S T A T E O F C O N N E C T I C U T
DEPARTMENT OF TRANSPORTATION

2800 BERLIN TURNPIKE, P.O. BOX 317546
NEWINGTON, CONNECTICUT 06131-7546

Phone: 860-594-3128

November 12, 2014

Subject: Project No. 431-0006
F.A.P. No. CT-90-X523
Waterbury Bus Maintenance Facility Replacement in the Town of Watertown.

NOTICE TO CONTRACTORS:

This is to notify all concerned and especially the prospective bidders that the bid opening for the subject project is being postponed Two (2) additional weeks from November 19, 2014 to December 3, 2014 at 2:00 P.M. in the Conference Room of the Department of Transportation Administration Building, 2800 Berlin Turnpike, Newington, Connecticut.

Addendum No. 4 is attached and can also be obtained on the Statewide Contracting Portal at http://www.biznet.ct.gov/scp_search/BidResults.aspx?groupid=64

This Addendum is necessary to revise a contract documents.

Pre-Bid Questions and Answers: Questions pertaining to DOT advertised construction projects must be presented through the CTDOT Pre-Bid Q and A Website. The Department cannot guarantee that all questions will be answered prior to the bid date. **PLEASE NOTE - at 12:01 am, the day before the bid, the subject project(s) being bid will be removed from the Q and A Website, Projects Advertised Section, at which time questions can no longer be submitted through the Q and A Website. At this time, the Q and A for those projects will be considered final, unless otherwise stated and/or the bid is postponed to a future date and time to allow for further questions and answers to be posted.**

Philip J. Melchionne
For: Gregory D. Straka
Contracts Manager
Division of Contracts Administration

NOVEMBER 10, 2014
WATERBURY BUS MAINTENANCE FACILITY REPLACEMENT
FEDERAL AID PROJECT NO. CT-90-X523
STATE PROJECT NO. 431-006
TOWN OF WATERTOWN

ADDENDUM NO. 4

SPECIAL PROVISIONS

NEW SPECIAL PROVISION

The following Special Provision is hereby added to the Contract:

- SECTION 1.10 – ENVIRONMENTAL COMPLIANCE

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT
- ITEM NO. 0969066A – CONSTRUCTION FIELD OFFICE, EXTRA - LARGE

CSI FORMATTED SPECIAL PROVISIONS

NEW CSI SECTIONS

The following CSI Specifications are hereby ADDED to the Contract:

- DIVISION 27 – SECTION 275116 PUBLIC ADDRESS NOTIFICATION SYSTEM

REVISED CSI SECTIONS

The following CSI Sections are hereby deleted in their entirety and replaced with the attached like-named CSI Sections:

- DIVISION 03 – SECTION 033000 CAST-IN-PLACE CONCRETE
- DIVISION 03 – SECTION 033610 BONDED POST TENSIONED CONCRETE
- DIVISION 04 – SECTION 042000 UNIT MASONRY
- DIVISION 05 – SECTION 057500 DECORATIVE FORMED METAL

- DIVISION 07 – SECTION 071616 CRYSTALLINE WATERPROOFING
- DIVISION 07 – SECTION 075423 THERMOPLASTIC POLYOLEFFIN (TPO) ROOFING
- DIVISION 07 – SECTION 078123 INTUMESCENT FIREPROOFING
- DIVISION 08 – SECTION 080671 DOOR HARDWARE SCHEDULE
- DIVISION 08 – SECTION 084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
- DIVISION 08 – SECTION 088000 GLAZING
- DIVISION 10 – SECTION 102800 TOILET, BATH AND LAUNDRY ACCESSORIES
- DIVISION 10 – SECTION 103000 SPILL BARRIER
- DIVISION 11 – SECTION 115100 SHOP EQUIPMENT
- DIVISION 11 – SECTION 115213 PROJECTION SCREENS
- DIVISION 11 – SECTION 115400 FARE COLLECTION EQUIPMENT
- DIVISION 11 – SECTION 115800 FLUID LUBRICATION SYSTEMS
- DIVISION 14 – SECTION 143000 CRANES
- DIVISION 23 – SECTION 238200 TERMINAL UNITS
- DIVISION 26 – SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PLANS
REVISED PLANS
The following Plan Sheets are hereby deleted and replaced with the like-numbered Plan Sheets:

