-lubricating wheels or elongated bearing surfaces; following carriers have self-lubricating wheels.
- F. Valance: Manufacturer's standard with vane insert
- G. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
1. Type: Wall
 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- H. Colors, Textures, and Patterns:
1. Vanes: As selected by Architect from manufacturer's full range
 2. Components: Provide materials exposed to view matching or coordinating with vanes unless otherwise indicated

2.3 VERTICAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate vertical louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Fabrication: Blind measurements shall be accurate within 1/8" or as recommended in writing by manufacturer.
- C. Unit Sizes: Fabricate units in sizes to cover 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 blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- D. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Rotation-and-Traverse Mechanisms: With permanently lubricated moving parts.
- E. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail[, valance, and operating hardware and for bracket positions and blind mounting method indicated.
- F. 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.
- G. Color-Coated Finish: For metal components exposed to view unless anodized or plated finish is indicated. 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.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install vertical louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 1. Locate so exterior vane edges are not closer than 2 inches (51 mm) from interior faces of glass and not closer than 1-1/2 inches (38 mm) from interior faces of glazing frames through full operating ranges of blinds.
 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 3. 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 vertical louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean vertical louver blind surfaces after installation according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that vertical louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged vertical louver blinds 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 systems.

END OF SECTION 122116

SECTION 123000 - RESIDENTIAL 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. Apartment Kitchen cabinets.
 - 2. Apartment Vanity cabinets.
 - 3. Apartment Plastic-laminate countertops and backsplashes.
 - 4. Apartment cultured marble vanity tops and sinks.
 - 5. Solid Surface countertops and backsplashes at Public Restrooms.
 - 6. Countertop supports.
 - 7. Public Restrooms vanity brackets.

- B. Related Sections:

- 1. Section 113100 "Residential Appliances" for appliances.
 - 2. Section 224100 "Residential Plumbing Fixtures" for sinks and plumbing fittings.
 - 3. Section 090000 "Schedule of Finishes" for colors.

1.3 DEFINITIONS

- A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- B. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers, and bottoms of wall cabinets.
- C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, ends of cabinets installed directly against and completely concealed by walls or other cabinets, and tops of wall cabinets and utility cabinets.

1.4 ACTION SUBMITTALS**A. Product Data:** For the following:

1. Cabinets.
2. Plastic-laminate countertops.
3. Solid Surface countertops.
4. Cultured marble countertops.
5. Cabinet hardware.
6. Countertop support brackets.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.**C. Samples for Initial Selection:** For each type of material exposed to view.**D. Samples for Verification:** For the following products:

1. Wood-veneered panels with transparent finish, 8 by 10 inches, for each species.
2. Solid wood trim with transparent finish, 8 inches (200 mm) long, for each species.
3. Solid surface for countertops, 4 inches by 4 inches
4. Cultured marble for countertops, 4 inches by 4 inches
5. Plastic laminate for countertops, 8 by 10 inches (200 by 250 mm).
6. Exposed hardware, for each type of item.
7. One full-size plastic-laminate countertop, with front edge and backsplash 8 by 10 inches (200 by 250 mm), in configuration specified.

1.5 INFORMATIONAL SUBMITTALS**A. Qualification Data:** For qualified manufacturer.**B. Product Certificates:** For casework, from manufacturer.**1.6 QUALITY ASSURANCE****A. Manufacturer Qualifications:** Obtain cabinets from a manufacturer that is certified for chain of custody by an FSC-accredited certification body.**B. Source Limitations for Cabinets:** Obtain cabinets, each type of cabinet from single source from single manufacturer.**C. Product Options:** Drawings indicate size, configurations, and finish material of cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' cabinets of similar sizes and door and drawer configurations, same finish material, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."

- D. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.
- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Field Measurements for Countertops: Verify actual dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.
- B. Coordinate locations of utilities that will penetrate countertops or backsplashes.
- C. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that residential casework can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 CABINETS

- A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."
- B. Products: Subject to compliance with requirements, provide the following. More than 100 manufacturers offer KCMA-certified cabinets. See the Certified Directory on KCMA's Web site for a complete list.

- C. Basis of Design Product: The design for cabinets is based on Echelon Advanta Cabinets Extreme Series. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Advanta Cabinets Extreme Series
 - 2. Echelon Cabinety
- D. Quality Standard: Provide cabinets that comply with KCMA A161.1.
 - 1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.
- E. Face Style: Full overlay; door and drawer faces cover cabinet fronts with only enough space between faces for operating clearance.
- F. Face Style: Full overlay; door and drawer faces partially cover cabinet fronts.
- G. Face Style: Lipped overlay; door and drawer faces are rabbeted and partially inset within cabinet fronts with the lip of the rabbet overlapping cabinet body members or face frames.
- H. Face Style: Flush inset; door and drawer faces are set within cabinet fronts, flush with face.
- I. Cabinet Style: Face frame.
- J. Door and Drawer Fronts: 3/4" thick solid maple door frames and drawer fronts. Shaker style flat center panel; Drawers slab style.
- K. Drawers: 11/16" thick solid pine lumber four sided drawer box. Drawer bottoms are nominal 1/4" (6mm) thick hardwood plywood dadoes into all four drawer box sides. Slab Style.
- L. Face Frames: 3/4-by-1-5/8-inch (19-by-41-mm) solid kiln dried hardwood with glued mortise and tenon or doweled joints.
- M. Exposed Cabinet End Finish: Wood veneer
- N. For basic-quality cabinets, delete remainder of this article and rely on KCMA standard, together with previous paragraphs on materials, to ensure that cabinets are of required quality. When proprietary specification is allowed, naming acceptable manufacturers and models is best way to ensure that cabinets are of required quality and remainder of this article can be deleted. If retaining any of the remaining paragraphs, carefully consider the effect they may have on cost and competition and also consider researching cabinet construction at shops of local dealers.

- O. Cabinet End Construction: 1/2-inch- (12.7-mm-) thick multi-plywood type 1 exterior glue hardwood plywood dadoed to received tops and bottoms.
- P. Cabinet Tops and Bottoms: 1/2-inch- (12.7-mm-) thick multi ply hardwood, fully supported by and secured in rabbets in end panels, front frame, and back rail.
- Q. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch (19-by-63-mm) solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.
- R. Wall-Hung-Unit Back Panels: 1/4 -inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.
- S. Base-Unit Back Panels: 1/4-inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.
- T. Front Frame Drawer Rails: 3/4-by-1-1/4-inch (19-by-32-mm) solid wood mortised and fastened into face frame. Stiles 1-1/2" wide, mulls 3" wide, rails 1-3/4" wide
- U. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued dovetail joints.
 - 2. 11/16" thick solid pine lumber four sided drawer box. Drawer bottoms are nominal 1/4" (6mm) thick hardwood plywood dadoes into all four drawer box sides.
 - 3. Bottoms: 1/4-inch- (6.4-mm-) thick plywood.
- V. Shelves: 1/2-inch- (12.7-mm-) thick plywood with hardwood veneer banded front edge. Shelves are fixed into dadoes in end panels on all cabinets.
- W. Base Corner Braces: Two 1/2" thick (12mm) x 2 7/8" wide plywood braces running full-depth front to back of cabinet, recessed down 1/2" from top. All braces are glued and stapled at top of cabinet to front frame and hang rail, and dadoed into end panel.
- X. Toe Board: Toe kick is 4" high and recessed 4". 3/4" thick, ACQ* pressure treated toe board captured between end panels.
- Y. Hinges: Heavy-duty, high-quality steel, concealed 6-way adjustable hinge with self-closing feature.
- Z. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
- AA. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

2.2 CABINET MATERIALS**A. General:**

1. Certified Wood Materials: Fabricate cabinets with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Adhesives and Composite Wood and Agrifiber Products: Do not use products that contain urea formaldehyde.
3. Adhesives: Use adhesives that 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."
4. Composite Wood and Agrifiber Products: Products 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."
5. Hardwood Lumber: Kiln dried to 7 percent moisture content.
6. Softwood Lumber: Kiln dried to 10 percent moisture content.
7. Hardwood Plywood: HPVA HP-1[, made with adhesive containing no urea formaldehyde].
8. Particleboard: ANSI A208.1, Grade M-2[, made with binder containing no urea formaldehyde].
 - a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.
9. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
10. Medium-Density Fiberboard: ANSI A208.2, Grade MD[, made with binder containing no urea formaldehyde].
 - a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.
11. Hardboard: ANSI A135.4, Class 1 Tempered.
 - a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.

B. Exposed Materials:

1. Exposed Wood Species: Maple.
 - a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - b. Staining and Finish: As selected by Architect from manufacturer's full range.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
 3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
 - a. Edge band exposed edges with minimum 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.
 4. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS, Grade HGL.
 - a. Where edges of solid-color plastic-laminate sheets will be visible after fabrication, provide through-color plastic laminate.
 - b. For doors and drawer fronts faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces
 - c. Colors, Textures, and Patterns: As indicated by manufacturer's designations; As selected by Architect from manufacturer's full range.
- C. Semiexposed Materials: Unless otherwise indicated, provide the following:
1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces and stained to match exposed surfaces.
 2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.
 3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS, Grade CLS.
 - a. For backs of doors and drawer fronts faced with plastic laminate, provide same grade, pattern, color, and texture of plastic laminate as for faces.
 - b. For face frames faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
 - c. For shelves faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces
 - d. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range.
- D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.
- B. Pulls: Surface-mounted decorative pulls; Hafele 110.93.361 Handle, Keystone, zinc, antique black, 118ZN72, 8-32 center to center 96mm, includes 1 " screws.

- C. Hinges: Concealed European-style self-closing hinges. Heavy-duty, high-quality steel, concealed 6-way adjustable hinge with self-closing feature.
- D. Drawer Guides: High-quality epoxy coated steel, Extreme grade, side mounted guides, self-adjusting in mounting brackets, built-in stop, self-closing, and stay-closed features with a 100 lb. rated load capacity. Mounting brackets are screwed to solid pine back hanging rails. BHMA A156.9, Type B05011 or B05091.
- E. Vanity Brackets: Surface mounted bracket fabricated from miter cut and welded aluminum sections; Vanity Bracket as manufactured by Rangine Corporation.
 - 1. Configuration: C shaped with vertical rear leg for attachment to wall, horizontal member for supporting vanity top, and vertical front leg with sloped return for attachment of front baffle..
- F. Surface Mounted Countertop Brackets: Surface mounted counter brackets: L-shaped bracket fabricated from aluminum T sections designed for supporting 24inches deep counter; Model No. EH-1818 as manufactured by Rangine Corporation.
 - 1. Load Capacity per bracket: 450 pounds.

2.4 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: KCMA A161.2.
- B. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:
 - 1. Front: Rolled edge.
 - 2. Cove: Cove molding one-piece postformed laminate supported at junction of top and backsplash by wood cove molding.
 - 3. Idealedge decorative edging; ogee edge
 - 4. Backsplash: Curved or waterfall shape with scribe
 - 5. Endsplash: None
 - 6. Aluminum Counter Support Bracket: Rakks EH-1818 Radius End Option
- C. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch (19 mm) thick.
 - 1. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood.
 - 2. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of particleboard laminated to top.
- D. Backer Sheet: Provide plastic-laminate backer sheet on underside of countertop substrate.
- E. Paper Backing: Provide paper backing on underside of countertop substrate.

2.5 COUNTERTOP MATERIALS

- A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
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. Formica Corp.
 - b. Lamin-Art, Inc.
 - c. Panolam Industries International Incorporated.
 - d. Pionite Decorative Surfaces.
 - e. Wilsonart International.
 - f. DesignLab
 2. Grade: HGP.
 3. Provide through-color plastic laminate.
 4. Grade for Backer Sheet: BKL.
 5. Edge: Idealeedge Ogee
 6. Colors, Textures, and Patterns: As selected by Architect from plastic-laminate manufacturer's full range.
- B. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. Composite Wood and Agrifiber Products: Products 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."
- D. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
1. Recycled Content: Not less than 20 percent preconsumer or postconsumer recycled content.
- E. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- F. Adhesives: Do not use adhesives that contain urea formaldehyde.
- G. Adhesives: Adhesives 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."

2.6 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Solid-Surfacing-Material Thickness: As shown on drawings.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - 1. As specified in Schedule of Finishes, Section 090000.
- C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2.7 CULTURED MARBLE VANITY COUNTERTOPS

- A. Cultured Marble Material Thickness: As shown on drawings.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of cultured marble material complying with the following requirements:
 - 1. As specified in Schedule of Finishes, Section 090000.
- C. Fabricate tops in one piece, unless otherwise indicated. Comply with cultured marble material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
 - 2. Integral seamless sink. Refer to Section 090000 for size and style.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Coordinate requirements for stud spacing, blocking, and auxiliary structural supports to ensure adequate means for installation and anchorage of support brackets.

- C. Coordinate installation of flush mounted support brackets with application of gypsum board finish specified in Section 09 21 16 - Gypsum Board Assemblies. Ensure that brackets are delivered to site and installed in a timely manner to allow for vertical bracket leg to be concealed by gypsum board.
- D. Install cabinets without distortion so doors and drawers fit openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- E. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- F. Fillers shall not exceed 3" U.N.O.
- G. Fasten cabinets to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c., with toggle bolts through metal backing behind gypsum board.
- H. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
 - 1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
 - 2. Seal edges of cutouts by saturating with varnish.

3.2 ADJUSTING AND CLEANING

- A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 123530

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Pipe Portals.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages
13. Access doors and panels

1.2 BID SUBMISSION REQUIREMENTS

- A.** The Contractor shall submit his bid, including the Base Bid and all Alternate Bids, in accordance with the General Provisions of the Contract, including General, Supplementary, and Special Conditions.
- B.** Three manufacturers shall be listed for each equipment item.

1.5 DEFINITIONS

- A. Finished Spaces:** Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations:** Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations:** Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations:** Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations:** Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient

temperatures. Examples include installations within unheated shelters.

- F. Provide: Furnish and install, complete and ready for use; all items noted on the drawings and/or indicated in the Specifications.
- G. Furnish: Supply and deliver to the job site; all items noted on the drawings and/or indicated in the Specifications. The Owner or another contractor will install the items.
- H. Install: Install complete and ready for use; all items furnished by the Owner or another contractor that are noted on the drawings and/or indicated in the Specifications to be installed by the Contractor.
- I. Relocate: Move from the existing location to the new location installed complete and ready for use; all items noted on the drawings and/or indicated in the Specifications.
- J. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PP: Polypropylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.
- K. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.6 REGULATORY REQUIREMENTS

- A. General: International Building Code, 2009.
- B. Plumbing: International Plumbing Code, 2009.
- C. Energy conservation: International Energy Conservation Code, 2009.
- D. Fire Protection: NFPA 13, 14, 101 and 24.

1.7 PERMITS, FEES, AND NOTICES

- A. The Contractor shall give all requisite notices, obtain and pay all fees necessary for the installation, tests connections to the utility company service lines, street openings, repairs and inspection of all work provided under this Specification. These tests shall be conducted in the presence of the Architect.
- B. The Owner will pay all tap-in fees for water, sewer, and gas.

1.8 APPLICABLE PUBLICATIONS

- A. The publications listed in each section form a part of that Section to the extent referenced.
- B. The publication date is the publication in effect as of the bid date, except when a specific publication date is specified.
- C. Obtain copies of referenced standards direct from publication source when needed for proper performance of work, or when required for submittal by Contract Documents.

1.9 SCOPE OF WORK

- A. The work to be performed under these specifications shall include providing all labor, materials and equipment necessary to furnish and install, complete, properly and fully, all Plumbing Work as shown on drawings, herein specified and/or necessary thereto, whether or not specified herein in detail, and/or reasonably implied, and leaving the same in satisfactory operating condition. It is the intent of these specifications that a complete and operating system shall be installed and this Contractor shall carefully examine the site, plans, and specifications, and shall include all items necessary to accomplish this purpose.

1.10 DESCRIPTION OF SYSTEMS

- A. Without intending to limit or restrict the volume of work required by this Specification and the applicable drawings, the work generally consists of:
 - 1. Complete Plumbing systems including sanitary, waste, vent, hot water and cold-water piping, hot water systems, specialties and fixtures.
 - 2. Complete Plumbing system with new fixtures, piping, specialties, and equipment.
 - 3. Thermal insulation of equipment and piping.
 - 4. Cleaning of all equipment, piping, and fixtures.
 - 5. Testing, balancing and adjusting.
 - 6. Vibration isolation equipment.
 - 7. Demonstration of successful system operation.
 - 8. Demolition Work

1.11 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

- C. Equipment and piping shop drawings shall be produced and submitted in accordance with the paragraph in this section entitled "Coordination With Other Trades".
- D. Submittals for equipment and pumps shall include manufacturer's published performance curves showing flow rate, pressure drop, efficiency, horsepower, NPSH required (for pumps), and operating points.
- E. The Plumbing Contractor shall begin no fabrication or work which requires submittals until return of submittals with Architect approval.

1.12 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. The Contractor, at his own expense, shall make good to the Architect and the Owner's satisfaction any damage to his work incurred by the action of the elements or any other cause due to the neglect on the part of the Contractor or his representatives.

1.14 MATERIALS PROHIBITED

- A. Absolutely no materials, equipment, etc., containing asbestos and/or lead shall be installed on this construction project. No deviations will be entertained or accepted.

1.15 CERTIFICATION

- A. After the architect has performed a final site observation, the contractor shall provide the

Owner with a letter certifying that he did not install any asbestos- containing and/or lead containing materials on this projects a result of his construction work. In addition, the contractor shall provide the owner with a letter from each of his sub-contractors certifying the same.

1.16 EQUIPMENT FURNISHED UNDER OTHER CONTRACTS

- A. Unless otherwise specified or shown on the drawings, this Contractor shall make final plumbing connections to all equipment furnished under General and Electrical Contracts. For HVAC equipment this Contractor shall provide a capped water or gas outlet within five (5) feet of the HVAC equipment, and that Contractor shall make and be responsible for the final connections.
- B. Unless otherwise specified or shown on drawings, the equipment furnished under the concurrent contracts will be furnished with their operating controls. This Contractor shall provide valves on water and gas, and unless otherwise shown or specified traps on waste outlets, and shall furnish all labor and materials required to connect the equipment and make it operative. Unless otherwise shown or specified valves on lines to equipment shall be ball valves.
- C. Equipment furnished under other contracts will be set in place by the Contractor for that equipment. Controlling devices for this equipment will be furnished with the equipment, but were supplied detached they shall be installed into the plumbing work piping assemblies by the Contractor.
- D. This Contractor shall refer to the shop drawings of equipment furnished under other contracts to obtain the locations of connections and arrangements of piping assemblies to which he is required to connect. This Contractor shall provide all required pipe, fittings, adapters, couplings and other accessories required to make the equipment operative.