SHEET NO.	DRAWING NO.	DRAWING TITLE
02.001.A4	G-002	INDEX OF REVISIONS
03.006.A4	C-103	SITE DEMOLITION PLAN
03.009.A4	C-200	OVERALL LAYOUT & UTILITIES PLAN
03.010.A4	C-201	MATERIALS & UTILITIES PLAN
03.011.A4	C-202	MATERIALS & UTILITIES PLAN
03.012.A4	C-203	MATERIALS & UTILITIES PLAN
03.013.A4	C-204	MATERIALS & UTILITIES PLAN
03.015.A4	C-206	LAYOUT PLAN
03.016.A4	C-207	LAYOUT PLAN
03.017.A4	C-208	LAYOUT PLAN
03.018.A4	C-209	LAYOUT PLAN
03.030.A4	C-313	SITE RETAINING WALL ELEVATIONS
03.031.A4	C-501	MISCELLANEOUS SITE DETAILS
03.033.A4	C-503	MISCELLANEOUS SITE DETAILS

SHEET NO.	DRAWING NO.	DRAWING TITLE
04.002.A4	MPT-100	MAINTENANCE OF TRAFFIC PLAN – WORK AREAS
04.003.A4	MPT-101	MAINTENANCE OF TRAFFIC PLAN–SIGNAGE PLAN
05.003.A4	OPS-201	PS-2 MATERIAL, UTILITY AND LAYOUT PLANS
07.002.A4	A-002	SYMBOLS, ABB. & CODE INFO
07.005.A4	A-005	GROUND FLOOR CODE COMPLIANCE PLAN
07.006.A4	A-006	FIRST FLOOR CODE COMPLIANCE PLAN
07.007.A4	A-007	ENLARGED CODE COMPLIANCE PLAN-AREAS D & G
07.008.A4	A-008	ENLARGED CODE COMPLIANCE PLAN - AREA E
07.010.A4	A-102	FIRST FLOOR PLAN
07.011.A4	A-103	SECOND FLOOR PLAN
07.012.A4	A-104	ROOF PLAN
07.018.A4	A-110	FIRST FLOOR PLAN - AREA B
07.020.A4	A-112	FIRST FLOOR PLAN - AREA D
07.021.A4	A-113	FIRST FLOOR PLAN - AREA E
07.023.A4	A-115	SECOND FLOOR PLAN - AREA G
07.025.A4	A-117	FIRST FLOOR BUS STRIPING PLAN
07.026.A4	A-152	ROOF PLAN - AREA A
07.027.A4	A-153	ROOF PLAN - AREA B
07.028.A4	A-154	ROOF PLAN - AREA C
07.029.A4	A-155	ROOF PLAN - AREA D
07.030.A4	A-156	ROOF PLAN - AREA E
07.031.A4	A-157	ROOF PLAN - AREA F
07.032.A4	A-201	ENLARGED TOILET ROOM PLANS
07.034.A4	A-203	ENLARGED PIT PLANS
07.046.A4	A-357	BUILDING SECTIONS
07.047.A4	A-358	BUILDING SECTIONS
07.051.A4	A-404	WALL SECTIONS
07.062.A4	A-451	EXTERIOR DETAILS
07.063.A4	A-452	EXTERIOR DETAILS
07.064.A4	A-453	EXTERIOR DETAILS
07.065.A4	A-454	EXTERIOR DETAILS
07.069.A4	A-481	ROOF DETAILS
07.071.A4	A-501	STAIR A- PLANS AND SECTIONS
07.072.A4	A-502	STAIR D- PLANS AND SECTIONS