1.17 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.
- B. The Contractor shall provide any apparatus, appliance, material, or work not shown as standard industry practice on drawings, but mentioned in the specifications, or vice versa, without additional expense to the Owner.
- C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.
- D. Due to the small scale of the drawings, all required offsets and fittings may not be shown but shall be provided at no change in Contract price.
- E. As many of the small lines required for the complete installation are shown on the drawings as is practicable, but some may have been omitted. The Contractor shall do

all such piping that may be required or directed to effect proper connections to all apparatus, equipment, and fixtures in accordance with the manufacturer's detailed drawings and instructions.

1.18 COORDINATION WITH OTHER TRADES

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Section 08 "Access Doors and Frames."
- D. This Plumbing Contractor must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications.

1.19 SPECIAL CONDITIONS RELATED TO PLUMBING WORK

- A. During construction, cap or otherwise seal off, in an approved manner, those portions of the piping system in which work is not being performed, in order to prevent the entry of dirt or dust.
- B. The Contractor shall coordinate all utility shut-downs with the Owner and Architect.
- C. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.
- D. Do not install piping in transformer vaults or electrical equipment rooms. In accordance with the National Electric Code Article 110-34f, do not install piping adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.
- E. Exposed piping shall be run to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves, and fittings.
- F. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available. All materials and equipment shall be American made.

- G. Equipment shall be installed in strict accordance with the manufacturer's instructions for type and capacity of each piece of equipment. The Contractor shall obtain these instructions from the manufacturer and such instructions shall be considered a part of these specifications. Type, capacity, and application of equipment shall be suitable and capable of satisfactory operation for the purpose intended in the plumbing system.
- H. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation, and maintenance.
- I. It shall be the responsibility of the Contractor to ensure that the items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connection, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications.
- J. Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install that equipment to operate properly and in harmony with the intent of drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, wiring, heaters, panel boards, etc. He shall provide any additional motors, controllers, valves, fittings, and other additional equipment for the proper operation of the system resulting from the selection of that equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing-in and in connections by other trades. All changes shall be made at no increase in the Contract Amount or additional cost to the other trades.
- K. Unless otherwise noted on the drawings or in the specifications, concrete pads and bases for heaters, tanks, and other equipment shall be furnished and installed by the Contractor furnishing the equipment requiring such pad or base. The Contractor shall establish sizes and locations of the various concrete bases required and shall provide all necessary anchor bolts, together with the templates for holding these bolts in position.

Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with suitable plate at bottom end of sleeve to hold the bolt. Each concrete base shall be not less than 4" high, which shall project 3" on all sides beyond the equipment. Special vibration isolation foundations that are required are specified with the equipment supported.

- L. The Contractor shall support, plumb, rigid and true to line, all work and equipment furnished under each section. The Contractor shall study thoroughly all general, structural, mechanical, and electrical drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, conduit, ductwork, etc. are to be supported, mounted, or suspended and shall provide extra steel bolts, inserts, pipe standards, brackets and accessories for proper support, whether or not shown on the drawings. When directed, the Contractor shall submit prints showing supports for approval.
- M. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety

requirements of the Pennsylvania Department of Labor and Industry and OSHA shall be met.

1.20 CUTTING AND PATCHING

- A. Cutting and patching shall be in accordance with the drawings and general provisions of the contract, including the existing Work Order.
- B. The Contractor shall seal all openings he has utilized in fire-rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire-rating equal to or greater than the rating of the floor, ceiling or partition material.
- C. The Contractor shall be responsible for providing all cutting, patching, and finishing of existing construction which is not specifically shown on the Architectural Drawings and which is required for the proper installation of his equipment and materials which are to be installed in the existing portion of this project. This work shall also be provided when removing existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project.
- D. Cutting, patching and finishing shall be performed by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas. All finishing shall match the undisturbed adjacent areas. Painting of the final finished areas, where general construction work occurs, will be the responsibility of the Contractor. Painting of the final finished areas, where no general construction work occurs, shall be the responsibility of the Contractor. The Contractor shall paint entire plane in which damage occurs whether the surface is a wall or a ceiling
- E. No cutting shall be done which may affect the building structurally or architecturally without first consulting with the Contractor and then securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the Contractor shall be required, at his own expense, to repair the damaged areas. Note all holes or openings in existing concrete or masonry shall be drilled, core bored or saw cut.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Available Manufacturers or Approved Equal:
 - a. Cascade Waterworks Mfg. Company
 - b. Dresser Industries, Inc.; DMD Division
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Division
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers or Approved Equal:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers or Approved Equal:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers or Approved Equal:
 - a. Nibco Inc.
 - b. Nibco, Inc.; Chemtrol Division
- E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers or Approved Equal:
 - a. Cascade Waterworks Mfg. Company
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers or Approved Equal:
 - a. Capitol Manufacturing Company
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Division
 - g. Zurn Industries, Inc.; Wilkins Division
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers or Approved Equal:
 - a. Capitol Manufacturing Company
 - b. Central Plastics Company
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Division
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers or Approved Equal:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225° F.
 - 1. Available Manufacturers or Approved Equal:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic

lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers or Approved Equal:

- a. Perfection Corporation
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Company, Inc.
- d. Victaulic Company of America.

2.6 TRAPS

- A. Unless otherwise specified or shown on the drawings, all plumbing fixtures, floor drains, and equipment furnished by this or other current contracts shall be individually trapped with full bore traps. Generally, plumbing fixture traps shall be on the wall outlet type connecting to a sanitary tee drainage fitting, the vent being extended vertically and provided with offsets where shown or specified.
- B. Traps supplied with the plumbing fixtures are specified elsewhere; however, all equipment furnished under other contracts and requiring waste connections and not furnished with traps shall be provided with traps furnished and installed by this Contractor. All unburied traps shall be cast brass of the sizes shown on the drawings, and shall, where exposed, be chrome plated and connected to the roughing with chrome plated copper tubing. Buried traps shall be cast iron.

2.7 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers or Approved Equal:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Company
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

- 2. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

2.9 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.10 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.11 PIPE PORTALS

- A. Acceptable Manufacturers or Approved Equal:
 - 1. Pipe Portal Systems.
 - 2. RPS.
- B. Description: 18-ga. galvanized roof curb with integral base plate, continuously welded corner seams, factory installed wood nailer and 1.5" 3lb. rigid fiberglass insulation. The portal shall be furnished with a laminated, acrylic coated, ABS plastic curb cover with

pre-punched holes and molded sealing ring on an 8-in collared opening. An EPDM compression molded cap with stainless steel clamp shall be provided.

PART 3 - EXECUTION

3.1 CLEANING UP AND REMOVAL OF DEBRIS

- A. This Contractor shall periodically, and at such times as directed by the Owner or Architect, remove from the premises all trash and debris caused by the performance of his work. At the completion of the work, all parts of the plumbing installation shall be thoroughly cleaned by this Contractor. All piping, flush valves, fixtures, trim, strainers, etc., shall be cleaned of all grease, dirt and metal cuttings. All plumbing fixtures shall be cleaned to restore to their original condition.
- B. Any damage to the building finishes or furnishings due to the failure of this Contractor to afford proper protection during the execution of his work shall be restored in a manner satisfactory to the Architect or Owner.

3.2 PIPING SYSTEMS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install all piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install all piping to permit valve servicing.
- F. Install all piping at indicated slopes.
- G. Install all piping free of sags and bends.
- H. Install all fittings for changes in direction and branch connections.
- I. Install all piping to allow application of insulation.

- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep- pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped- steel type with concealed hinge and set screw.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- L. Sleeves are required for core-drilled holes.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum- board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

- a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Section 07 "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Through-Penetration Firestop Systems" for materials.
- S. Pipe portals shall be installed where piping penetrates the roof construction. Attachment and installation to the pipe portal shall be done in accordance with the pipe portal and roof membrane manufacturer's written recommendations.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than- schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Non-pressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

- K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment. Edit dielectric connection types in two subparagraphs below for each fluid.
 - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

- B. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.10 STARTING OF PLUMBING SYSTEMS AND EQUIPMENT

- A. Provide material and labor required to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures. Refer to the section in Division 22 in which the system or equipment item is specified for specific start-up requirements for that system or equipment item.

3.11 OPERATING AND MAINTENANCE DATA AND OWNER INSTRUCTION

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under this Contract in a neatly bound and tabulated format. The manual shall be bound in a standard 1-inch three-ring binder.
- B. The manual shall contain as a minimum: models and serial numbers for the equipment; description of the equipment/system and its components; recommended

routine, preventative and emergency maintenance; start-up, operating and safety instructions; recommended frequency of inspection; oil type; belt tension adjustment; performance curves, engineering data, and tests; "trouble-shooting guide"; a spare parts list; and names, addresses and telephone numbers for the equipment installer, the maintenance contractor, and the local spare parts source.

- C. Provide complete operating and maintenance information for products specified in:
 - 1. Section 220523: General Duty Valves for Plumbing Piping.
 - 2. Section 221119: Domestic Water Piping Specialties.
 - 3. Section 221319: Sanitary Waste, Storm, and Vent Piping Specialties.
 - 4. Section 224000: Plumbing Fixtures.
- D. Submit three (3) copies of completed operating and maintenance manual in pre-final form 30 days prior to final inspection or acceptance for approval. The copy will be returned before final inspection or acceptance, with comments.
- E. Submit 3 copies of revised operating and maintenance manual in final form 10 days after return of the pre-final operating and maintenance manual.
- F. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in order, adjustment and maintenance of products, equipment and systems. The instruction shall consist of a minimum of one 8-hour session on site. The session shall include a review of the contents of manual with personnel in full detail to explain all aspects of operations and maintenance. Instruction shall be arranged at the Owner's convenience.

3.12 FINAL PLUMBING CONNECTIONS

- A. Provide rough-in and final connection of all Plumbing services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings

3.13 GUARANTEE OF WORK

- A. Where applicable, furnish manufacturer's written warranty for materials and equipment.
- B. This Contractor shall furnish a written warranty stating that all work shall be free from defects of equipment, material for workmanship for a period of one year from date of final acceptance and all defects developing during that period shall be made good without cost to the Owner.
- C. This Contractor shall service the installation for one year from date of final acceptance. This shall include all emergency service and adjustment, with the exception of the oiling of motors and cleaning of filters and screens.

END OF SECTION

SECTION 220523 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Iron, single-flange butterfly valves.
 - 3. Bronze swing check valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
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 or approved equal:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
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 or approved equal:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.

- g. Disc: Aluminum bronze.

2.4 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 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 or approved equal:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: ball, or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve- end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, fullport, bronze with brass trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Ball Valves: Two piece, fullport, bronze with brass trim.
5. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified Professional, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to the Code.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Equipment supports.
- B. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Professional responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U- bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- 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 or Approved Equal:
 - 1. Carpenter & Paterson, Inc.

2. ERICO International Corporation.
 3. National Pipe Hanger Corporation.
 4. PHS Industries, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon- steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Non-staining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 – EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and

stresses from movement will not be transmitted to connected equipment.

- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 PAINTING

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

3.4 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non- insulated, stationary pipes NPS 3/4 to NPS 8.
 - 3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel- pipe base stanchions support and cast-iron floor flange or carbon-steel plate.
 - 4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for

pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an

apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory- applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 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. Ramco Insulation, Inc.; Super-Stik.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for

bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.

- B. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
 - D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.4 MASTICS
- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf / inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

- A. Bands:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 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 or Approved Equal:
 - a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 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 or Approved Equal:
 - a. McGuire Manufacturing.
 - b. Plumberex.
 - c. Truebro; a brand of IPS Corporation.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold- water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply

a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- E. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to

- and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless- steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with

insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not

staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.8 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Professional. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Professional, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold and Hot Water:
 - 1. NPS 1 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be[one of] the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
- C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 deg F:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 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 or Approved Equal:

- a. Cascade Waterworks Manufacturing.
- b. Dresser, Inc.; Piping Specialties Products.
- c. Smith-Blair, Inc.; a Sensus company.
- d. Viking Johnson.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 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 or Approved Equal:
 - a. Central Plastics Company.
 - b. Hart Industries International, Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.
 2. Standard: ASSE 1079.
 3. Pressure Rating: 125 psig minimum at 180 deg F.
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric 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 or Approved Equal:
 - a. Central Plastics Company.
 - b. Watts; a division of Watts Water Technologies, Inc.
 - c. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 125 psig minimum at 180 deg F.
 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install shutoff valve immediately upstream of each dielectric fitting.
- C. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- G. Install piping to permit valve servicing.
- H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500.
- M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500.
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- G. Install supports for vertical steel piping every 15 feet.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill new domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of

- piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:

- 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water- sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water NPS 3 and smaller, shall be the following:
 1. Soft copper tube, ASTM B 88, Type K without joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
 1. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
 2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- F. Aboveground domestic water piping, NPS 3 and smaller, shall be one of the following:
 1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and soldered joints.

**ARMDC TASK ORDER CONTRACT NO. 33
GLEN HAZEL HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**DOMESTIC WATER PIPING
221116**

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing valves.
 - 2. Temperature-actuated, water mixing valves.
 - 3. Strainers.
 - 4. Wall hydrants.
 - 5. Drain valves.
 - 6. Water-hammer arresters.
 - 7. Flexible connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BALANCING VALVES

- A. Memory-Stop Balancing Valves:
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 or Approved Equal:
 - a. Conbraco Industries, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO Inc.
 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 3. Pressure Rating: 400-psig minimum CWP.
 4. Size: NPS 2 or smaller.
 5. Body: Copper alloy.
 6. Port: Standard or full port.
 7. Ball: Chrome-plated brass.
 8. Seats and Seals: Replaceable.
 9. End Connections: Solder joint or threaded.
 10. Handle: Vinyl-covered steel with memory-setting device.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Primary, Thermostatic, Water Mixing Valves (TMV):
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 or Approved Equal:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a division of Watts Water Technologies, Inc.
 - e. Symmons Industries, Inc.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded inlets and outlet.
 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller; cast iron [with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and] for NPS 2-1/2 and larger.
 - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 - 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.062 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - c. Strainers NPS 5 and Larger: 0.125 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.6 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.
 - 8. Inlet: Threaded or solder joint.
 - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products to be incorporated into the Work include, but are not limited to, the following or Approved Equal:
 - a. Precision Plumbing Products, Inc.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
 - 1. Body: Bronze.
 - 2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.
 - 5. Size: NPS 1/2 minimum inlet.
 - 6. Inlet and Vent Outlet End Connections: Threaded.
- B. Welded-Construction Automatic Air Vents:
 - 1. Body: Stainless steel.
 - 2. Pressure Rating: 150-psig minimum pressure rating.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.
 - 5. Size: NPS 3/8 minimum inlet.
 - 6. Inlet and Vent Outlet End Connections: Threaded.

2.9 FLEXIBLE CONNECTORS

- 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 or Approved Equal:
 - 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries.
 - 3. Flex Pression, Ltd.
 - 4. Metraflex, Inc.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless- steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on

inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve.
- E. Install water-hammer arresters in water piping according to PDI-WH 201.
- F. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Electrical Section for "Grounding and Bonding for Electrical Systems".

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following or approved equal:
1. Primary, thermostatic, water mixing valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.

- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221125 - NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified Professional, using performance requirements and design criteria indicated.

1.4 ACTION SUBMITTALS

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

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Dielectric fittings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Qualification Data: For qualified Professional.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations.

Contact utility-locating service for area where Project is located.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Mechanical Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following or Approved Equal :
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Stainless-steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Stainless-steel bolts, washers, and nuts.
 - e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 FLEXIBLE CONNECTORS

- 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 or Approved Equal:
 - 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries.
 - 3. Flex Pression, Ltd.
 - 4. Metraflex, Inc.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual

- Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or Approved Equal:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. McDonald, A. Y. Mfg. Co.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or Approved Equal:
 - a. Flowserve.
 - b. McDonald, A. Y. Mfg. Co.
 - c. Milliken Valve Company.
 - d. Mueller Co.; Gas Products Div.
 2. Body: Cast iron, complying with ASTM A 126, Class B.
 3. Plug: Bronze or nickel-plated cast iron.
 4. Seat: Coated with thermoplastic.
 5. Stem Seal: Compatible with natural gas.
 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. Operator: Square head or lug type with tamperproof feature where indicated.
 8. Pressure Class: 125 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating

nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or Approved Equal:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.
2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or Approved Equal:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - d. Wilkins; a Zurn company.
2. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder- joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of

drip to remove plug or cap.

- N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- P. Connect branch piping from top or side of horizontal piping.
- Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- R. Do not use natural-gas piping as grounding electrode.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons or piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for Plumbing."

3.4 SERVICE-METER ASSEMBLY INSTALLATION

- A. Install service-meter assemblies aboveground and per the local gas company requirements.
- B. Install metal shutoff valves upstream from service regulators.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.

3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing connector.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.

- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs.

3.10 PAINTING

- A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- C. Comply with requirements in Section 099600 "High Performance Coatings".

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, non-lubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
- D. Valves in branch piping for single appliance shall be the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping and "NSF-SEWER" for plastic sewer piping.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - 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 or Approved Equal:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. MIFAB, Inc.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8- inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment

rooms and service areas.

- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install steel piping according to applicable plumbing code.

- O. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500.

3.2 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 3. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 4. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 5. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have

been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping (all sizes) shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- C. Aboveground, vent piping (all sizes) shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Flashing materials.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified

testing agency.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts (CO):
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 2. Size: Same as connected drainage piping
 - 3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure: Countersunk, cast-iron plug.
 - 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 6. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts (CO):
 - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
 - 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 or Approved Equal:
 - 1) Smith, Jay R. Mfg. Co.
 - 2) Tyler Pipe.
 - 3) Watts Drainage Products.
 - 2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Cast-iron soil pipe with cast-iron ferrule.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Not required.
 - 7. Outlet Connection: Spigot.
 - 8. Closure: Brass plug with straight threads and gasket.
 - 9. Adjustable Housing Material: Cast iron with threads.
 - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains (FD):

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 or Approved Equal:
 - a. MIFAB, Inc.
 - b. Smith, Jay R. Mfg. Co.
 - c. Watts Drainage Products.
2. Standard: ASME A112.6.3.
3. Pattern: Area, Equipment Room (with funnel) and Kitchen Sanitary drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Required.
11. Top or Strainer Material: Nickel bronze
12. Top of Body and Strainer Finish: Nickel bronze.
13. Top Shape: Round and Square.
14. Dimensions of Top or Strainer: 6" round and 12"x12" square.
15. Top Loading Classification: Heavy Duty.
16. Funnel: Required.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Trap-seal primer valve drain connection.

2.3 FLASHING MATERIALS

- ### A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.

2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Applications: 12 oz./sq. ft.
 2. Vent Pipe Flashing: 8 oz. /sq. ft.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

- c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1- inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 223400 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fuel-fired water heaters:

1. Household, atmospheric, storage, gas water heaters.
2. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/ IESNA 90.1-2004.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): From date of Substantial Completion:
 - a. Household, Gas Water Heaters: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 HOUSEHOLD, GAS WATER HEATERS

- A. Household, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 1. Available Manufacturers:
 - a. American Water Heater Company.
 - b. Apollo Heating & Cooling; a division of State Industries, Inc.
 - c. Bradford White Corporation.
 - d. GSW Water Heating Company.
 - e. Lochinvar Corporation.
 - f. Maytag Corp.; Water Heating Appliances Div.
 - g. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - h. Ruud Water Heater Div.; Rheem Manufacturing Company.
 - i. Smith, A. O. Water Products Company.
 - j. State Industries, Inc.
 2. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1-2004 or ASHRAE 90.2-2004.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with atmospheric water heaters and for natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - j. Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
4. Draft Hood: Low-profile-type, draft diverter; complying with ANSI Z21.12.
5. Automatic Damper: ANSI Z21.66, mechanically activated automatic-vent-damper device with size matching draft hood.

B. Capacity and Characteristics:

1. Capacity: as presented on schedule.
2. Recovery: 43 gph at 100 deg F (56 deg C) temperature rise.
3. Temperature Setting: 120 deg F (52 deg C).
4. Fuel Gas Demand: 40 cfh
5. Fuel Gas Input: 40,000 Btu/h
6. Gas Pressure Required at Burner: 11 inches water column.
7. Electrical Characteristics:
 - a. Volts: 120.
 - b. Phase: Single.
 - c. Hertz: 60.
 - d. Full-Load Amperes: 15
 - e. Minimum Circuit Ampacity: 15
 - f. Maximum Overcurrent Protection: 25
8. Minimum Vent Diameter: 4 inches. Vent existing

2.3 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN 20).
- F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004 or ASHRAE 90.2-2004.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- B. Install gas water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- F. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

- G. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect installation, including connections.
- B. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 223400

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories and sinks.
 - 2. Laminar-flow faucet-spout outlets.
 - 3. Protective shielding guards.
 - 4. Fixture supports.
 - 5. Interceptors
 - 6. Shower receptors.
 - 7. Lavatories.
 - 8. Kitchen sinks.
 - 9. Service sinks.
 - 10. Service basins.
- B. Related Sections include the following:
 - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
 - 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and

tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B

PLUMBING FIXTURES
SECTION 224000

- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Slip-Resistant Bathing Surfaces: ASTM F 462.
 - 2. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
- I. Retain only subparagraphs below that match faucets, components, and features specified.
 - 1. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 2. Faucets: ASME A112.18.1.
 - 3. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 6. NSF Potable-Water Materials: NSF 61.
 - 7. Pipe Threads: ASME B1.20.1.
 - 8. Supply Fittings: ASME A112.18.1.
 - 9. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for bathtub bathtub/shower and shower faucets:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hand-Held Showers: ASSE 1014.
 - 6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - 7. Hose-Coupling Threads: ASME B1.20.7.
 - 8. Manual-Control Antiscald Faucets: ASTM F 444.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Brass Waste Fittings: ASME A112.18.2.

- L. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
 2. Hose-Coupling Threads: ASME B1.20.7.
 3. Off-Floor Fixture Supports: ASME A112.6.1M.
 4. Pipe Threads: ASME B1.20.1.
 5. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Period for Residential Applications of Shells: Five years from date of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or approved equal:
 - a. American Standard Companies, Inc.
 - b. Bradley Corporation.
 - c. Chicago Faucets.
 - d. Delta Faucet Company.
 - e. Eljer.
 - f. Elkay Manufacturing Co.
 - g. Fisher Manufacturing Co.
 - h. Grohe America, Inc.
 - i. Just Manufacturing Company.
 - j. Kohler Co.
 - k. Moen, Inc.
 - l. Royal Brass Mfg. Co.
 - m. Sayco; a Briggs Plumbing Products, Inc. Company.
 - n. Speakman Company.
 - o. T & S Brass and Bronze Works, Inc.
 - p. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Single-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: General-duty, solid brass
 - b. Finish: Polished chrome plate
 - c. Maximum Flow Rate: 1.2 gpm (4.2 L/min.)
 - d. Centers: 4 inches (102 mm)
 - e. Mounting: Deck, exposed
 - f. Valve Handle(s): Lever
 - g. Inlet(s): NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor
 - h. Spout: Rigid type.
 - i. Spout Outlet: Aerator
 - j. Operation: Noncompression, manual
 - k. Drain: Pop up
 - l. Tempering Device: Thermostatic.

2.2 BATHTUB FAUCETS

A. Bathtub Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or an approved equal:

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- a. American Standard Companies, Inc.
 - b. Brasstech Inc.; Newport Brass Div.
 - c. Broadway Collection.
 - d. Central Brass Manufacturing Company.
 - e. Delta Faucet Company.
 - f. Eljer.
 - g. Gerber Plumbing Fixtures LLC.
 - h. Grohe America, Inc.
 - i. Hansgrohe Inc.
 - j. Kohler Co.

 - k. Moen, Inc.
 - l. Paul Decorative Products.
 - m. Pegler, Ltd.
 - n. Powers; a Watts Industries Co.
 - o. Royal Brass Mfg. Co.
 - p. Sayco; a Briggs Plumbing Products, Inc. Company.
 - q. Speakman Company.
 - r. Sterling Plumbing Group, Inc.
 - s. St. Thomas Creations.
 - t. Symmons Industries, Inc.
 - u. T & S Brass and Bronze Works, Inc.
 - v. Wolverine Brass, Inc.
2. Description: Single-control mixing valve. Include hot- and cold-water indicators and tub spout. Coordinate faucet inlets with supplies.
- a. Body Material: Solid brass.
 - b. Finish: Polished chrome plate.
 - c. Mounting: Wall.
 - d. Valve Handle(s): Lever
 - e. Bathtub Spout: Chrome-plated brass with diverter.
 - f. Operation: Noncompression, manual.
 - g. Supply Connections: NPS 1/2 (DN 15) Sweat.

2.3 BATHTUB/SHOWER FAUCETS

A. Bathtub/Shower Faucets:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or approved equal:
 - a. American Standard Companies, Inc.
 - b. Brasstech Inc.; Newport Brass Div.
 - c. Broadway Collection.
 - d. Central Brass Manufacturing Company.
 - e. Chicago Faucets.
 - f. Delta Faucet Company.
 - g. Eljer.

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- h. Gerber Plumbing Fixtures LLC.
 - i. Hansgrohe Inc.
 - j. Kohler Co.
 - k. Leonard Valve Company.
 - l. Moen, Inc.
 - m. Paul Decorative Products.
 - n. Pegler, Ltd.
 - o. Powers; a Watts Industries Co.
 - p. Price Pfister, Inc.
 - q. Rohl LLC.
 - r. Royal Brass Mfg. Co.

 - s. Sayco; a Briggs Plumbing Products, Inc. Company.
 - t. Speakman Company.
 - u. Sterling Plumbing Group, Inc.
 - v. St. Thomas Creations.
 - w. Symmons Industries, Inc.
 - x. T & S Brass and Bronze Works, Inc.
 - y. Wolverine Brass, Inc.
 - z. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation.
 - aa. Zurn Plumbing Products Group; Wilkins Operation.
2. Description: Single-handle thermostatic/pressure-balance valve for bathtub and for shower. Include hot- and cold-water indicators; check stops; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies; coordinate outlet with diverter valve.
- a. Body Material: Solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
 - d. Diverter Valve: Integral with mixing valve.
 - e. Mounting: Wall.
 - f. Bathtub Spout: Chrome-plated.
 - g. Operation: Noncompression, manual.
 - h. Antiscald Device: Integral with mixing valve.
 - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - j. Supply Connections: NPS 1/2 (DN 15) Sweat.
 - k. Backflow Protection Device for Hand-Held Shower: Required
 - l. Shower Head Type: Ball joint
 - m. Shower Head Material: Metallic with chrome-plated finish.
 - n. Spray Pattern: Fixed.
 - o. Integral Volume Control: Required.
 - p. Shower-Arm Flow-Control Fitting: 1.5 gpm (5.7 L/min).

2.4 SINK FAUCETS

A. Sink Faucets:

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or an approved equal:
 - a. American Standard Companies, Inc.
 - b. Bradley Corporation.
 - c. Broadway Collection.
 - d. Chicago Faucets.
 - e. Delta Faucet Company.
 - f. Dormont Manufacturing Company.
 - g. Eljer.
 - h. Elkay Manufacturing Co.
 - i. Fisher Manufacturing Co.
 - j. Grohe America, Inc.
 - k. Just Manufacturing Company.
 - l. Kohler Co.
 - m. Moen, Inc.
 - n. Royal Brass Mfg. Co.
 - o. Sayco; a Briggs Plumbing Products, Inc. Company.
 - p. Speakman Company.
 - q. T & S Brass and Bronze Works, Inc.
 - r. Zurn Plumbing Products Group; Wilkins Operation.
2. Description: Kitchen faucet with spray, four-hole fixture. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: General-duty, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.5 gpm (9.5 L/min), unless otherwise indicated.
 - d. Mixing Valve: Single control.
 - e. Centers: 4 inches (102 mm).
 - f. Mounting: Deck.
 - g. Handle(s): Lever.
 - h. Inlet(s): NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter
 - i. Spout Type: Swivel gooseneck.
 - j. Spout Outlet: Aerator
 - k. Operation: Noncompression, manual.
 - l. Drain: Grid.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

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 or an approved equal:

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products.
 - f. TRUEBRO, Inc.
 - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

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. TRUEBRO, Inc.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.6 FIXTURE SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Lavatory Supports:
1. Description: lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

2.7 INTERCEPTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Sediment Interceptors:
1. Description: Manufactured unit with removable screens or strainer and removable cover; designed to trap and retain waste material.
 - a. Material: stainless-steel.
 - b. Pipe Connections: NPS 2 (DN 50)

2.8 LAVATORIES

- A. Lavatories:
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 or approved equal:
 - a. American Standard Companies, Inc.
 - b. Barclay Products, Ltd.
 - c. Briggs Plumbing Products, Inc.
 - d. Crane Plumbing, L.L.C./Fiat Products.
 - e. Eljer.
 - f. Gerber Plumbing Fixtures LLC.
 - g. Kohler Co.
 - h. Mansfield Plumbing Products, Inc.
 - i. Peerless Pottery, Inc.
 - j. Sterling Plumbing Group, Inc.
 - k. St. Thomas Creations.
 2. Description: Accessible, wall-mounting, vitreous-china fixture.
 - a. Type: Ledge back.
 - b. Size: 19 by 16 inches (483 by 406 mm) rectangular.
 - c. Faucet Hole Punching: Three holes, 2-inch (51-mm)
 - d. Faucet Hole Location: Top.

TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B

PLUMBING FIXTURES
SECTION 224000

- e. Color: White
- f. Faucet: Lavatory with pop-up waste.
- g. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
- h. Drain: Grid.
 - 1) Location: Near back of bowl.
- i. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) tubular brass waste to wall; and wall escutcheon.
 - 1) Exception: Omit P-trap if hair interceptor is required.
- j. Protective Shielding Guard(s): provide
- k. Fixture Support: Lavatory provide

B. Lavatories:

- 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. American Standard Companies, Inc.
 - b. Barclay Products, Ltd.
 - c. Briggs Plumbing Products, Inc.
 - d. Crane Plumbing, L.L.C./Fiat Products.
 - e. Eljer.
 - f. Gerber Plumbing Fixtures LLC.
 - g. Kohler Co.
 - h. Mansfield Plumbing Products, Inc.
 - i. Peerless Pottery, Inc.
 - j. Sterling Plumbing Group, Inc.
 - k. St. Thomas Creations.
- 2. Description: Undercounter-mounting vitreous-china fixture.
 - a. Type: Flat rim with ledge.
 - b. Oval Lavatory Size: 20 by 17 inches (508 by 432 mm)
 - c. Faucet Hole Punching: Three holes, 2-inch (51-mm) centers
 - d. Faucet Hole Location: Top.
 - e. Color: White.
 - f. Faucet: Lavatory with pop-up waste.
 - g. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - h. Drain: Grid.
 - 1) Location: Near back of bowl.

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- i. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) tubular brass waste to wall; and wall escutcheon.
- j. Protective Shielding Guard(s): provide

2.9 BATHTUBS

A. Bathtubs,:

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. Acryline USA, Inc.
 - b. American Standard Companies, Inc.
 - c. Aqua Bath Company, Inc.
 - d. Aqua Glass Corporation.
 - e. Aquatic Industries, Inc.
 - f. Best Bath Systems; a div. of Fiberglass Systems, Inc.
 - g. Clarion Bathware.
 - h. Crane Plumbing, L.L.C./Fiat Products.
 - i. Florestone Products Co., Inc.
 - j. Kohler Co.
 - k. Lyons Industries, Inc.
 - l. Mansfield Plumbing Products, Inc.; Acrylic Operations.
 - m. Praxis Industries, Inc.; Aquarius Products.
 - n. St. Thomas Creations.
 - o. Swan Corporation (The).
2. Description: Enameled, cast-iron fixture.
 - a. Bathing Surface: Slip resistant.
 - b. Size: 66 by 30 inches (1680 by 765 mm) with front apron.
 - c. Color: White.
 - d. Drain Location: Left or right end depending on existing conditions.
 - e. Faucet: Bathtub/shower.
 - f. Supplies: NPS 1/2 (DN 15) copper tubing with globe valves.
 - g. Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - h. Drain Piping: Existing

2.10 KITCHEN SINKS

A. Kitchen Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or approved equal:
 - a. Dayton Products, Inc.
 - b. Eljer

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- c. Elkay Manufacturing Co.
 - d. Franke Consumer Products, Inc., Kitchen Systems Div.
 - e. Just Manufacturing Company.
 - f. Kohler Co.
 - g. Moen, Inc.
 - h. Revere Sink.
 - i. Sterling Plumbing Group, Inc.
 - j. Teka USA.
 - k. WhiteRock Corp.
2. Description: Two-bowl, residential, counter-mounting, stainless-steel kitchen sink for UFAS residential units.
- a. Overall Dimensions: 33 inches by 22 inches
 - b. Metal Thickness: 0.038 inch (1.0 mm).
 - c. Bowl:
 - 1) Dimensions: 16 inches by 14 inches by 6 inches deep
 - 2) Drain: 3-1/2-inch (89-mm) grid.
 - a) Location: Center of bowl.
 - d. Sink Faucet: See drawings for schedule
 - e. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
 - f. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall and wall escutcheon(s).
- B. Kitchen Sinks:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or approved equal:
- a. Dayton Products, Inc.
 - b. Eljer
 - c. Elkay Manufacturing Co.
 - d. Franke Consumer Products, Inc., Kitchen Systems Div.
 - e. Just Manufacturing Company.
 - f. Kohler Co.
 - g. Moen, Inc.
 - h. Revere Sink.
 - i. Sterling Plumbing Group, Inc.
 - j. Teka USA.
 - k. WhiteRock Corp.
2. Description: Two-bowl, residential, counter-mounting, stainless-steel kitchen sink.
- a. Overall Dimensions: 33 inches by 22 inches
 - b. Metal Thickness: 0.038 inch (1.0 mm).
 - c. Bowl:

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

- 1) Dimensions: 16 inches by 14 inches by 8 inches deep
- 2) Drain: 3-1/2-inch (89-mm) grid.
 - a) Location: Center of bowl.
- d. Sink Faucet: See drawings for schedule
- e. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
- f. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall and wall escutcheon(s).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 1. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install wall-mounting fixtures with tubular waste piping attached to supports.
- D. Install counter-mounting fixtures in and attached to casework.
- E. Install fixtures level and plumb according to roughing-in drawings.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 1. Exception: Use globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- J. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- K. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- L. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
- M. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- N. Set bathtubs in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- O. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings for ADA and UFAS residential units. .
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

**TASK ORDER CONTRACT NO. 33
GLEN HAZED HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**PLUMBING FIXTURES
SECTION 224000**

END OF SECTION 224000

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Fire stopping.
9. Equipment rails.
10. Pipe portals.
11. Concrete bases.
12. Supports and anchorages.
13. Access doors and panels.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Escutcheons.
3. Equipment rails.
4. Pipe portals.
5. Access doors and panels.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Deliver ducts with shop-applied plastic covers over each opening of every duct. Prior to applying the plastic covers on each duct, vacuum all dirt and debris from its interior. Maintain the plastic covers through shipping and storage. Handle ducts to prevent damage to the ducts and to the plastic covers. If a duct's plastic cover(s) is damaged or comes loose, re-vacuum the interior of the duct and apply new plastic covers. The plastic cover shall be maintained over the openings of each duct until that duct is ready to be installed.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place

concrete and other structural components as they are constructed.

- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- D. Cooperation and Coordination with Other Trades:
 - 1. This HVAC trade must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications. This is particularly important regarding Division 26 - Electrical.

1.7 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
- B. Any apparatus, appliance, material or work not typically shown on drawings as standard industry practice but is mentioned in the specifications, or vice versa, shall be provided by the HVAC Trade without additional expense to the Owner.
- C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.
- D. Due to the small scale of the drawings, all offsets and fittings required for a complete installation may not be shown but shall be provided at no change in Contract price.
- E. The equipment schedules shown on the drawings list the manufacturer used as the basis of design in the preparation of the Bid Drawings. The equipment specifications list that manufacturer as well as other manufacturers the Engineer, Architect and/or Owner find acceptable from a performance and product quality standpoint. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they have a positive or negative monetary impact on the design shown on the Bid Drawings. In addition, listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether the dimensions of these products will have a negative impact on the space allotted for this equipment. If the Contractor or his Subcontractors decide to use a product or manufacturer that is listed as acceptable in the specifications but is different from the product or manufacturer scheduled on the drawings, it will be the responsibility of the Contractor or his Subcontractors to fully explore the product to ensure that it can be installed in the space allotted and shall pay any and all costs (including additional professional design fees) associated with the use of these products or manufacturers that impact the structure, the electrical system(s),

the plumbing system(s) and/or the fire protection system(s) due to an increase in weight, electrical load, drain and vent requirements, connection sizes, etc., between the scheduled item and the equipment item used.