SHEET NO.	DRAWING NO.	DRAWING TITLE
07.084.A4	A-708	FIRST FLOOR REFLECTED CEILING PLAN-AREA D
07.093.A4	A-901	ROOM FINISH SCHEDULE
07.094.A4	A-902	DOOR SCHEDULE AND TYPES
07.095.A4	A-903	VIEW WINDOW SCHEDULE
07.099.A4	A-908	WINDOW DETAILS
09.002.A4	S-100	GENERAL NOTES
09.003.A4	S-101	GROUND FLOOR FOUNDATION PLAN - AREA A
09.004.A4	S-102	GROUND FLOOR FOUNDATION PLAN – AREA B
09.005.A4	S-103	GROUND FLOOR FOUNDATION PLAN – AREA C
09.006.A4	S-104	GROUND FLOOR & FOUNDATION PLAN-AREA D&E
09.007.A4	S-105	FIRST FLOOR FRAMING PLAN - AREA A
09.008.A4	S-106	FIRST FLOOR FRAMING PLAN - AREA B
09.009.A4	S-107	FIRST FLOOR FRAMING PLAN - AREA C
09.011.A4	S-109	FIRST FLOOR FOUNDATION PLAN - AREA E
09.012.A4	S-110	FIRST FLOOR FOUNDATION PLAN - AREA F
09.014.A4	S-112	LOW ROOF FRAMING PLAN - AREA A
09.024.A4	S-122	HIGH ROOF FRAMING PLAN - AREA A
09.027.A4	S-125	PT TOPPING SLAB CJ PLAN
09.029.A4	S-301	TYPICAL DETAILS
09.031.A4	S-303	TYPICAL DETAILS
09.036.A4	S-308	TYPICAL DETAILS
09.037.A4	S-309	TYPICAL DETAILS
09.038.A4	S-310	TYPICAL DETAILS
09.040.A4	S-401	SECTIONS
09.041.A4	S-402	SECTIONS
09.042.A4	S-403	SECTIONS
09.045.A4	S-406	SECTIONS
09.046.A4	S-407	SECTIONS
09.051.A4	S-412	SECTIONS
09.052.A4	S-413	SECTIONS
09.059.A4	S-504	COLUMN SCHEDULE
09.060.A4	S-505	BEAM SCHEDULE
09.061.A4	S-601	BRACING DETAILS

SHEET NO.	DRAWING NO.	DRAWING TITLE
11.006.A4	FP-104	GROUND FLOOR REFLECTED CEILING PLAN AREA D & E
11.009.A4	FP-107	FIRST FLOOR REFLECTED CEILING PLAN – AREA C
11.012.A4	FP-110	FIRST FLOOR REFLECTED CEILING PLAN – AREA F
11.016.A4	FP-901	FIRE PROTECTION SCHEDULE
12.021.A4	M-211	MECHANICAL FIRST FLOOR PIPING PLAN – AREA C
12.025.A4	M-125	MECHANICAL SECOND FLOOR PIPING PLAN AREA G
12.036.A4	M-602	MECHANICAL SCHEDULES
13.001.A4	E-001	ELECTRICAL ABBREVIATIONS, SYMBOLS & NOTES
13.011.A4	E-111	ELECTRICAL FIRST FLOOR POWER PLAN – AREA C
13.015.A4	E-115	ELECTRICAL SECOND FLOOR POWER PLAN-AREA G
13.016.A4	E-116	ELECTRICAL POWER PLAN - BUS STORAGE CLERSTORY
13.029.A4	E-210	ELECTRICAL FIRST FLOOR LIGHTING PLAN - AREA B
13.030.A4	E-211	ELECTRICAL FIRST FLOOR LIGHTING PLAN - AREA C
13.032.A4	E-213	ELECTRICAL FIRST FLOOR LIGHTING PLAN - AREA E
13.033.A4	E-214	ELECTRICAL FIRST FLOOR LIGHTING PLAN - AREA F
13.034.A4	E-215	ELECTRICAL SECOND FLOOR LIGHTING PLAN - AREA G
13.038.A4	E-308	ELECTRICAL GROUND FLOOR SYSTEMS PLAN-AREA D&E
13.040.A4	E-310	ELECTRICAL FIRST FLOOR SYSTEMS PLAN – AREA B
13.041.A4	E-311	ELECTRICAL FIRST FLOOR SYSTEMS PLAN – AREA C
13.042.A4	E-312	ELECTRICAL FIRST FLOOR SYSTEMS PLAN – AREA D

SHEET NO.	DRAWING NO.	DRAWING TITLE
13.043.A4	E-313	ELECTRICAL FIRST FLOOR SYSTEMS PLAN – AREA E
13.044.A4	E-314	ELECTRICAL FIRST FLOOR SYSTEMS PLAN – AREA F
13.045.A4	E-315	ELECTRICAL SECOND FLOOR SYSTEMS PLAN - AREA G
13.047.A4	E-402	ELECTRICAL ENLARGED PLAN-UNIT SHOP AND TIRE ROOM
13.053.A4	E-408	ELECTRICAL ENLARGED PLAN - PAINT RM, WELDING SHOP AND AIR COMP. ROOM
13.055.A4	E-501	ELECTRICAL LIGHTING FIXTURE SCHEDULE
13.056.A4	E-502	ELECTRICAL EQUIPMENT SCHEDULE
13.061.A4	E-601	ELECTRICAL ONE-LINE DIAGRAM
13.062.A4	E-602	ELECTRICAL PANELBOARD SCHEDULES
13.063.A4	E-603	ELECTRICAL PANELBOARD SCHEDULES
13.065.A4	E-605	ELECTRICAL PANELBOARD SCHEDULES
13.066.A4	E-606	ELECTRICAL PANELBOARD SCHEDULES
13.070.A4	E-703	ELECTRICAL DETAILS
13.071.A4	E-704	ELECTRICAL DETAILS
13.076.A4	E-709	ELECTRICAL DETAILS
14.007.A4	Q-105	PARTIAL FIRST FLOOR EQUIPMENT PLAN
14.008.A4	Q-301	EQUIPMENT SCHEDULE & DETAILS

The Bid Proposal Form is not affected by these changes.

There will be no change in the number of calendar days due to this Addendum.

The Construction Contracts – Required Contract Provisions dated October 2011 are hereby deleted and replaced with the attached Construction Contracts – Required Contract Provisions dated October 2014.

The foregoing is hereby made a part of the contract.

NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT

This Project is being bid with both lump sum and unit price items. The bid items include unit price and lump sum items which are IN ADDITION TO the Major Lump Sum Item (MLSI) of the Project, Item No. 0100150A, titled "-Maintenance Facility, Item No. 0100151A, titled “Water and WasteWater Facilities” and Item No. 0000202, titled “Multi-use Trail”. These separate items will be measured for payment on a unit price or lump sum basis (whichever is applicable) for which a separate bid price is required, at the quantities as indicated in the Bid Proposal Form. Each item to be measured is more specifically described in a corresponding Form 816 Standard Specification related to that item, or a special provision, as applicable.

Standard Form 816 Items are referenced by their standard item numbers. Refer to the applicable article of Form 816 for the requirements for this item. Special Provisions included in this Contract are referenced by their item number followed by an "A" suffix. Refer to the Special Provisions contained within this Contract for requirements for this item.

All work depicted on the Contract Plans and described in the Contract Specifications, including mobilization, is included in the MLSI of the Project, with the exception of the unit price or other lump sum items listed in the Bid Proposal Form. Any work incidental to an item which is not specifically described or included in the item, but which is required for performance and completion of the work required under the Contract, is included in the MLSI.

SECTION 1.10 ENVIRONMENTAL COMPLIANCE

Article 1.10.03 Water Pollution Control:

Add the following after Best Management Practice Number 14.