1. Use of a product or manufacturer not scheduled on the Bid Drawings constitutes a representation that:
 - a. The HVAC Trade has investigated the proposed product and determined that the product can be installed within the space allotted.
 - b. The HVAC Trade will coordinate the installation of product used into the work
 - c. The HVAC Trade will be responsible for making all changes as may be required to make the work complete in all respects; waives all claims for additional costs under his responsibility, which may subsequently become apparent.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers or Approved Equal:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation
- D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers or Approved Equal:
 - a. Perfection Corporation
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Victaulic Company of America.

2.4 SLEEVES

- A. Galvanized-Steel Sheet (For Ductwork Only): 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that

completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw, and chrome plated finish.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic- cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.7 METAL SUPPORTS AND ANCHORAGES

- A. Structural design shall be provided through the HVAC trade by a civil or structural Engineer who is registered in the Commonwealth of Pennsylvania.
- B. Details of all structural steel shall be provided in shop drawing format. All structural steel shop drawings shall be stamped by the HVAC Trade's design Engineer prior to submittal.
- C. The design, materials, fabrication and erection shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges", of the American Institute of Steel Construction, and also, when applicable,

shall conform to the "Code for Welding Building Construction" of the American Welding Society.

- D. Steel angles, channels, and plate shall be in accord with ASTM A36.
- E. Bolts, including nuts and washers, used for fabricating steel members shall be in accord with ASTM A325.
- F. Steel members, including fasteners, exposed to weather shall be galvanized.
- G. Refer to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" for additional requirements for hanging and supporting HVAC piping, ductwork and equipment.

2.8 FIRESTOPPING

- A. Firestopping material shall be in accordance with ASTM E 814 or UL 1479. Provide intumescent fire caulk.

2.9 EQUIPMENT RAILS

- A. The HVAC trade shall furnish equipment rails to support roof-mounted equipment items, such as condensing units which are not furnished with factory built curbs. The equipment rails shall be 18 gauge galvanized steel, monolithic construction, with integral base plate, continuous welded corners, and wood nailer with 18 gauge galvanized steel counter-flashing and insulated with 1-1/2 inch, 3 pound density rigid fiberglass board. All equipment rails shall be designed and rated for the loads which will be applied to them. Height of raised built-in cant to be determined in field.
- B. Equipment rails shall be similar to the Roof Products Systems (RPS) Type ER-4.

2.10 PIPE PORTALS

- A. The HVAC Contractor shall furnish factory built pipe portals at all locations where pipes or conduit penetrates the roof.
- B. Factory built pipe portals shall be of box section design, 18 gauge galvanized steel with continuous welded corner seams, factory installed wood nailer and insulated with 1-1/2 inch, 3 pound density rigid fiberglass board. Height of raised built-in cant to be determined in field. Minimum height of the pipe portal shall be 24 inches. The curb cover shall be a laminated acrylic ABS plastic cover with pre-punched mounting holes and molded sealing ring on a collared opening and an EPDM compression molded rubber cap.
- C. The base of each pipe portal shall be pitched to match the roof pitch while maintaining a vertical pipe installation.

- D. Roof curbs shall be similar to the Roof Products Systems (RPS) Type RC-4.

2.11 ACCESS DOORS AND PANELS

- A. Provide access doors and panels of the type that can be finished the same as the construction in which installed, except furnish stainless steel doors and/or panels for kitchens, toilet rooms, janitor's closet, or where indicated. Doors and/or panels shall be of sufficient size for the intended function, but not less than 12 inches by 16 inches.
- B. The General Trade and HVAC Trade shall determine door and/or panel locations subject to the Architect's approval. Locate items to be made accessible through doors and/or panels so that the doors and/or panels may be installed with not less than 6 inches between an edge and the surface of any intersecting construction or opening.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed or where new equipment is to be installed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. The HVAC trade shall demolish all work as outlined on the drawings.
- E. The Owner shall decide the disposition of all removed materials. The HVAC trade shall deliver to the Owner all materials identified to be salvaged. The HVAC trade shall properly dispose of all materials not identified to be salvaged.

- F. Refer to the paragraph entitled "Special Conditions Related to HVAC Work" in this section for requirements related to utility shut downs, capping of existing system, and air balancing services which may be required.
- G. When demolishing existing equipment, the HVAC trade shall remove all existing piping, ductwork, insulation, supports, hangers, hanger rods, anchor bolts, structural steel, and concrete pads related to the work being removed. When demolishing piping or ductwork branch runouts, remove the entire branch which is accessible above lay-in ceilings or accessible during the construction period back to the main, unless otherwise noted. When demolishing equipment and diffusers and the branch runouts are inaccessible, cap, seal, and abandon the branch runouts in an approved manner.
- H. Where demolition of work results in unsightly openings in occupied spaces or jeopardizes the integrity of a fire or smoke barrier, the opening shall be patched in accordance with the paragraph in this section entitled "Cutting and Patching".
- I. Where demolition requires the removal of a concrete equipment pad, remove the pad, cut all anchor bolts, dowel pins, and steel bases off flush with the floor so as to eliminate any tripping hazard. Fill any openings, voids, or holes with a fine cement grout or another appropriate floor patching material. Provide surface finish to match adjacent flooring material.

3.2 CUTTING AND PATCHING

- A. The HVAC trade shall seal all openings penetrating fire-rated floors, ceilings or partitions after work has been installed. The material used for sealing the openings shall have a fire-rating equal to or greater than the rating of the floor, ceiling or partition material.
- B. The HVAC trade shall be responsible for providing all cutting, patching, and finishing of existing construction which is not specifically shown on the Architectural Drawings and which is required for the proper installation of his equipment and materials which are to be installed in the existing portion of this project. This work shall also be provided when removing existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project.
- C. Cutting, patching and finishing shall be performed by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas. All finishing shall match the undisturbed adjacent areas. Painting of the final finished areas, where general construction work occurs, will be the responsibility of the General Trade. Painting of the final finished areas, where no general construction work occurs, shall be the responsibility of the HVAC trade. The HVAC trade shall paint entire plane in which damage occurs whether the surface is a wall or a ceiling.
- D. No cutting shall be done which may affect the building structurally or architecturally

without first consulting with the General Trade and then securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the HVAC trade shall be required, at his own expense, to repair the damaged areas. Note: all holes or openings in existing concrete or masonry shall be drilled, core bored or saw cut.

- E. Where present equipment or material is removed and unused openings remain in walls, floors, partitions, etc., the HVAC trade shall properly patch all such openings.

3.3 SPECIAL CONDITIONS RELATED TO HVAC WORK

- A. During the course of construction, cap or otherwise seal off, in an approved manner, those portions of the piping or duct system in which work is not being performed, in order to prevent the entry of dirt or dust. Should the HVAC trade fail to cover open ends of ducts, he may be required to vacuum the entire duct system and remove sections of ductwork for inspection.
- B. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.
- C. Do not install piping and ductwork in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the piping and/or ductwork serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install piping and ductwork adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.
- D. Exposed piping shall be run so as to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves, and fittings.
- E. Lay out the work and establish all heights and grades required for installation.
- F. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety requirements of OSHA shall be met.

3.4 SPACE PRIORITY

- A. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems.
 2. Vent piping systems.
 3. Ceiling recessed lighting fixtures.
 4. Concealed air terminal units, fans.
 5. Air duct systems.
 6. Sprinkler systems piping.
 7. Forced flow piping systems.
 8. Electrical conduit, wiring, control wiring.
- B. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.
- C. Change in order of priority is permissible by mutual agreement of all affected trades.
- D. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.
- E. The work of a particular trade shall not obstruct access for installation, operation, and maintenance of the Work, materials and equipment of another trade.

3.5 PIPING SYSTEMS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.

- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep- pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece (for drywall type ceilings) or split-casting (for lay-in type ceilings), cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces and Equipment Rooms: One-piece, cast-brass type with polished rough-brass finish.
 - f. Bare Piping at Floor Penetrations in Unfinished Service Spaces and Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 8 (DN 200).
 - 4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for material and installation requirements of joint sealants.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings,

and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Provide intumescent fire caulk.

- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.6 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry or Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.8 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.9 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
 - 1. Construct concrete bases of dimensions indicated, but not less than 3 inches (75 mm) larger in both directions than supported unit.
 - 2. 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 the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Provide all materials, equipment, supplies and labor necessary to construct all miscellaneous steel required for supporting piping, ductwork and equipment for installation of the HVAC system. All miscellaneous steel, metal supports and anchorages required for supporting ductwork, piping and equipment is not shown on the Drawings, but shall be provided.

- B. All structural steel shall be designed to attach to the main building structure in such a manner as to not overstress this structure. Reinforcement of the building structure may be required in work areas located in existing buildings and in areas where the HVAC trade has relocated ductwork, piping, and equipment to areas other than is shown on the Drawings.
- C. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- D. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- E. Shop and Field Welding: Shop and field welding shall be in accordance with AWS D1.1.

3.12 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.13 FIRESTOPPING

- A. Firestopping is required in the following locations:
 - 1. Where exposed and concealed horizontal ducts penetrate fire rated walls and shaft walls, except where fire dampers are installed in ducts.
 - 2. Where exposed and concealed vertical ducts penetrate rated and non-rated floors, except where fire dampers are installed in ducts.
- B. Clean surfaces to be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

- C. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.
- D. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.
- E. Where large openings are created in walls or floors to permit installation of ducts or other items, close unused portions of opening with firestopping material tested for the application.
- F. Fill annular space between duct and sleeve, with approved material. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.
- G. Damming material may be temporary non-fire approved, or permanent fire-approved. Where permanent fire-approved damming material is used, depth of firestopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of firestopping material.
- H. Seal all gaps or voids in cured foam with material to match the firestopping material.
- I. Trim excess cured foam from around all openings and leave smooth, flush surface.
- J. Position metal collar on duct penetrating floors or walls in air plenums and air shafts. Secure neck of collar to duct with screws.

3.14 INSTALLATION OF EQUIPMENT RAILS

- A. Prefabricated equipment rails shall be furnished by the HVAC Trade and delivered to the General Trade. The equipment rails, including base flashing, shall be installed by the General Trade. Counter flashing shall be provided by the General Trade.

3.15 INSTALLATION OF PIPE PORTALS

- A. Prefabricated pipe portals shall be furnished by the HVAC Trade and delivered to the General Trade. The pipe portals, including base flashing, shall be installed by the General Trade. Counter flashing shall be provided by the General Trade.
- B. Cutting of roof deck will be performed by the General Trade. The HVAC Trade shall coordinate the exact opening sizes with the entity designated to cut the roof deck to ensure roof deck is not over-cut. Verify the exact opening requirements with the unit manufacturer.

3.16 INSTALLATION OF ACCESS DOORS AND PANELS

A. Access Doors and Panels:

1. Where HVAC devices which require periodic maintenance, cleaning or adjustment will be concealed in shafts, chases, above drywall ceilings and in other inaccessible general construction work, the HVAC Trade shall furnish and install access doors and panels for all such devices. These HVAC devices include, but are not limited to, valves, traps, air vents, cleanouts, damper regulators, fire dampers, smoke dampers, controls and other devices,
2. The HVAC Trade in conjunction with the General Trade shall determine door and/or panel locations subject to the Architect's approval. Locate items to be made accessible through doors and/or panels so that the doors and/or panels may be installed with not less than 6 inches between an edge and the surface of any intersecting construction or opening.
3. Access doors and panels shall be installed in accordance with the manufacturers written recommendations and Division 08 of these Specifications.

3.17 DUCT-MOUNTED SMOKE DETECTOR INSTALLATION

- A. All duct-mounted smoke detectors will be furnished by the Electrical Trade. The HVAC Trade shall install all duct-mounted smoke detectors furnished by the Electrical Trade under this project.
- B. The Electrical Trade will provide all power wiring and will provide all fire alarm system control wiring for all duct-mounted smoke detectors.
- C. The HVAC Trade shall provide all control wiring from the smoke detector(s) auxiliary contacts to its associated system supply and/or return fan(s) motor starter(s) for the purpose of de-energizing the fan motor when smoke is detected within the duct system.

3.18 PIPING VENTS

- A. For all regulators, gas solenoid valves, etc., serving gas-fired equipment, the HVAC Trade shall extend vents from their vent connections to the exterior of the building. The vents shall be terminated a minimum of 10-feet from any building opening or air intake. Vents shall not be combined. The size of each vent shall be equal to or greater than the vent connection size of the equipment item it serves.

3.19 FINAL HVAC CONNECTIONS

- A. Provide rough-in and final connection of all HVAC services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings.

- B. In general, connection and termination points are given in the Contract Documents. Where not given or where conflicts occur, refer the question to the Architect for a binding decision.

3.20 RECORD DOCUMENTS

- A. The HVAC Trade shall also submit the following:
 - 1. Red-line a clean set of Specifications to indicate approved substitutions, change orders and actual equipment and materials used and installed.
 - 2. Furnish to the Architect a CD-Rom containing all of the HVAC Drawings. The Drawings shall be in Microstation 2004 format or later, and shall show all “as-built” conditions. The Drawings shall indicate all changes made during construction, including tagging and room names.

END OF SECTION

SECTION 230511 - ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Starters
- B. Disconnect Switches
- C. Fuses
- D. Duct Mounted Smoke Detector Installation
- E. Piping and Ductwork Coordination

1.2 RELATED WORK

- A. All Division 23 Sections are related to this section.
- B. Division 26: Electrical

1.3 SUBMITTALS

- A. Submit manufacturer's data and wiring diagrams on the following:
 - 1. Combination Motor Starters.
- B. The following items shall be submitted with the equipment that it serves.
 - 1. Disconnect Switches.
 - 2. Motors

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS or Approved Equal.

- A. Motors
 - 1. General Electric or Approved Equal.

2. Reliance Electric or Approved Equal.
3. Baldor or Approved Equal.
4. Marathon Electric or Approved Equal.

B. Motor Starters

1. General Electric or Approved Equal.
2. Square D or Approved Equal.
3. Furnas or Approved Equal.
4. Cutler-Hammer or Approved Equal.
5. Allen-Bradley or Approved Equal.

C. Disconnect Switches

1. Square D or Approved Equal.
2. Cutler Hammer or Approved Equal.
3. General Electric or Approved Equal.
4. Westinghouse or Approved Equal.

D. Fuses

1. Bussman Division of Cooper Industries, Inc. or Approved Equal.
2. Shawmut Division of Gould, Inc. or Approved Equal.
3. Littlefuse, Inc. or Approved Equal.

2.2 STARTERS

- A. The HVAC Contractor shall furnish properly-sized starters for all three-phase motors provided under section 230513. Starters shall be as follows, unless provided as a part of packaged equipment or noted otherwise elsewhere. All starters shall be standard NEMA sizes and be UL-listed. Starters for indoor locations shall have NEMA 1 enclosure. Starters for outdoor locations shall have NEMA 3R enclosure. Where motors will operate at a different temperature than the starters serving them provided ambient compensated overload relays. Furnish overload heaters sized for the nameplate running amps of the motor protected.

- B. For all three-phase motors, the HVAC Contractor shall furnish a magnetic combination starter with fusible disconnect switch, Hand-Off-Auto switch and red "run" pilot light on cover, integral 120V secondary control transformer with dual primary fusing and a fuse in a hot secondary leg, one normally open auxiliary contact and a NEMA class 20 three-phase overload relay.

For starters with external control voltages, furnish an auxiliary contact on the disconnect switch to disconnect the external voltage source when the disconnect switch is off.

- C. For three-phase two-speed motors, the HVAC Contractor shall furnish a combination magnetic starter as specified herein with the following exceptions; provide a High-Off-Low-

Auto cover switch in lieu of a Hand-Off-Auto cover switch, high and low speed contactors must be electrically and mechanically interlocked to prevent simultaneous pull in and provide a low speed compelling relay and deceleration relay factory wired in starter enclosure.

- D. All safety devices shall be wired so that they stop the motor with the Hand-Off-Auto switch in the Hand as well as the Auto position. This will normally mean breaking the common wire from the Hand-Off-Auto switch to the starter's holding coil through the safety devices.

2.3 DISCONNECT SWITCHES

- A. The HVAC Contractor shall provide a disconnect switch for each piece of HVAC equipment.
- B. Non-fused disconnect switches may be used provided that the equipment name-plate makes no reference to "maximum fuse size", "fuse size" or "MFS".
- C. Disconnect switches specified as being an integral part of a piece of equipment shall come factory installed and wired.

2.4 FUSES

- A. All fuses shall be Class RK1, time delay type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Electrical Contractor shall be responsible for proper direction of rotation of all three phase equipment.
- B. Equipment delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions by the HVAC Contractor furnishing the equipment.
- C. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not exceeding 18" in length.
- D. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.
- E. All electrical work required in the HVAC Contracts shall conform to all applicable requirements of Division 16 of these Specifications, and shall comply with the latest edition of the National Electric Code.

- F. The HVAC Contractor shall assign all low-voltage and line-voltage Electrical Control Work required under this Contract to the Automatic Temperature Control Sub-Contractor, who shall perform this work with qualified electricians employed by that Sub-Contractor.
- G. The HVAC Contractor shall co-operate with the contractor for Electrical Work in making all necessary tests and in receiving, storing and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these Contracts.
- H. Single phase equipment controls and wiring shall be as follows:
 - 1. HVAC Contractors shall retain the services of an ATC Contractor, who shall furnish and install all control devices, such as motor sentinel switches, PE switches, thermostats, etc.
 - 2. The Electrical Contractor shall complete all power wiring and connections for single phase equipment, through the disconnect and/or the thermal cutouts and local control stations to the equipment as required.
 - 3. The HVAC Contractor will furnish a THERMAL OVERLOAD SWITCH for all single phase motors except where units are furnished with built-in Thermal Protection, in which case he will furnish a single pole switch.
- I. Three phase equipment controls and wiring shall be as follows:
 - 1. The HVAC Contractor shall furnish all combination motors starters. The Electrical Contractor shall install all combination motor starters.
 - 2. The HVAC Contractor shall retain the services of an ATC Contractor, who shall furnish and install all control devices, such as EP and PE switches, thermostats, etc.
 - 3. The ATC Contractor shall furnish and install all controls and control wiring from control devices to motor starters and contactors and between control devices.
 - 4. The Electrical Contractor shall complete all electrical connections through the disconnect, starter and motor terminals of all three phase equipment. He shall be responsible for all power wiring and connections.

3.2 DUCT-MOUNTED SMOKE DETECTOR INSTALLATION

- A. All duct-mounted smoke detectors will be furnished by the Electrical Contractor. The HVAC Contractors shall install all duct-mounted smoke detectors furnished by the Electrical Contractor under this project.
- B. The Electrical Contractor will provide all power wiring for duct-mounted smoke detectors.
- C. The HVAC contractor shall provide all control wiring from the smoke detector(s) auxiliary contacts to its (their) associated system supply and/or return fan(s) motor starter(s) for the purpose of de-energizing the fan motor when smoke is detected within the duct system.