15. The Contractor is hereby notified that the state and regional species of greatest conservation need and federal listing candidate species New England cottontail (*Sylvilagus transitionalis*), is present within the project limits**.** In Connecticut, this rabbit breeds throughout the spring, summer, and sometimes into the fall. New England cottontails are active year round during dawn, dusk, and at night. In the summer, they feed on grasses and forbs and in the winter they feed on bark, twigs, and buds of shrubs and young trees. These rabbits prefer early successional habitats such as brushy second-growth tangles, briers, and dense thickets often near wet areas. Maintaining existing early successional stage habitats (such as pasture land and agricultural fields) as well as forested edges with a well-developed understory (with shrubs and brushy thickets) will conserve the preferred habitat of this species. In general, larger contiguous patches of habitat are better for this species than small patches. All construction activities taking place within the New England cottontail's habitat (project limits) will need to be coordinated with the Office of Environmental Planning (OEP).

The Contractor shall arrange through the Engineer at least 10 days prior to the commencement of any construction activities that a CT DOT Environmental Inspector from the OEP or their authorized delegate is available to meet and discuss proper protocol for maintaining environmental commitments made to the protection of this species and habitat. OEP will provide oversight to ensure that the following protocols are followed and maintained during the course of the project:

- A thorough walk through and inspection of all New England cottontail habitat areas must be performed immediately prior to clearing and grubbing. OEP will not release the site for ground disturbance until all New England cottontail habitat is surveyed.

- All staging and storage areas, outside of previously paved locations, regardless of the duration of time which it will be utilized, must be reviewed by and receive written approval from OEP.

- If suitable habitat is present, within the project limits, than small areas of habitat enhancement will be implemented under direction of OEP. These enhancements will consist of brush piles and leaving dense thickets undisturbed.

- All construction personnel working within New England cottontail habitat must be apprised of the species description and be able to identify the possible presence of a listed species within the project site.

Workers should be notified of the existence of the New England cottontail in this area. Photographs of the New England cottontail (species ID sheets will be provided by OEP) shall be posted in the Contractor's and DOT field office. Any observations of this species are to be immediately reported to OEP at (860) 594-2937 or (860)-594-2938.

ITEM # 0969066A - CONSTRUCTION FIELD OFFICE, EXTRA-LARGE

Description: Under the item included in the bid document, adequate weatherproof office quarters will be provided by the Contractor for the duration of the work, and if required, for a maximum of ninety days thereafter for the exclusive use of ConnDOT forces and others who may be engaged to augment ConnDOT forces with relation to the contract. The office quarters shall be located convenient to the work site and installed in accordance with Article 1.08.02, this office shall be separated from any office occupied by the Contractor. Ownership and liability of the office quarters shall remain with the Contractor.

Materials: Materials shall be in like new condition for the purpose intended and shall be approved by the Engineer.

Office Requirements: The Contractor shall furnish the office quarters and equipment as described below.

	Description:
2,000 SF	Sq. Ft. of floor space with a minimum ceiling height of 7 ft. and shall be partitioned as shown on building floor plan as provided by the Engineer.
2 EA	Minimum number of exterior entrances.
15 EA	Minimum number of parking spaces.

Office layout: The office shall have a minimum square footage as indicated in the table above, and shall be partitioned as shown on building floor plan as provided by the Engineer. The underside of the office shall be fully skirted to the ground.

Lavatory Facilities: The Contractor shall furnish a minimum of two (2) separate lavatories and toilet facilities ("men" and "women"), in separately enclosed rooms that are properly ventilated and comply with applicable sanitary codes. The Contractor shall provide each lavatory with hot and cold running water and flush-type toilets. He shall also supply lavatory and sanitary supplies as required.

Windows and Entrances: The windows shall be of a type that will open and close conveniently, shall be sufficient in number and size to provide adequate light and ventilation, and shall be fitted with locking devices, blinds and screens. The entrances shall be secure, screened, and fitted with a lock for which four keys shall be furnished. All keys to the construction field office shall be furnished to the Department and will be kept in their possession while State personnel are using the office. Any access to the entrance ways shall meet applicable building codes and be slip resistant, with appropriate handrails.