3.3 PIPING AND DUCTWORK COORDINATION

- A. The HVAC Contractor shall not run ductwork or piping above switchboards or panelboards in accordance with the National Electric Code Article 384. Before ductwork or piping is installed coordinate the exact locations with the Electrical Contractor. Failure to comply with this requirement shall be cause for the duct- work and piping to be removed and relocated at no additional cost to the Owner.

END OF SECTION

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 1000 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer or Approved Equal.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes:** Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes:** ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves:** ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves:** 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- 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 or Approved Equal:
1. Advance Products & Systems, Inc.
 2. CALPICO, Inc.

3. Metraflex Company (The).
 4. Pipeline Seal and Insulator, Inc.
 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Provide intumescent fire caulk.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Provide intumescent fire caulk.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

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

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.

END OF SECTION

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze angle valves.
 - 2. Brass ball valves.
 - 3. Bronze ball valves.
 - 4. Iron ball valves.
 - 5. Iron, single-flange butterfly valves.
 - 6. Bronze swing check valves.
 - 7. Bronze globe valves.
 - 8. Iron globe valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer or Approved Equal.

- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

- 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:
 - 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 or Approved Equal.
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.
- B. Class 150, Bronze Angle Valves with Bronze Disc:
 - 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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.

2.3 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.

- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

2.5 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

- 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 or Approved Equal.
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Sure Flow Equipment Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Split body.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Ends: Flanged.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

2.6 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

- 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 or Approved Equal.
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.

- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Stainless steel.
- B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - 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 or Approved Equal.
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Stainless steel.

2.7 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 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 or Approved Equal.

- a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - 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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.8 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:
 - 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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.

- d. NIBCO INC.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

- 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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

- 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 or Approved Equal.
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chain wheels on operators for valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service except Steam: Calibrated balancing valves.
 - 4. Throttling Service, Steam: Globe or angle valves.
 - 5. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve- end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

1.2 DEFINITIONS

- A. MSS:** Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design:** Design trapeze pipe hangers and equipment supports, including comprehensive Professional analysis by a qualified professional, using performance requirements and design criteria indicated.
- B. Structural Performance:** Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 ACTION SUBMITTALS

- A. Product Data:** For each type of product indicated.
- B. Shop Drawings:** Signed and sealed by a qualified professional Professional. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional Professional responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made

from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U- bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- 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 or Approved Equal:
 - 1. ERICO International Corporation.
 - 2. National Pipe Hanger Corporation.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 5. Piping Technology & Products, Inc.
 - 6. Value Professional Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig with minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon- steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A.** Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B.** Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1.** Properties: Non-staining, noncorrosive, and nongaseous.
 - 2.** Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A.** Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B.** Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1.** Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2.** Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C.** Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D.** Fastener System Installation:
 - 1.** Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2.** Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

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

abraded areas of shop paint on miscellaneous metal as required.

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off- center closure for hanger installation before pipe erection.
 - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non- insulated, stationary pipes NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 - 7. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 9. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and

contraction might occur.

- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I- beams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I- beams for heavy loads, with link extensions.
 - 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1- 1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 7. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

**ARMDC TASK ORDER CONTRACT NO. 33
GLEN HAZEL HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**HANGERS AND SUPPORTS FOR
HVAC PIPING AND EQUIPMENT
230529**

END OF SECTION

SECTION 230548 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Restrained isolation roof-curb rails.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For each vibration isolation device.
 - 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For testing agency.
- C. Welding certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For restrained-air-spring mounts to include in operation

and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS (Type A)

- A. Elastomeric Isolation Pads:
 - 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 or Approved Equal.
 - a. Kinetics Noise Control, Inc.
 - b. Mason Industries, Inc.
 - c. Vibration Eliminator Co., Inc.
 - d. Vibration Mountings & Controls, Inc.
 - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 3. Size: Factory or field cut to match requirements of supported equipment.
 - 4. Pad Material: Oil and water resistant with elastomeric properties.
 - 5. Surface Pattern: Waffle pattern.
 - 6. Infused nonwoven cotton or synthetic fibers.
 - 7. Load-bearing metal plates adhered to pads.
 - 8. Sandwich-Core Material: Resilient and elastomeric.

2.2 RESTRAINED ISOLATION ROOF-CURB RAILS (Type E)

- 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 or Approved Equal.
 - 1. Kinetics Noise Control.
 - 2. Mason Industries, Inc.
 - 3. Thybar Corporation.
- B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment.
- C. Upper Frame: Upper frame shall provide continuous and captive support for equipment.

- D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials and shall be insulated with a minimum of 2 inches of rigid glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

3.3 PIPING AND DUCTWORK ISOLATION

- A. Isolate piping hangers connected within 30'-0" of any rotating equipment with Type "D"

hanger rod isolators with 1-inch static deflection.

- B. Isolate all ductwork and piping in mechanical rooms with Type "D" hanger rod isolators with 1- inch static deflection.
- C. Isolate all ductwork connected within 30'-0" of air-handling units, exhaust fans and rotating equipment with Type "D" hanger rod isolators with 1-inch static deflection.
- D. Provide flexible connections at all connections of pipe to rotating equipment and sheet metal to rotating equipment.
- E. Guide and anchor piping in shafts as required with approved resilient mounting preventing direct contact of piping with building structure.
- F. Suspend isolators from rigid and massive support points.
- G. Adjust as required all isolators to eliminate all contact of the isolated rod with the hanger rod box retainer or short circuiting of the spring.
- H. Supplementary steel to be sized for a maximum deflection of 0.08 inches at the center span.

3.4 VIBRATION ISOLATION SCHEDULE

Equipment Type	Tag Number	Isolator Type	Min. Static Deflection (in
Roof-mounted Fans		E, DC	1.5

ISOLATOR TYPES:

- A Neoprene Pads
- B Restrained Spring
- C Spring Hangers
- D Vibration Isolation Curb
- TH Thrust Restraints
- FC-1 Neoprene Piping Flexible Connection
- FC-2 Braided Piping Flexible Connection
- DC Flexible Duct Connector

3.5 FINAL INSPECTION

- A. On completion of installation of all vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed systems and re- port, in writing, any installation error, improperly selected isolation devices or other faults in the system that could affect the performance of the system. Contractor shall

submit a report to the Professional, including the manufacturer's representative's final report, indicating all isolation re-ported as properly installed or requiring correction and include a report by the Contractor on steps taken to properly complete the isolation work.

- B. The Professional will subsequently inspect the systems for conformance to specifications and for proper installation methods. Contractor shall replace or repair, at his expense, any isolation de- vices that deviate from the specifications, approved shop drawings, and manufacturer's recommendations as a result of this inspection.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Valve tags.
6. Warning tags.

1.2 ACTION SUBMITTALS

- A.** Product Data: For each type of product indicated.
- B.** Samples: For color, letter style, and graphic representation required for each identification material and device.
- C.** Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D.** Valve numbering scheme.
- E.** Valve Schedules: For each piping system to include in maintenance manuals.

1.3 COORDINATION

- A.** Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B.** Coordinate installation of identifying devices with locations of access panels and doors.
- C.** Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2- inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Red: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Measurement of sound and vibration.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB.
- B. TAB Conference: Meet with Professional, Owner and Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Professional and Owner.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize

conflicts with Owner's operations.

1.6 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow- control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in another section of the specifications and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine terminal units; such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine control valves for proper installation for their intended function.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan- speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Professional and Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult

equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of sub-main and branch ducts.
 - a. Where sufficient space in sub-main and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Re-measure each sub-main and branch duct after all have been adjusted. Continue to adjust sub-main and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan

- airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.10 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.11 SOUND AND VIBRATION MEASUREMENT

- A. At the completion of the air and hydronic balancing, during an unoccupied time of the facility with the systems in operation, walk the facility and document any excessive noise and vibration.
- B. Record spaces where excessive noise and vibration was experienced. Send list to Professional and Owner.
- C. Record background noise levels for the performance spaces. The sound power levels shall be recorded in decibels (dB) for each octave band. These spaces include the main Auditorium (orchestra and Stage levels) and Black Box Theater.

3.12 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing Professional.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Manufacturers' test data.
 - 2. Field test reports prepared by system and equipment installers.
 - 3. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Professional's name and address.
 - 6. Professional's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Position of balancing devices.
- E. Apparatus-Coil Test Reports:
1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.

- c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

3.14 INSPECTIONS

- A. Initial Inspection:
 - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 - 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 10 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
 - 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Professional and Owner.

2. The TAB contractor's test and balance Professional shall conduct the inspection in the presence of the Professional or Owner.
 3. Professional or Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating

materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 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. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible elastomeric insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 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. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 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. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets"

Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 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. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 - 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81- 84.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 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. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85- 75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85- 60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive 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."
- E. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85- 50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF- 19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30- 80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L

- or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30- 36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30- 45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.

B. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95- 44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may

be incorporated into the Work include, but are not limited to, the following or approved equal:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.

- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Bands:
 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. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or

Monel.

- C. Wire: 0.080-inch nickel-copper alloy.
 - 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 or approved equal.
 - a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless- steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches to 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas.
Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):

Install insulation continuously through walls and partitions.

- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire- resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the

- thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two- part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor- barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward- clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended

adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor- barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward- clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation

2. when available.
When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Professional, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 1. All Pipe Sizes: Insulation shall be the following:

- a. Flexible Elastomeric: 3/4 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping (indoor and outdoor):
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

END OF SECTION

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Upgrade the existing building automation system to a complete system as shown on the contract drawings.
- B. The following sections as well as the sequence of operations, include control equipment methods for the various HVAC systems and components at this site, including control components for terminal heating and cooling units not supplied with factory-wired BACnet controls.

1.2 DEFINITIONS

- A. DDC: Direct digital control.
- B. BAS: Building Automation System. DDC temperature control system.
- C. I/O: Input/output.
- D. MS/TP: Master slave/token passing.
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. RTD: Resistance temperature detector.

1.3 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Use new thermostat system.
 - 2. Reporting Accuracy and Stability of Control: Report values and maintain measured
 - a. Space Temperature: Plus or minus 1 deg F.
 - b. Temperature Differential: Plus or minus 0.25 deg F.
 - c. Carbon Dioxide: Plus or minus 50 ppm.
 - d. Electrical: Plus or minus 5 percent of reading.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 - 2. Controlled Systems:
 - a. Points list.
- C. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- B. Qualification Data: For Installer and manufacturer or Approved Equal.
- C. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section for "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 5. Calibration records and list of set points for equipment installed in this contract.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's factory branch personnel using individual employees that are trained and approved for installation of system

components required for this project.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

1.9 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation with the project electrical contractor.
- C. Coordinate equipment with electrical Section for "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- D. Coordinate equipment with electrical Section for "Panelboards" to achieve compatibility with starter coils and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 CONTROL SYSTEM

- A. Siemens,
- B. Johnson Controls,
- C. Tridium,
- D. Honeywell

- E. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems.
- F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.
 - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations (if required) or controllers with the following:
 - 1. Minimum dielectric strength of 1000 V.
 - 2. Maximum response time of 10 nanoseconds.
 - 3. Minimum transverse-mode noise attenuation of 65 dB.
 - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.3 THERMOSTATS

- A. Line-Voltage, On-Off Thermostats used for non-DDC device: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 90 deg F set-point range, and 2 deg F maximum differential.
 - 1. Selector Switch: Integral, manual on-off-auto.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s), if required. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches to 60 inches above the floor; coordinate installation with other wall mounted devices such as light switches.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install automatic dampers according to Section 233300 "Air Duct Accessories."
- E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- F. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."
- G. Install duct volume-control dampers according to Section 233113 "Metal Ducts". All dampers are furnished and installed by the sheet metal contractor.
- H. Install electronic and fiber-optic cables according to Section for "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to electrical Section for "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to electrical Section for "Low-Voltage Electrical Power Conductors and Cables."
- C. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Provide minimum four, four hour sessions for training of the Owner's personnel at each garage. The four trainings will be held on different days convenient to the Owner.

3.7 WARRANTY

- A. Provide two year warranty for controls.
- B. Contractor shall make minimum two visits after the first year to check/adjust and fine tune the controls for proper and energy efficient operation of HVAC systems at each garage.

END OF SECTION

SECTION 23 09 93 – SEQUENCE OF CONTROLS

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 – SEQUENCE OF OPERATION

- A. Furnaces w/ ACCUs
- B. Exhaust Fans

1.3 SYSTEM DESCRIPTION

- A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS

- A. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
- B. Submittals to be prepared by Controls Subcontractor:
 - 1. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
 - 2. Include at least the following sequences:
 - a. Start-up.
 - b. Warm-up mode.
 - c. Normal operating mode.
 - d. Unoccupied mode.
 - e. Shutdown.
- C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.

- D. Points List: Submit list of all control points indicating at least the following for each point.
 - 1. Name of controlled system.
 - 2. Point abbreviation.
 - 3. Point description; such as dry bulb temperature, airflow, etc.
 - 4. Display unit.
 - 5. Control point or setpoint; i.e. a point that controls equipment and can have its setpoint changed.
 - 6. Monitoring point; i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 - 7. Intermediate point; i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 - 8. Calculated point; i.e. a “virtual” point generated from calculations of other point values.
- E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - SEQUENCE OF CONTROLS

3.1 GENERAL VENTILATION EQUIPMENT CONTROL

- A. Building Automation System Interface:
The Building Automation System (BAS) shall send the controller Occupied Bypass, Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. The BAS shall also send the discharge air temperature set-point and the duct static pressure set-point. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and set-points.
- B. Occupied:
Low Rise residential units: During occupied periods, the OA air damper shall open and the supply fan shall run on call for heat/cool. The nat gas valve shall modulate to maintain space temperature set point to desired room.
- C. Occupied:
High Rise units: during occupied periods, the hot water valve shall open to maintain space temperature set point to desired room.
- D. Unoccupied:

Low Rise residential units: When the space temperature is below the unoccupied heating set point of 65°F (adj.), the supply fan shall start, the OA damper shall open and the nat gas valve shall open. When the space temperature rises above the unoccupied heating set point of 65° F (adj.) the supply fan shall stop, the nat gas valve shall close and the outside air damper shall close.

- E. Unoccupied:
High Riser residential units: When the space temperature is below the unoccupied heating set point of 65 deg. F (adj) the hot water valve shall open. When the space temperature rises above the unoccupied heating set point of 65 deg F the hot water valve shall close.
- F. Space Temperature Control:
The room thermostats will have a room/space temperature set point of 67° F in all resident units.
- G. Supply Fans:
The fans shall be off in the unoccupied mode. When the unit controller is in the occupied mode, the supply fans shall operate continuously and its speed shall be modulated to maintain required CFM set-point via flow measuring station on the fans. If the supply fan fails to prove status for 30 seconds (adj.), the fans shall be commanded off, the outside air damper shall close, hot water valve shall close and an alarm shall be annunciated at the BAS. A manual reset shall be required to restart the fans. A hardwired, high static pressure cut-off switch shall be electrically interlocked with the variable speed drives. If the high static pressure cut-off switch is tripped, the fans shall stop, the outside air damper shall close, hot water valve shall close and an alarm shall be annunciated at the BAS. A manual reset of the high static pressure cut-off switch shall be required to restart the fan.
- H. Exhaust Fans:
After the supply fans are started, the exhaust fans in the air-handling unit will be energized and shall operate continuously and their speed shall be modulated via VFD drives to maintain required CFM set-point via flow measuring station on the fans as per the cfm in the schedules and also to maintain the building pressurization. High static pressure cut-off switch shall trip the fans and the unit to stop as described under supply fans.

3.2 FURNACE AND SPLIT SYSTEM COOLING

- A. Provide seven day programmable thermostat. When set for heat, the thermostat will keep the furnace fan running and bring the heat "on" on call for heat in two steps (low and high) and shut off the heat in two steps when the thermostat is satisfied. When the thermostat is set for cooling, the condenser will be turned "on" on call for cooling and shut down when the thermostat is satisfied. The furnace fan will be kept running all the time.

**ARMDC TASK ORDER CONTRACT NO. 33
GLEN HAZEL HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**SEQUENCE OF CONTROLS
230993**

END OF SECTION

SECTION 235400 - FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Gas-fired, noncondensing furnaces and accessories complete with controls.
 - 2. Air filters.
 - 3. Air cleaners.
 - 4. Refrigeration components.
 - 5. Condensate pump
- B. Related Sections include the following:
 - 1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
 - 1. Furnace.
 - 2. Thermostat.
 - 3. Air filter.
 - 4. Refrigeration components.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:
 - 1. Furnace and accessories complete with controls.

- 2. Air filter.
- 3. Refrigeration components.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
 - 1. Warranty Period, Commencing on Date of Substantial Completion:
 - a. Furnace Heat Exchanger: 10 years
 - b. Integrated Ignition and Blower Control Circuit Board: Five years
 - c. Evaporator and Condenser Coils: Five years

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Disposable Air Filters: Furnish two complete sets.
2. Fan Belts: Furnish one set(s) for each furnace fan.

PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, NONCONDENSING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:
1. Adams Manufacturing Company.
 2. Amana Heating & Air Conditioning; Goodman Manufacturing Company, L.P.
 3. American Standard Companies, Inc.
 4. Arcoaire Air Conditioning & Heating; a division of International Comfort Products, LLC.
 5. Armstrong Air Conditioning Inc.
 6. Bard Manufacturing Company.
 7. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
 8. Carrier Corporation; Div. of United Technologies Corp.
 9. Clare Brothers.
 10. Comfort-Aire; a division of Heat Controller, Inc.
 11. Comfortmaker Air Conditioning & Heating; a division of International Comfort Products, LLC.
 12. Dornback Furnace.
 13. Goodman Manufacturing Company, L.P.
 14. Heil Heating & Cooling Products; a division of International Comfort Products, LLC.
 15. Lennox Industries Inc.
 16. Luxaire Corporation; a division of Unitary Products Group.
 17. Rheem Manufacturing Company; Air Conditioning Division.
 18. Ruud Air Conditioning Division.
 19. Tempstar Heating & Cooling Products; a division of International Comfort Products, LLC.
 20. Thermo Products, Inc.; a division of Burnham Holdings Inc.
 21. Trane.
 22. York International Corp.; a division of Unitary Products Group.
- B. General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
- C. Cabinet: Galvanized steel.
1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.

3. Factory paint external cabinets in manufacturer's standard color.
 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Fan: Centrifugal, factory balanced, resilient mounted, direct or belt drive.
1. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 2. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
 3. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
- E. Type of Gas: Natural.
- F. Heat Exchanger: Aluminized steel.
- G. Burner:
1. Gas Valve: 100 percent safety modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- H. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.
- K. Vent Materials: Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks" for Type B metal vents.
- L. Capacities and Characteristics:
1. Airflow Configuration: Upflow.
 2. Gas:
 - a. Type: Natural.

- b. Minimum Efficiency AFUE: 80percent.
 - c. Input: See schedule on drawings.
 - d. Heat Output: See schedule on drawings.
 - e. Gas Connection Size: 1/2" NPS.
 - f. Vent Size: 4 inches.
- 3. Fan:
 - a. Airflow: See schedule on drawings.
 - b. External Static Pressure: See schedule on drawings.
 - c. Motor:
 - 1) Size: 1/3 horsepower.
 - 2) Speed: See schedule on drawings.
 - d. Volts: 120
 - e. Phase: single
 - f. Hertz: 60
 - g. Full-Load Amperes:
 - h. Minimum Circuit Ampacity: 15
 - i. Maximum Overcurrent Protection: 25.
- 4. Furnace Electrical Connection:
 - a. Volts: 120
 - b. Phase: single.
 - c. Hertz: 60.
 - d. Full-Load Amperes:
 - e. Minimum Circuit Ampacity: 15
 - f. Maximum Overcurrent Protection: 25

2.2 THERMOSTATS

- A. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.
- B. Modulating, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounting unit with fan on-automatic selector.
- C. Control Wiring: Unshielded twisted-pair cabling.
 - 1. No. 24 AWG, 100 ohm, four pair.
 - 2. Cable Jacket Color: Blue.
- D. Controls shall comply with requirements in ASHRAE/IESNA 90.1-2004, "Controls."

2.3 AIR FILTERS

- A. Disposable Filters: 1-inch- (25-mm) in sheet metal frame.

2.4 REFRIGERATION COMPONENTS

- A. General Refrigeration Component Requirements:

- 1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
- 2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet.

- 1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

- C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

- 1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1/2 inch (13 mm) thick.

- D. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping."

2.5 Air-Cooled, Compressor-Condenser Unit:

- 1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- 2. Compressor: Hermetically sealed reciprocating or scroll type.
 - a. Crankcase heater.
 - b. Vibration isolation mounts for compressor.
 - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - e. Refrigerant Charge: R-407C or R-410A.
 - f. Refrigerant: R-407C or R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: concrete

B. Capacities and Characteristics:

1. Refrigerant Coil:
 - a. Total Cooling Capacity: See schedule on drawings.
 - b. Sensible Cooling Capacity: See schedule on drawings.
 - c. Heating Capacity: See schedule on drawings.
 - d. Maximum Air Pressure Drop: See schedule on drawings.
 - e. Condensate Drain Size: 3/4" Nps
2. Compressor-Condenser Unit:
 - a. Cooling Energy Efficiency: see drawing schedule.
 - b. Heating Coefficient of Performance: See schedule on drawings.
 - c. Volts: 208/203
 - d. Phase: single
 - e. Hertz: 60
 - f. Full-Load Amperes: See schedule on drawings.
 - g. Minimum Circuit Ampacity: See schedule on drawings.
 - h. Maximum Overcurrent Protection: See schedule on drawings.
 - i. Fan Motor Full-Load Amperes: See schedule on drawings.
 - j. Compressor Running Load Amperes: See schedule on drawings.
 - k. Compressor Motor Full-Load Amperes: See schedule on drawings.

2.6 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers:

1. Aurora Pump; Division of Pentair Pump Group.
2. Beckett Corporation.
3. Flowserve Corporation; Div. of Ingersoll-Dresser Pumps.
4. Hartell Pumps Div.; Milton Roy Co.
5. Little Giant Pump Co.; Subsidiary of Tecumseh Products Co.
6. MEPCO (Marshall Engineered Products Co.).
7. Or approved equal.

- B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory or field-installed check valve and a 72-inch (1800 mm) minimum, electrical power cord with plug.

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. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
 - 1. Anchor furnace to substrate to resist code-required seismic acceleration.
- C. Controls: Install thermostats and humidistats at mounting height of 60 inches (1500 mm) above floor and 48 inches (1200 mm) above floor in UFAS units.
- D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- E. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- F. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

3.3 CONNECTIONS

- A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent Connection, Noncondensing, Gas-Fired Furnaces: to existing Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Division 23 Section "Breechings, Chimneys, and Stacks"
- D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories."
- E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.
 - 1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
 - 2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 - 3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Comply with requirements in Division 23 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical test and visual and mechanical inspection.
 - 2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - 4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for physical damage to unit casings.

2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

- B. Adjust fan belts to proper alignment and tension.
- C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
- D. Measure and record airflows.
- E. Verify proper operation of capacity control device.
- F. After startup and performance test, lubricate bearings and adjust belt tension.

3.6 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.7 CLEANING

- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.
- B. Install new filters in each furnace within 14 days after Substantial Completion.
- C. Clean ductwork in residential units prior to startup.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 235400

SECTION 238113 - PACKAGED TERMINAL AIR-CONDITIONERS

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 packaged terminal air conditioners and their accessories and controls, in the following configurations:
 - 1. Through-the-wall air conditioners.
 - 2. Drip pan

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, electrical characteristics, and accessories.
- B. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for packaged terminal air conditioners.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For packaged terminal air conditioners to include in emergency, operation, and maintenance manuals.
- G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.5 COORDINATION

- A. Coordinate layout and installation of packaged terminal air conditioners and wall construction with other construction that penetrates walls or is supported by them.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
 - 2. Warranty Period for Non-sealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
 - 3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal:
 - 1. Ammana
 - 2. Carrier Corporation; a United Technologies company.
 - 3. ClimateMaster, Inc.
 - 4. Friedrich Air Conditioning Co.

5. General Electric Company; GE Consumer & Industrial - Appliances.
6. McQuay International.
7. Suburban Manufacturing Company; a subsidiary of AIRXCEL, Inc.
8. Trane; a business of American Standard Companies.

2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, and temperature controls; fully charged with refrigerant and filled with oil; with chassis.

2.3 CHASSIS

- A. Cabinet: 0.052-inch- (1.32-mm-) thick steel with removable front panel with concealed latches.
 1. Mounting: Wall with wall sleeve.
 2. Discharge Grille: Extruded-aluminum discharge grille
 3. Louvers: Stamped aluminum with clear-anodized finish
 4. Finish: Epoxy coating
 5. Access Door: Hinged door in top of cabinet for access to controls.
 6. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 7. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 8. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates
 9. Wall Sleeves: Galvanized steel with polyester finish
- B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.
 1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins
 2. Accumulator.
 3. Constant-pressure expansion valve.
 4. Reversing valve.
 5. Charge: R-407C or R-410A.
- C. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual operator.
- D. Filters: Washable polyurethane in molded plastic frame.
- E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation and piping to direct condensate to condensate waste.
 1. Comply with ASHRAE 62.1-2004 for drain pan construction and connections.

F. Outdoor Fan: Forward curved, centrifugal or propeller type driven by indoor fan motor.

1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - a. Fan Motors: Permanently lubricated split capacitor.
 - b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.4 CONTROLS

- A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
 1. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F (5 deg C) outdoor air temperature.
 2. Temperature-Limit Control: Prevents occupant from exceeding preset setback or setup temperature.
 3. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on indoor or outdoor coil and reverses unit to melt frost.
- B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with on-auto fan switch.

2.5 CAPACITIES AND CHARACTERISTICS

- A. Airflow: see schedule on drawings
- B. Outdoor Air-Intake Rate: see schedule on drawings
- C. Cooling Capacity:
 1. Total: see schedule on drawings
 2. Sensible: see schedule on drawings
 3. Energy-Efficiency Ratio: see schedule on drawings
 4. Indoor Coil Entering-Air Dry Bulb Temperature: see schedule on drawings
 5. Indoor Coil Entering-Air Wet Bulb Temperature: see schedule on drawings
 6. Indoor Coil Leaving-Air Dry Bulb Temperature: see schedule on drawings
 7. Indoor Coil Leaving-Air Wet Bulb Temperature: see schedule on drawings
 8. Outdoor Coil Entering-Air Temperature: see schedule on drawings

D. Electrical Characteristics:

1. Volts: 208/230
2. Phase: Single
3. Hertz: 60.
4. Full-Load Amperes: see schedule on drawings
5. Minimum Circuit Ampacity: see schedule on drawings
6. Maximum Overcurrent Protection: see schedule on drawings

2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
- B. Unit Performance Ratings: Factory test to comply with ARI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

2.7 Drip pan

- A. Manufacturer:
 1. MarketAir
 2. DiversiTech
 3. Killarnay Metals
 4. or approved equal.
- B. Provide watertight drip pan under condenser of thru-wall AC outside.
 1. Includes integral slope to ensure complete drainage.
 2. Drain outlet accepts 5/8 inch or 3/4 inch drain hose.
 3. Made of UV resistant polypropylene
 4. Rust free support brackets are molded from glass fiber reinforced plastic.
 5. Suitable for use at temperatures from -4 to 140 deg F.
 6. Mounts under the condenser to collect condensate dripping from unit

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."
- C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements for piping specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- C. Install piping adjacent to machine to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- C. Tests and Inspections:

- 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- D. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
- B. After installation, verify the following:

1. Unit is level on base and is flashed in exterior wall.
2. Unit casing has no visible damage.
3. Compressor, air-cooled condenser coil, and fans have no visible damage.
4. Labels are clearly visible.
5. Controls are connected and operable.
6. Shipping bolts, blocks, and tie-down straps are removed.
7. Filters are installed and clean.
8. Drain pan and drain line are installed correctly.
9. Electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
10. Installation. Perform startup checks according to manufacturer's written instructions, including the following:
 - a. Lubricate bearings on fan.
 - b. Check fan-wheel rotation for correct direction without vibration and binding.

C. After startup service and performance test, change filters.

3.5 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged terminal air conditioners.

END OF SECTION 238113

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Link-Seal

- f. Or approved equal.
- 3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
- 4. Pressure Plates: Stainless steel. Include two for each sealing element.
- 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 260503 - EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, material, tools, equipment, and incidentals necessary for complete and operable equipment wiring systems, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following activities:
 - 1. Electrical connections to equipment specified under other Sections.

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Result for HVAC
- B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- D. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- E. Section 26 05 33 – Raceway and Boxes for Electrical Systems

1.3 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 COORDINATION

- A. Determine connection locations and requirements.

- B. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- C. Sequence electrical connections to coordinate with start-up schedule for equipment.
- D. Provide disconnect switches for mechanical equipment that is provided by HVAC, Plumbing, and General Contractors. HVAC Contractor will provide starters and controllers for HVAC equipment.
- E. HVAC and Plumbing Contractor will furnish and install control wiring.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over current protection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Terms and Conditions.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquid tight conduit with watertight connectors in damp or wet locations.
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

- D. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- E. Install disconnect switches, controllers, control stations, and control devices as indicated.
- F. Modify equipment control wiring with terminal block jumpers as indicated.
- G. Provide interconnecting conduit and wiring between devices and equipment where indicated.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Related Sections include the following:
 - 1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
 - 2. Division 26 Section "Undercarpet Electrical Power Cables" for flat cables for undercarpet installations.
 - 3. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- C. Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THW and THHN-THWN

ARMDC TASK ORDER CONTRACT NO. 33 LOW VOLTAGE ELECTRICAL POWER AND CABLES
GLEN HAZEL HIGH RISE – LOW RISE SECTION 260519
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B

- E. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping intumescent fire stop caulk.

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal.
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Plastic Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Underground branch-circuit cable, Type UF.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- G. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- H. Class 2 Control Circuits: Type THHN-THWN, in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint. Provide intumescent fire stop caulk.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop intumescent fire stop caulk.

K. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals

and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Provide intumescent fire stop caulk.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

ARMDC TASK ORDER CONTRACT NO. 33 LOW VOLTAGE ELECTRICAL POWER AND CABLES
GLEN HAZEL HIGH RISE – LOW RISE SECTION 260519
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for grounding and bonding for electrical systems, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following activities:
 - 1. Grounding conductors.
 - 2. Equipment grounding conductors.
 - 3. Bonding.

1.2 RELATED SECTIONS

- A. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- D. Section 26 05 33 – Raceway and Boxes for Electrical Systems

1.3 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.

1.4 SUBMITTALS

- A. Submit under provisions of Terms and Conditions.
- B. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of exothermic connectors.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Terms and Conditions.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three (3) years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 MECHANICAL CONNECTORS

- A. Material: Bronze.

2.2 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

2.3 EXOTHERMIC CONNECTIONS

- A. Cadweld or equal exothermic welded connection.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Provide bonding to meet Regulatory Requirements.
- C. Bond together metal siding and ceilings not attached to grounded structure; bond to ground.
- D. Equipment Grounding Conductor: Provide separate insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Interface with site grounding system.

3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations.
- C. Use Erico model EST301 resistance tester or approved equal, using stakeless test. Add electrodes as required to achieve specified resistance. Submit written report prior to final inspection.

END OF SECTION

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for hangers and supports for electrical systems, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following activities:
 - 1. Equipment and conduit supports.
 - 2. Anchors and fasteners.

1.2 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting Products.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use precast insert system and preset inserts.
 - 2. Steel Structural Elements: Use beam clamps.
 - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.

- 6. Sheet Metal: Use sheet metal screws.
- 7. Wood Elements: Use wood screws.

2.2 STEEL CHANNEL

- A. Description: Galvanized.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Obtain permission from Structural Engineer before drilling or cutting structural members.
- F. Fabricate supports from structural steel or steel channel. Use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- G. Install surface-mounted cabinets and panelboards with minimum of four (4) anchors.
- H. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (1") off wall.

END OF SECTION

SECTION 260533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for raceways and boxes for electrical systems, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following items:
 - 1. Metal conduit.
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Electrical metallic tubing.
 - 5. Fittings and conduit bodies.
 - 6. Wall and ceiling outlet boxes.
 - 7. Pull and junction boxes.

1.2 RELATED SECTIONS

- A. Section 260519 – Low-Voltage Electrical Power Conductors and Cables.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 – Hangers and Supports for Electrical Systems.
- D. Section 260553 – Identification for Electrical Systems.

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electric Code /IBC.
- E. NECA "Standard of Installation."
- F. NEMA FS, FD – Cast Metal Boxes, Covers.
- G. NEMA OS-1 – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

- H. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
- I. NFPA 70 – National Electrical Code.
- 1.4 DESIGN REQUIREMENTS
 - A. Conduit Size: ANSI/NFPA 70/IBC
- 1.5 SUBMITTALS
 - A. Submit under provisions of Terms and Conditions.
- 1.6 PROJECT RECORD DOCUMENTS
 - A. Submit under provisions of Terms and Conditions.
 - B. Accurately record actual routing of conduits larger than 1 inch.
- 1.7 REGULATORY REQUIREMENTS
 - A. Conform to requirements of ANSI/NFPA 70.
 - B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, protect, and handle Products to site under provisions of Terms and Conditions.
 - B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
 - C. Accept conduit on site. Inspect for damage.
- 1.9 PROJECT CONDITIONS
 - A. Verify that field measurements are as shown on Drawings.
 - B. Verify routing and termination locations of conduit prior to rough-in.
 - C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4 inch unless otherwise specified.
- B. Outdoor Locations, Above Grade: Use rigid steel.
- C. Wet and Damp Locations: Use rigid steel conduit.
- D. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing or flexible metal conduit.

2.2 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Intermediate Metal Conduit (IMC): Rigid steel.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings.

2.3 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction.
- B. Fittings: ANSI/NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB1; steel or malleable iron, compression type.

2.6 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch male fixture studs where required.
- B. Cast Metal
 - 1. Malleable Iron
 - 2. Covers: Gasketed, Weatherproof, Malleable Iron.
 - 3. Hubs: Threaded
 - 4. Lugs: Cast Mounting
- C. Cast Aluminum
 - 1. Box: Cast Copper Free Aluminum
 - 2. Covers: Cast Copper Free Aluminum, Gasketed, Weatherproof-In-Use Type.

2.7 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 262716.
- C. Surface Mounted Cast Metal Box: NEMA 250, type 4; flat-flanged, surface mounted junction box:
 - 1. Material: Cast Aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.1 INSTALLATION OF CONDUIT

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

- E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- F. Fasten conduit supports to building structure and surfaces under provisions of Section 260529.
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit and boxes to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls. Exposed conduit is permitted in the Mechanical Rooms and Garage Areas.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Maintain adequate clearance between conduit and piping.
- M. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F/40 degrees C.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three (3) 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends or factory elbows for bends in metal conduit larger than 2-inch size.
- R. Avoid moisture traps; provide junction box with drain at low points in conduit system.
- S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.
- T. Provide suitable pull string in each empty conduit except sleeves and nipples. Flat tape is not permitted.
- U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Ground and bond conduit under provisions to Section 260526.

W. Identify conduit under provisions of Section 260553.

3.2 INSTALLATION OF BOXES

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- G. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- H. Install boxes to preserve fire resistance ratings of partitions and other elements, using materials and methods specified in Division 7.
- I. Locate outlet boxes to allow luminaires positioned as shown on Drawings.
- J. Use adjustable steel channel fasteners for hung ceiling outlet box.
- K. Do not fasten boxes to ceiling support wires.
- L. Support boxes independently of conduit.
- M. Use gang box where more than one (1) device is mounted together. Do not use sectional box.
- N. Use gang box with plaster ring for single device outlets.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements.
- B. Coordinate installation of outlet box for equipment connected under Section 260503.

3.4 ADJUSTING

- A. Per Terms and Conditions.
- B. Install knockout closures in unused box openings.

3.5 CLEANING

- A. Per Terms and Conditions.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for installation of fuses in accordance with the Contract Documents.
- B. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- C. Related Requirements
 - 1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 RELATED SECTIONS

- A. Section 26 05 33 – Raceways and Boxes for Electrical Systems

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Presealed Systems.
- b. Advance Products and Systems, Inc..

2.4 GROUT

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

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of *<Insert value>* g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

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

END OF SECTION

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for identification for electrical systems, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following items:
 - 1. Nameplates and labels.
 - 2. Wire and cable markers.
 - 3. Conduit markers.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure (panelboards, disconnect switches).
 - 2. Communication & Auxiliary System cabinets.
 - 3. Contactor cabinets.
- C. Letter Size:
 - 1. Use 1/4 inch letters for identifying individual equipment and loads.
 - 2. Use 1/2 inch letters for identifying grouped equipment and loads.

2.2 WIRE MARKERS

- A. Description: Tape type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit and feeder number, typed and attached to inside of panelboard cover.

2.3 CONDUIT MARKERS

- A. Location: Furnish snap-on plastic markers for each conduit longer than 6 feet.
- B. Spacing: 20 feet on center.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws and adhesive.
- C. Install snap-on plastic labels on each conduit longer than 6 feet.
- D. Install markers 20 feet on center.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for complete and operable panelboards, in accordance with the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following items:
 - 1. Panelboards.
 - 2. Circuit breakers for existing branch circuit panelboards.
 - 3. Molded case circuit breakers.