Lighting: The Contractor shall equip the office interior with electric lighting that provides a minimum illumination level of 100 foot-candles at desk level height, and electric outlets for each desk and drafting table. The Contractor shall also provide exterior lighting that provides a minimum illumination level of 2 foot-candles throughout the parking area and for a minimum distance of 10 ft. on each side of the field office.

The Contractor shall provide the following additional equipment, facilities, and/or services at the Field Office on this project to include at least the following to the satisfaction of the Engineer:

Parking Facility: Adequate parking spaces with adequate illumination on a paved surface, with surface drainage if needed. If paved parking does not exist adjacent to the field office, the Contractor shall provide a parking area of sufficient size to accommodate the number of vehicles indicated in the table above. Construction of the parking area and driveway, if necessary, will consist of a minimum of 6 inches of processed aggregate base graded to drain. The base material will be extended to the office entrance.

Field Office Security: Physical Barrier Devices - This shall consist of physical means to prevent entry, such as: 1) All windows shall be barred or security screens installed; 2) All field office doors shall be equipped with dead bolt locks and regular day operated door locks; and 3) Other devices as directed by the Engineer to suit existing conditions.

Electric Service: The field office shall be equipped with an electric service panel to serve the electrical requirements of the field office, including: lighting, general outlets, computer outlets, calculators etc., and meet the following minimum specifications:

A. 120/240 volt, 1 phase, 3 wire.
B. Ampacity necessary to serve all equipment. Service shall be a minimum 100 amp dedicated to the construction field office.
C. The electrical panel shall include a main circuit breaker and branch circuit breakers of the size and quantity required.
D. Additional 120 volt, single phase, 20 amp, isolated ground dedicated power circuit with dual NEMA 5-20 receptacles will be installed at each computer workstation location.
E. Additional 120 volt, single phase, 20 amp, isolated ground dedicated power circuit with dual NEMA 5-20 receptacles will be installed, for use by the Telephone Company.
F. Additional 120-volt circuits and duplex outlets as required meeting National Electric Code requirements.
G. One exterior (outside) wall mounted GFI receptacle, duplex, isolated ground, 120 volt, straight blade.
H. After work is complete and prior to energizing, the State's ConnDOT electrical inspector, must be contacted at 860-594-2240. (Do Not Call Local Town Officials)
I. Prior to field office removal the ConnDOT Data Communications office must be notified to deactivate the communications equipment.

Heating, Ventilation and Air Conditioning (HVAC): The field office shall be equipped with sufficient heating, air conditioning and ventilation equipment to maintain a temperature range of 68°-80° Fahrenheit within the field office.

The Following Furnishings and Equipment Shall Be Provided In The Applicable Field Office Type:

QTY	Description:
10 EA	Office desks (2.5 ft x 5 ft) with drawers, locks, and matching desk chairs that have pneumatic seat height adjustment and dual wheel casters on the base.
1 EA	Standard secretarial type desk and matching desk chair that has pneumatic seat height adjustment and dual wheel casters on the base.
2 EA	Conference table, 4 ft x12 ft.
30 EA	Office Chairs.
6 EA	Fire resistant cabinets (legal size/4 drawer), locking.
4 EA	Non-fire resistant cabinets (legal size/4 drawer), locking.
2 EA	Storage racks to hold 3 ft x 5 ft display charts.
1 EA	Mail slot bin - legal size.
2 EA	Drafting type tables (3 ft x 6 ft) and supported by wall brackets and legs; and matching drafters stool that have pneumatic seat height adjustment, seat back and dual wheel casters on the base.
1 EA	Flat file (4/drawers).
10 EA	Personal computer tables (4 ft x 2.5 ft).
1 EA	Hot and cold water dispensing unit and supply of cups and bottled water shall be supplied by the Contractor for the duration of the project.
4 EA	Electronic office type printing calculators capable of addition, subtraction, multiplication and division with memory and a supply of printing paper.
1 EA	Business telephone system for three lines with ten handsets, intercom capability, and one speaker phone for conference table.
1 EA	Telephone answering machine.
1 EA	Color Multi-function Printer/Copier/Scanner/Fax –high speed, dry, plain paper with sorting capability, automatic feeder and reducing capability. The copier shall be capable of producing a minimum of 25 copies per minute. All supplies, paper and maintenance shall be provided by the Contractor. With network capability
10 EA	Computer systems as specified below under Computer Hardware and Software. All supplies and maintenance shall be provided by the Contractor.
3 EA	Laser printer as specified below under Computer Hardware and Software. All supplies, paper and maintenance shall be provided by the Contractor.
3 EA	Digital Camera as specified below under Computer Hardware and Software. All supplies and maintenance shall be provided by the Contractor.
1 EA	Smart Board/Projector combination- to be installed on one of the required computers in the conference room. All supplies, paper and maintenance shall be provided by the Contractor.
2 EA	Wastebaskets - 30 gal., including plastic waste bags.
10 EA	Wastebaskets - 5 gal., including plastic waste bags.
2 EA	Electric pencil sharpeners.
2 EA	Electric wall clocks.