1.2 RELATED SECTIONS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems
- B. Section 26 05 53 – Identification for Electrical Systems

1.3 REFERENCES

- A. NECA Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA AB1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 – Industrial Control Devices, Controllers and Assemblies.
- D. NEMA KS1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- E. NEMA PB-1 - Panelboards.
- F. NEMA PB-1.1 – Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
- H. NFPA 70 – National Electrical Code.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes, enclosure types, evidence of NRTL listing for series rating of installed devices.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Terms and Conditions.
- B. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three (3) years documented experience.

1.7 MAINTENANCE MATERIALS

- A. Terms and Conditions.
- B. Furnish two (2) of each panelboard key.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush and Surface Mounted Cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

- 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Har-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Compression type.
 - 4. Feed-Through Lugs: mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: mechanical type suitable for use with conductor material. Located at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or main service disconnecting and overcurrent protective devices.
- F. Future (Space/Provisioned Space) Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short Circuit Current Rating: Fully rated to interrupt symmetrical short circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical; Cutler Hammer
 - 2. General Electric Company
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only, as indicated on construction drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. External Control-Power Source: 120V branch circuit.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed to match existing panelboards on site.

2.3 BRANCH CIRCUIT BREAKERS

- A. Manufacturers:
 - 1. Cutler-Hammer-Eaton
 - 2. General Electric
 - 3. Square D
 - 4. Approved Equal.
- B. Branch Overcurrent Protective Devices: Bolt On circuit breakers, replaceable without disturbing adjacent units.
- C. Minimum Integrated Short Circuit rating: 10,000 amperes rms symmetrical for 240 volt panelboards.
- D. Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles listed as Type SWD for lighting circuits, Class A ground fault interrupter circuit breakers where required. Do not use tandem or "THIN" circuit breakers. Provide arc fault interrupter circuit breakers where required by NEC or where scheduled.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and circuit breakers in accordance with NEMA PB 1.1 and the NECA "Standard of Installation."
- B. Comply with mounting and anchoring requirements specified in 260529 Hangers and Supports for Electrical Systems.
- C. Mount top of trim 64 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mounted recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Stub four 1-inch empty conduits from panelboard into accessible ceiling space. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- F. Install overcurrent protective devices and controllers not already factory installed and set field adjustable, circuit breaker trip ranges.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.
- I. Provide and install filler plates for unused spaces in panelboards.
- J. Provide arc flash protection labeling on all electrical equipment.
- K. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- L. Provide engraved plastic nameplates under the provisions of Section 260553 if nameplate is not already present.

3.2 FIELD QUALITY CONTROL

- A. Section 260500 – Common Work Results for Electrical Work.
- B. Acceptance Testing Preparation:
 - 1. Test continuity of affected circuits.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5 for circuit breakers.
- D. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.3 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 10 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- B. Adjust as required under Terms and Conditions.

END OF SECTION

SECTION 262716 – ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for electrical cabinets and enclosures, in accordance with the Contract Documents.
- B. The work of this Section includes, but not limited to, the following items:
 - 1. Hinged cover enclosures.
 - 2. Cabinets.
 - 3. Terminal Blocks.
 - 4. Accessories.

1.2 RELATED SECTIONS

- A. Section 26 05 29 – Hangers and Supports for Electrical Systems

1.3 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratories, Inc.

1.5 EXTRA MATERIALS

- A. Furnish under provisions of Section 26 05 01 - Basic Requirements.
- B. Provide two (2) of each cabinet key.

PART 2 PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type 1, 3R, and 4 steel enclosures.
- B. Covers: Continuous hinge, held closed by flush latch operable by key.

- C. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

- A. Boxes: Galvanized steel with removable end walls.
- B. Backboard: Provide 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.
- C. Fronts: Steel, surface type with concealed trim clamps, conceal hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

2.3 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Terms and Conditions and Section 260500 – Common Work Results for Electrical.
- B. Verify that surfaces are ready to receive Work.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.
- C. Install cabinet fronts plumb.

**ARMDC TASK ORDER CONTRACT NO. 33
GLEN HAZEL HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**ELECTRICAL CABINETS AND ENCLOSURES
262716**

END OF SECTION

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures.
 - 2. Lighting fixture supports.
- B. Related Sections:
 - 1. Section 26 09 23 - Lighting Control Devices.
 - 2. Section 26 27 26 – Wiring Devices.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings in the Lighting Fixture Schedules.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 LED LIGHT FIXTURES

- A. General:
 - 1. See drawings for model numbers and manufacturers basis of design or approved equal.
 - 2. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
 - 3. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
 - 4. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
 - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95.
 - f. Total Harmonic Distortion: ≤ 20%.
 - g. Comply with FCC 47 CFR Part 15.
 - 5. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature 3000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

- c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
- B. LED Downlights:
 - 1. Housing, LED driver, and LED module shall be products of the same manufacturer.
- C. LED Troffers:
 - 1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
 - 2. Housing, LED driver, and LED module shall be products of the same manufacturer.

2.4 LED exit light fixtures

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
 - 1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
 - 2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
 - 3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
- G. Voltage: Multi-voltage (120 – 277V).

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery or generator and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

**ARMDC TASK ORDER CONTRACT NO. 33
GLEN HAZEL HIGH RISE – LOW RISE
HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
R3A PROJECT NO. 15074B**

**INTERIOR LIGHTING
265100**

END OF SECTION

SECTION 28 31 00 – UFAS Apartment Fire Alarm Interface

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations regarding the installation of accessories to the existing Fire Alarm System as shown on the drawings and as herein specified.

1.2 RELATED SECTIONS

- A. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements apply to the work specified in this section.
- B. The complete installation is to conform to the applicable sections of NFPA-72, Local Code Requirements and the National Electrical Code with attention to Article 760 for renovation of an existing building.
- C. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.3 REFERENCES

- A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL." label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
- B. The equipment and technical supervision furnished under this specification is to be provided directly by the equipment manufacturer. The manufacturers' project representative shall be NICET LEVEL III Certified in the field of fire alarm system technology. A copy of the representative's certificate shall be included with the equipment submittals.
- C. All control equipment must have transient protection devices to comply with UL864 requirements.

1.4 GENERAL

- A. Furnish and install smoke detectors connected to existing fire alarm panel in building.

1.5 OPERATION

- A. Under normal condition, the front panel shall display a "SYSTEM NORMAL" message and the current time and date.
- B. Should an abnormal condition be detected, the appropriate LED ("Fire Alarm", "System Supervisory", or "System Trouble") shall flash. The panel audible signal shall pulse for alarm conditions and sound steadily for trouble and supervisory conditions.
- C. The panel shall have existing display. The following information relative to the abnormal condition of a point in the system shall be displayed:
 - 1. Custom location label describing the exact location of the device to include floor, room number (or nearest room number for corridor mounted devices). No two devices shall have the same location label. Provide forty (40) characters minimum to describe location information, this is in addition to the "type of device" and "status" requirements listed below.
 - A. The custom location label of each device shall be capable of being edited by the owner from the front panel controls. An off board programmer and or/computer shall not be required for the owner to change this information.
 - 2. Types of device (i.e. smoke, pull station, waterflow). Provide twenty (20) characters minimum to describe device type information.
 - 3. Point status (i.e. alarm, trouble, sprinkler supervisory). Provide twenty (20) characters minimum to describe point status.

1.6 ALARM SEQUENCE

- A. The system alarm operation subsequent to an alarm is to be as follows:
 - 1. All audible alarm notification appliances shall sound a temporal code pattern (.5 sec. on, .5 sec. off, .5 sec. on, .5 sec. off, .5 sec. on, 2.5 sec. off, then repeat) until silenced by the alarm silence switch at the control panel or at the remote annunciator panel.

2. All visible alarm notification appliances [Xenon Strobes] shall display a continuous pattern until the system is reset.
3. The Digital Alarm Communicating Transmitter, programmed to notify an owner selected central station is to be activated.
4. The alarm is to be recorded with the time and date in the system's alarm log.
5. UFAS Apartment smoke sensors when in alarm shall operate its base mounted piezo sounder. It will not cause an alarm to be transmitted to the existing panel. The Supervisory indicators on the new panel shall operate and indicate the specific apartment in alarm. When the smoke is cleared from the sensor, the sensor will silence. The Supervisory condition must then be reset at the panel. The apartment strobes shall operate until the system is reset.
6. An alarm originating from the existing system shall cause the same operation as stated above but will include all UFAS Apartments. The panel(s) must be reset to place the system(s) back to normal.

1.7 POWER REQUIREMENTS

- A. The control panel shall receive power as existing.

1.8 SUBMITTALS

- A. Include bound equipment data booklets to include the following:
 1. An indexed list of materials with mounting box requirements for each device. Each item shall reference a page number where detailed manufacturers data for that component can be located within the submittal.
 - A. Product data for system components shall include UL listing information, detailed product data, dimensioned plans and elevations showing minimum clearances and installed features of devices.
 - B. Where more than one product model is described on the manufacturers data sheet, the specific unit proposed shall be highlighted or otherwise identified.
 2. When equipment other than that specified is submitted, a complete paragraph-by-

paragraph comparison with the specification shall be included.

3. A detailed battery calculation document indicating each control panel component and peripheral device along with the following information:
 - A. The quantity of each component
 - B. The stand-by and alarm power requirements of each component
 - C. Calculations to clearly indicate battery size needed to comply with the specification requirements.
 - D. The size of batteries that are proposed to be furnished.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

- A. existing fire alarm control panel shall be used with new smoke detectors added to it.

2.2 PERIPHERAL DEVICES

- A. **UFAS APARTMENT SMOKE:** Furnish and install KIDDE Model 4098-9714 with a Sounder base where indicated on the drawings. Sensors shall be of the photoelectric type and shall communicate actual smoke chamber values to the system control panel. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications. The sensitivity of each individual detector shall be programmable from the control panel. The sensors shall automatically compensate for the accumulation of dust and dirt to maintain operation at their programmed sensitivity level as these contaminants accumulate. The sensors shall be documented to automatically meet NFPA sensitivity testing requirements.
- B. **STANDARD APARTMENT SMOKE SENSORS:** Furnish and install where indicated on the drawings KIDDE model #9010 smoke/carbon monoxide detectors with integral sounder. Detector shall operate on 120 VAC and have a 9 VDC battery backup in case of a power failure. The built-in piezo shall provide the temporal 3 evacuation tone when in the alarm mode.
- C. **INDIVIDUAL ADDRESSABLE MODULE (IAM):** Furnish and install Simplex Model 4098-9817 Individual Addressable Modules as required. The units shall provide location specific addressability to non-addressable devices such as waterflow,

sprinkler tamper switches, and kitchen suppression systems, furnished by others, by monitoring normally open dry contacts. Closure of the monitored contact shall initiate an alarm or supervisory condition, as required. An open in the initiating circuit will cause a trouble to be reported at the fire alarm control panel. Units shall mount in a standard single gang electrical box.

- D. UFAS APARTMENT VISUAL ONLY UNITS (BEDROOMS ONLY): existing strobes.
- E. UFAS APARTMENT VISUAL ONLY UNITS (BATHROOMS ONLY): existing strobe

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. All fire alarm system conductors shall be installed in conduit. Wire sizes and types shall be per manufacturer recommendations.
- B. Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.
- C. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

3.2 EQUIPMENT INSTALLATION

- A. Existing Fire Alarm Equipment: Maintain fully operational system. As new equipment is installed, label it "NOT IN SERVICE" until operational. Remove tags from new equipment when put into service and tag inactive, existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal (If Applicable): After acceptance of the new fire alarm system, remove existing, disconnected fire alarm equipment and restore damaged surfaces. Remove from the site and legally dispose of the material.
- C. Smoke Detectors: Install ceiling-mounted detectors in center of corridors or as indicated on the drawings but not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.
- D. Visual Alarm-Indicating Devices: Install no more than twenty-four inches down from the ceiling, no less than 80 inches above the finished floor, and no more than 16 feet from the bed in the UFAS apartments. Install Bathroom strobes at 80 inches

above the finished floor or 6 inches (150 mm) below the ceiling, whichever is lower in the Bathrooms.

- E. Fire Alarm Control Panel (FACP): Surface mount with tops of cabinets not more than 6 feet above the finished floor.

3.3 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways." Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. System Wiring: For the low-voltage portion of the fire alarm system, install No. 14 AWG conductors and 75-deg C insulation in wet, damp, or dry locations. For line-voltage wiring, install No. 12 AWG size with insulation rated 75 deg C minimum.
- D. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. Wiring to Central Station Transmitter: 3/4-inch conduit between the FACP and the central station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as required to suit central-station monitoring function.

3.4 WARRANTY

- A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test.
- B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION 28 31 00

SECTION 31 10 00 - SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
 - 2. Protection of existing bank vegetation and utilities.
 - 3. Removing existing trees, shrubs, groundcovers, plants, and grass.
 - 4. Clearing and grubbing.
 - 5. Stripping and stockpiling topsoil.
 - 6. Removing above- and below-grade site improvements.
 - 7. Temporary erosion and sedimentation control measures.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.
- C. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged or to remain the Owner's property.
- D. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in their original locations.
- E. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Owner, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

- F. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
- G. Restore damaged improvements to their original condition, as acceptable to property owner.
- H. Utility Services: Maintain existing utility mains and protect them against damage during demolition operations. Cut and plug utility laterals servicing the site and indicated to be abandoned in accordance with the local and county standard specifications and/or the affected utility company.
- I. Comply with all Federal, State and Local rules and regulations as applicable.
- J. Explosives will not be permitted on site.
- K. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, and other facilities and injury to persons.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations. Maintain safe and clean vehicular and pedestrian access to the existing medical office building at all times. All expenses shall be borne by the Contractor.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
 - 3. Provide safety devices and personnel including but not limited to warning devices, barricades, flares, reflective markers, flagman, dust control, lights, signage, etc.!
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings, Report and approved PA DEP requirements.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Tree Protection: Prior to the start of construction, and with the approval of the Owner's Representative, erect protective fencing around trees which are to be saved on the

construction site. No removal or intrusions into the enclosures will be allowed. This enclosure will establish the tree protection zone. Tree protection fence will be 48"-high orange construction fence or wood slat "snow" fence with posts set 10' on center minimum. If tree protection fence is damaged, work in the area may be suspended until fence is repaired to the satisfaction of the Owner.

1. Do not store construction materials, debris, or excavated material within fenced area.
 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 3. Maintain fenced area free of weeds and trash.
- B. Protect existing trees against cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within 1' for each 1" diameter of the tree. There shall be no foot or vehicular traffic or parking within 1' for each 1" diameter of the tree. There shall be scaffolding erected within 1' for each 1" diameter of the tree. Alternative methods of scaffolding will need to be provided to protect trees.
1. Water trees to remain within the limits of contract work as required to maintain their health during course of construction operations.
 2. Provide protection of roots over 1 inch in diameter that are cut during construction operations. Cuts shall be cleanly pruned close to the tree side of the ditch and coating formulated to use on damaged plant tissues shall be provided. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
 3. Repair or replace trees indicated to remain that are damaged by construction operations in a manner acceptable to the Owner. Employ a licensed arborist to prepare a report and recommendations for the repair to damaged trees. If repair is unacceptable, replace in size and species as acceptable to the Owner.
- C. Tree Root Protection: When an underground project encounters the roots of an existing tree two inches or more in diameter, the Contractor shall tunnel or bore under the tree or otherwise modify the project to protect the tree's root system. No machine digging shall take place with a radius of 1' for each 1" diameter of the tree. There shall remain at least 24" of undisturbed earth over the tunnel, bore or other type of installation. All construction work shall be completed in a manner least damaging to trees and tree roots.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than two days in advance of proposed utility interruptions.

- 2. Do not proceed with utility interruptions without Owner's written permission.
 - C. Excavate for and remove underground utilities indicated to be removed.
 - D. Removal of underground utilities is included in Sections covering site utilities.
- 3.5 PROTECTION OF EXISTING BANK VEGETATION & UTILITIES
- A. Protect existing bank vegetation and utilities. No encroachment beyond the filter sock is permitted.
- 3.6 CLEARING AND GRUBBING
- A. Remove stumps, roots, and other debris protruding through ground surface.
 - B. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - C. Remove and dispose of shrubs, stumps and roots larger than 1-1/2" in diameter to a depth of 20".
 - D. Fill depressions caused by clearing, grubbing and demolition operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill consisting of materials as specified in Division 2 of the specifications.
 - E. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - F. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - G. Chip removed tree branches and dispose of off-site.
 - H. Remove all vegetation, improvements, or obstructions as required to permit installation of new construction. "Removal" includes digging out and off-site disposing of stumps, roots, concrete and bituminous paving and curbing material, foundations, walls, steps, structures, utility structures and any other material not suitable for fills. See site plan for proposed final grades.
 - I. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.
 - J. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - K. Clean on-site adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.7 TOPSOIL STRIPPING

- A. Strip existing topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass before stripping.
- B. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1 inch in diameter, and without weeds, roots, and other objectionable material.
- C. Stockpile topsoil in storage piles in sufficient quantities to satisfy the requirements for planting and seeding in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Stockpiled topsoil for reuse is to be tarped and kept dry.
- D. Dispose of unsuitable or surplus soil same as specified for disposal of waste material.

3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.9 SAWCUTTING OF CURBS AND PAVEMENTS

- A. Saw cut all areas where new work adjoins existing conditions. Sawcutting is specified for concrete sidewalks, paving bases, roadway pavements and curbs. Use a mechanically driven concrete cutter for a minimum depth of two (2) inches from the top or exposed surface. Sawcut to a smooth straight line. Make sawcuts parallel and plumb to related surfaces.

3.10 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
2. Remove daily from the site and do not allow accumulating on the site.
3. Disposal of excavated topsoil and earthen material to comply with Pennsylvania Department of Environmental Protection environmental codes.

3.11 CLEANUP AND REPAIR

- A. Upon completion of site preparation work, remove tools, equipment, and demolished materials from site. Remove protections and leave areas clean to the approval of the Owner.

END OF SECTION 31 10 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. This Section includes the following:
 - 1. Hot-mix asphalt (HMA) paving.
 - 2. Hot-mix asphalt (HMA) patching.
 - 3. Hot-mix asphalt (HMA) paving overlay.
 - 4. Asphalt surface treatments.
 - 5. Pavement-marking paint.
 - 6. Cold milling of existing hot-mix asphalt (HMA) pavement.

1.2 DEFINITIONS

- A. Hot-Mix Asphalt (HMA) Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. PennDOT: Pennsylvania Department of Transportation.

1.3 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of PennDOT Publication 408 Section 409.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

- E. Qualification Data: For manufacturer.
- F. Material Certificates: For each paving material, signed by manufacturers.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with Pennsylvania Department of Highways Standard Specifications, Form 408, latest edition and with supplements as PennDOT 408 for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1, complying with DOT standards and specifications.
- B. Asphalt Cement: Complying with DOT standards and specifications.
- C. Prime Coat: Asphalt emulsion prime complying with PennDOT Specifications, Form 408.
- D. Tack Coat: Shall meet the requirements of PennDOT Specifications, Form 408, latest edition and manufacturer's specifications.
- E. Water: Potable.
- F. Undersealing Asphalt: AASHTO M 238, pumping consistency.

2.2 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications. Paving Geotextile for subgrade reinforcement, stabilization and drainage: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot and mildew. Amoco Nonwoven Geotextiles as manufactured by Amoco Fabrics and

Fibers Co. 1-404-984-4444 or approved equal. Geotextile material to meet standards as per Penn DOT Class 4 fabric.

- D. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Pavement-Marking Paint: Penn DOT Section 962
 - 1. Color: As indicated.

2.3 MIXES

- A. Hot Mix Asphalt Superpave Surface / Top Course: 9.5 mm Superpave Courses shall consist of plant mixed HMA on a prepared surface in accordance with Section 409 of the Penn DOT Specifications, Form 409, latest edition for Superpave Mixture Design and applied to the lines, grades, width and depth shown on the drawings.
- B. Hot Mix Asphalt Superpave Base Course: 19 mm Superpave Courses shall consist of plant mixed HMA on a prepared surface in accordance with Section 409 of the Penn DOT Specifications, Form 409, latest edition for Superpave Mixture Design and applied to the lines, grades, width and depth shown on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PAVING GEOTEXTILE INSTALLATION

- A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).
 1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at minimum temperature of 250 deg F (121 deg C).
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch (13 mm).
 - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch (6 mm).
 - 2. Surface Course: 1/8 inch (3 mm).
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.10 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.11 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With a fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 PAVEMENT MARKING

- A. Allow paving to age for 30 days before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.13 FIELD QUALITY CONTROL

- A. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Concrete and related materials as specified in PennDOT, Form 408.
- C. Joint fillers is specified in PennDOT, Form 408.

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Vehicular concrete paving.
 - 2. Curbs.
 - 3. Walkways and Stairs

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.
- B. The following specifications and standards of the issues listed are to be utilized:
 - 1. The Commonwealth of Pennsylvania, Department of Transportation (PennDOT) Specification Form 408, latest edition with supplements hereinafter referred to as PennDOT 408.
 - 2. ACI 301 - "Specification for Structural Concrete".
 - 3. ACI 304 - "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 4. ACI 305 - "Recommended Practice for Hot Weather Concreting".
 - 5. ACI 306 - "Recommended Practice for Cold Weather Concreting".
 - 6. ACI 311 - "Recommended Practice for Concrete Inspection".
 - 7. ACI 318 - "Reinforced Concrete".
 - 8. American Society for Testing Materials (ASTM).
 - 9. American Association of State Highway and Transportation Officials (AASHTO).
- C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who 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."
- D. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.4 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.
- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

- F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.
- G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.
- H. Plain Steel Wire: ASTM A 82, as drawn.
- I. Deformed-Steel Wire: ASTM A 496.
- J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.
- K. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.
- L. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain steel bars.
- M. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- N. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- P. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.
- Q. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

- A. Concrete materials for curbs, sidewalks, steps and pavements: Comply with requirements of Commonwealth of Pennsylvania, Department of Transportation, Specifications (Pub form 408, latest edition) Section 704, Table A for Class AAA cement concrete mixture of Portland Cement, unless otherwise specified in this section, Type IA air-entraining cement, fine aggregate, coarse aggregate and water.

- B. Cement, as specified in PennDOT 408, Section 701, shall be a minimum of six (6) 94 lb. bags per cubic yard and a maximum of eight (8) bags per cubic yard.
- C. Fine aggregate (sand) to be Type A. Do not use fine aggregate produced from limestone in concrete wearing surfaces. See Table A PennDOT 408, Section 703.1.
- D. Compacted porous fill to be Type A, No. 57 as specified in PennDOT 408, Section 703.2, Tables B, C, and D.
- E. Cement to be air-entrained from an approved manufacturer as listed in PennDOT Bulletin 15. Use cement for each project from the same manufacturer.
- F. Cement concrete shall be mixed and transported in accordance with PennDOT 408, Section 704.
- G. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - 1. Aggregate Sizes: 3/8 to 5/8 inch (10 to 16 mm) nominal.
 - 2. Aggregate Source, Shape, and Color: To be determined by Architect.
- H. Water: ASTM C 94/C 94M.

2.4 CURING MATERIALS

- A. Curing and protective covers shall be in accordance with Commonwealth of Pennsylvania, Department of Transportation, Specifications (Pub form 408, latest edition) Section 711.1.

2.5 RELATED MATERIALS

- A. Expansion Joint Materials: 1/4" Fiber Joint Fillers conforming to AASHTO-M213 or Cork or Sponge Rubber Joint Fillers conforming to AASHTO-M153, 1/4" thick.
- B. Concrete Sealer: An approved material in accordance with PennDOT 408, Section 503.

2.6 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Penn DOT Section 962
 - 1. Color: As indicated.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 PSI.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: Slump range at point of delivery shall be 1" to 3". Test concrete for slump in accordance with Pennsylvania Test Methods (PTM) No. 600.
- C. Design cement concrete with an entrained air content of 6% in the plastic state with a tolerance of +/- 1.5% during the work. The specification for entrained air is met, if the entrained air in the hardened concrete is not less than 3.5% nor greater than 7.5%. Testing for air-entrained cement concrete shall be in accordance with PennDOT 408, Section 704.1(c)1.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (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 concrete mixes 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 concrete mixes 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, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 2. Provide tie bars at sides of pavement strips where indicated.
 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 4. 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.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated. Provide expansion joints where new or existing light standards, poles, fire hydrants, access frames / covers for utilities or sewers and similar structures abut new concrete work.
1. Locate expansion joints at intervals of 15 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 7. General: Comply with the requirements of Pennsylvania, Department of Transportation, Specifications (Pub form 408, latest edition), Section 630.3(e) and 676.3(e).
 8. Provide pre-molded expansion joint material the specified depth of the concrete slabs and curbs; where slabs abut other fixed structures; longitudinally where sidewalk slab is to be constructed in contact with curb, and adjacent to existing structures as directed.
 9. Construct sidewalks in separate slabs, maximum 20' in length to accommodate scoring joint pattern. Separate these slabs by 1/4" transverse expansion joint material to allow for edging, and sealants specified. Scoring and control joints must extend to a depth of at least 1/4 of the slab thickness.
 10. Unless otherwise directed by the Owner, use a metal edger with a 1/4" radius for edging joints. Do transverse and longitudinal scoring in accordance with the drawings or as directed.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover 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-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 3. Doweled Contraction 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.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side

forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Slabs
 - 1. Sidewalk slabs shall be one-course construction of thickness not less than a full depth shown on the drawings.
 - 2. Schedule continuous placement and consolidation of concrete within planned expansion joints.
- M. Curbs
 - 1. Curb shall be a monolithic pour with formed concrete. Maximum length between joints is 12'-0". Install load transfer between joints. Drill into existing curb and install dowel. Extruded or automatic machine placement of concrete curbs is not an acceptable construction method.
 - 2. Wood or metal forms may be used at small radius locations.
 - 3. Tool all exposed edges with 1/8" radius.
 - 4. Install expansion joint filler to the full depth on the concrete.
 - 5. Match curb profiles where new work is an extension or revision of existing.
- N. CONCRETE STEPS
 - 1. Steps should be built into the slopes and have a foundation below frost level. Risers shall have a backslope and treads shall have a 1/4" wash.
 - 2. Maintain 3" minimum clearance from edge of steps to outside of drilled hole for handrail installation where required.
 - 3. Handrails, tread, and riser design shall meet all local and national codes and ADA requirements.
 - 4. Treads shall have a non-slip finish.
 - 5. Nosing bars shall not be used in step construction.
- O. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

- P. 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 air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- Q. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Comply with the requirements of PennDOT 408, Section 630.3(c) and 501.3(j).
- B. Place cement sidewalk slabs to full thickness in one operation without change in proportions, rammed, spaded or vibrated, and screeded to proper grade, wood floated and lightly troweled with a steel trowel.
- C. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- D. After floating, test surface for trueness within a tolerance of 1/4 inch in 10' feet as determined by a 10' straightedge placed anywhere on the surface in any direction. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- E. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/4" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- F. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Sidewalks and pavements: Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Construction Manager.
2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.
3. Finish concrete curbs and steps in accordance with PennDOT 408, Section 1001.3.

3.8 SPECIAL FINISHES

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moist 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation 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.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm).
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.11 PAVEMENT MARKING

- A. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 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 mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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).
- D. 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.
- E. 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.
- F. 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.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.13 REPAIRS AND PROTECTION
- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
 - B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, Division B and other Division 1 Specifications Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Provide four (4) inch wide line striping and/or other specified-markings on pavement.
- B. Restoration and / or layout and painting of traffic markings, parking division lines, direction arrows, crosswalk lines, and handicap symbols.
- C. Removal and replacement of any existing signs or related appurtenances necessary for completion of the proposed pavement marking work.
- D. Traffic Control

1.04 SYSTEM DESCRIPTION

- A. Provide contractor-grade acrylic traffic paint for new asphalt paving, existing asphalt and concrete pavements and/or restriping.

1.05 FIELD MEASUREMENTS

- A. Contractor shall be responsible for the layout of the proposed pavement marking based upon the information shown on the Contract Drawings. If the Contractor deems that additional data may be required, the Client must be notified in writing prior to the submittal of the bid.
- B. Verify the pavement marking work as shown on the Contract Drawings can be performed based upon the information provided on the drawings.

1.06 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Commonwealth of Pennsylvania, Department of Transportation (PennDOT), Publication 408 Specifications, Latest Edition
 - 2. Commonwealth of Pennsylvania, Department of Transportation (PennDOT), Publication 203 Traffic Control, Latest Edition
 - 3. Standard Specifications for Materials and Construction for Local Governments and Authorities.

- B. Obtain materials from the same source throughout the duration of the project.

1.07 SUBMITTALS

- A. Manufacturer's printed Product Data Sheets.
- B. Proposed Traffic Control Plan

1.08 PROJECT CONDITIONS

- A. Coordination: Coordinate this work with the work of other Sections to avoid any delay or interference with other work.
- B. Environmental Requirements: Apply marking paint in dry weather when pavement and atmospheric temperatures are fifty (50) degrees F. or above and are anticipated to remain above fifty (50) degrees F. for four (4) hours after completing application.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. High-solids, water-based acrylic paint containing ultraviolet-resistant pigments.
- B. Colors: White, as shown on the Contract Drawings, or as otherwise directed by the Client's Professional. Blue only for ADA Accessible Symbol.
- C. Pavement Markings shall be Sherwin-Williams Traffic Paint, PermaLine Marking Paint as manufactured by Neyra Industries, Inc. of Cincinnati, OH, or an equal paint approved by PennDOT. All manufacturer's specifications shall govern.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas in which work is to be performed. Report in writing to the Client's Representative all prevailing conditions that will adversely affect satisfactory execution of work and/or defects that will adversely affect quality of work and which cannot be put into acceptable condition through normal preparatory work. Do not place marking on unsound pavements. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting work constitutes acceptance of the existing conditions and the Contractor shall then, at his/her expense, be responsible for correcting all unsatisfactory and defective work encountered.

- C. Verify that new asphalt pavement is complete, has been accepted by the Client's Representative and cured a minimum of twenty eight (28) days.

3.02 PREPARATION

- A. Contractor shall provide a qualified technician to supervise equipment and application of markings. Layout markings using guide lines, templates and/or forms.
- B. Thoroughly clean surfaces free of dirt, sand, gravel, oil and other foreign matter.
- C. Protect adjacent curbs, walks, fences and other items from receiving marking paint.
- D. Layout and paint parking division lines, roadway markings, crosswalk lines, directional arrows, handicap symbols and other markings shown on the Contract Drawings, in accordance with the "Uniform Federal Accessibility Standards".

3.03 APPLICATION

- A. Apply marking paint at a rate of one (1) gallon per four hundred fifty (450) lineal feet of four (4) inch wide line stripes. Should the Client's Professional require pavement markings in addition to the specified-stripes, the marking paint shall be applied at a rate of one (1) gallon per one hundred fifty (150) square feet.
- B. Apply marking paint by power spray, brush or roller.
- C. Apply second coat as required for proper approved coverage.
- D. Any existing pavement markings in place prior to construction and which become degraded by the construction must be replaced in kind with pavement markings, in accordance with these project specifications, at no additional cost to the Client.

3.04 FINISH AND PROTECTION

- A. Contractor shall barricade all marked-areas until the marking paint is dried and ready for traffic. Normally an area may be open to traffic in approximately six (6) hours in good drying conditions.
- B. Remove overspray, spills or drips from surfaces other than those requiring marking paint.

END OF SECTION 32 17 23

Section 32 31 23 - EXTRUDED VINYL FENCING SYSTEMS

PART 1 GENERAL

A. SECTION INCLUDES

- A. Rigid polyvinyl chloride (PVC) fencing sections profiles and accessories, including pickets, rails, posts and caps.

1.02 RELATED SECTIONS

- A. Section 31 00 00 Earthwork
- B. Section 32 00 00 Paving and Surfacing
- C. Section 03 30 00 Cast-In-Place Concrete

1.03 REFERENCES

- A. ASTM D4216 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Related Plastic Building Product Compounds
- B. ASTM F964-09 - Standard Specification for Rigid Poly (PVC) Exterior Profiles Used for Fencing and Railing.

1.04 SUBMITTALS

- A. Shop Drawings: Showing fence design, style and colors or woodgrains, layout of fence and gates with dimensions and specified options, including details and finishes of component accessories and post foundations.
- B. Product Data: Submit manufacturer's product data, including style, installation instructions and certification of compliance with material specifications.

1.05 WARRANTY

- A. Provide manufacturer's non-prorated warranty.

1.06 QUALITY INSURANCE

- A. Obtain PVC fences and gates, including accessories, fittings and fastenings, from a single source.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation in a secure and dry place.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Approved Manufacturer: **Illusions Vinyl Fence**, 274 Middle Island Road, Medford, NY, 11763.
Phone: 1-800-399-3362. Website: www.illusionsfence.com OR EQUAL.

2.02 MATERIALS

- A. Pickets, rails, and posts prefabricated sections using Rigid Poly Vinyl Chloride (PVC) compounds for exterior-profile extrusions with cell classification of 1-32333-3 as defined by ASTM D4216, that meets or exceeds the following proprieties:
 - i. Color/Consistency Testing – The PVC compound in extruded section shall maintain uniform color and be free of any visual surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting after weathering at intervals of six months and one year for white and for six months, one year and a temperate northern climate, when tested in accordance with ASTM Performance Weathering Requirements.
 - ii. Weathering Testing – The PVC compound shall have a minimum impact resistance of 0.6in.-lb/mil (2670 J/m) after weathering six months and one year in a temperate northern climate, when tested in accordance with ASTM Performance Weathering Requirements. The PVC compound shall have successfully met the weathering requirements prescribed for six months at each climatic testing site prior to use in production of exterior-profile extrusions, when tested in accordance with ASTM Performance Weathering Requirements.
 - iii. ASTM Specifications Met:
 - D256** – To determine Izod impact properties
 - D618** – Practice for Conditioning Plastics for Testing
 - D635** – Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position
 - D638** – To determine tensile properties
 - D648** – To determine heat distortion temperature

D696 – Test Method for Coefficient of Linear Thermal Expansion of Plastics between 0°C and 30°C with a Vitreous Silica Dilatometer

D790 – To determine flexural properties

D792 – To determine specific gravity

D883 – Terminology Relating to Plastics

D1435 – Practice for Outdoor Weathering of Plastics

D1600 – Terminology for Abbreviated Terms Relating to Plastics

D1784 – Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D1898 – Practice for Sampling of Plastics

D2240 – To determine Shore hardness values

D2244 – Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D2565 – Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

D4216 – Material Class Number 1-32333-3. To establish Cell Classification of PVC Material. Illusions compounds have a higher cell classification because one or more properties are superior to those used in standard acceptable compounds.

D4226 – Test Methods for Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products

D4726 – Specification for Rigid Poly (Vinyl Chloride)

2.03 PVC VINYL FENCE PREFABRICATED SECTIONS

1. Style:
 - a. Privacy by **Illusions Vinyl Fence**, 274 Middle Island Rd., Medford, NY 11763, **Toll Free:** 1-800-339-3362 **Website (includes Illusions Fence Design Center):** www.illusionsfence.com
 - b. OR EQUAL
2. Height:
 - a. 6 feet
3. Width, Nominal Center to Center of Posts:
 - a. 8 feet – See drawing for exact measurement of each style section.
4. Bend:
 - a. Straight
5. Color:
 - a. Classic Series: [White - C101] [Beige -C102] [Gray - C103]
6. Post Options
 - a. 5" x 5" H.D. - .250 wall
7. Post Cap Style:

- a. Flat V55FO

2.05 MISCELLANEOUS MATERIALS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Consult local code officials for compliance to building code requirements.
- B. Verify areas to receive fencing are completed to final grades and elevations.
- C. Ensure property lines and legal boundaries of work are clearly established.

3.02 FENCE INSTALLATION

- A. Excavation: Drill or hand-excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - 1. If not on drawings, excavate holes for each post to a minimum diameter 12"
 - 2. Unless otherwise indicated, excavate hold depths not less than 38 inches or to frost line.
- B. Posts: Install posts in one piece per prefabricated section, plumb and in line. Installation method is one post and one section at a time for proper spacing.
 - 1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, terminate top of concrete footings 3 inches below adjacent grade and trowel to a crown to shed water.
 - b. Secure posts in position with prefabricated section with manufacturer's recommendations until concrete sets.
 - c. Install post caps
 - d. Remove concrete splatters from PVC fence materials with care to avoid scratching.
- C. Fence Installation at Sloping Terrain: At sloping terrain, rails may be racked (sloped) or stepped to comply with manufacturer's recommendations.

3.04 CLEANING

- A. Clean up all debris and unused material and remove from the site.

TASK ORDER NO 33

EXTRUDED VINYL FENCING SYSTEMS

GLEN HAZEL RAD

323123

ALLIES AND ROSS MANAGEMENT AND DEVELOPMENT CO.

R3A PROJECT NO 15047B

3.05 DEMONSTRATION

- A. Instruct the owner's personnel on proper operation and maintenance of fence components.

END OF SECTION.