QTY	Description:
* EA	Fire extinguishers - provide and install type and number to meet applicable State and local codes for size of office indicated, including a fire extinguisher suitable for use on a computer terminal fire.
1 EA	Coat rack with 20 coat capacity.
1 EA	Tables - 3 ft x 6 ft.
6 EA	Interior partitions - 6 ft x 6 ft, soundproof type, portable and freestanding.
3 EA	Vertical plan racks for 2 sets of 2 ft x 3 ft plans for each rack.
2 EA	Double door supply cabinet with 4 shelves and a lock - 6 ft x 4 ft.
1 EA	Easel/chalkboard.
6 EA	Open bookcases - 3 shelf - 3 ft long.
2 EA	Infrared Thermometer, including certified calibration, case, cleaning wipes.
1 EA	Concrete Curing Box as specified below under Concrete Testing Equipment.
1 EA	Concrete Air Meter as specified below under Concrete Testing Equipment.
1 EA	Concrete Slump Cone as specified below under Concrete Testing Equipment.
1 Set	Set of the following Means Books, updated throughout the Contract life, to remain the property of the Engineer at the conclusion of the Contract: “Building Construction Cost Data” “Heavy Construction Cost Data” “Electrical Construction Cost Data” “Plumbing Construction Cost Data” “Mechanical Construction Cost Data”
1 EA	First Aid Kit
1 Set	Provide the following building and fire codes consistent with the Contract documents to remain property of the Engineer at the conclusion of the Contract: International Building Code with the State Building Code, Including the latest Connecticut Supplement. International Plumbing Code International Mechanical Code International Existing Building Code International Existing Building Code International Energy Conservation Code NEPA 70 National Electric Code ICC/ANSI A117.1 The Fire Safety Code, including latest Connecticut Supplement International Fire Code NEPA 1 Uniform Fire Code NEPA 101 Life Safety Code “Americans with Disabilities Act Accessibility Guidelines

The furnishings and equipment required herein shall remain the property of the Contractor. Any supplies required to maintain or operate the above listed equipment or furnishings shall be provided by the Contractor for the duration of the project.

Telephone Service: This shall consist of four (4) telephone lines: three (3) lines for phone/voice service and one (1) line dedicated for the facsimile machine. The Contractor shall pay all charges except for toll calls made by State personnel.

Data Communications Facility Wiring: Contractor shall install a Category 5e 468B patch panel in a central wiring location and Cat 5e cable from the patch panel to each PC station, terminating in a (category 5e 468B) wall or surface mount data jack. The central wiring location shall also house either the data circuit with appropriate power requirements or a category 5 cable run to the location of the installed data circuit. The central wiring location will be determined by the ConnDOT Data Center staff in coordination with the designated field office personnel as soon as the facility is in place. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications, approved printer list and data wiring schematic as soon as possible after the contract is awarded.

Contractor to run CAT 5e LAN cables from workstations, install patch panel in data circuit demark area and terminate runs with RJ45 jacks at each computer location. Terminate runs to patch panel in LAN switch area. Each cable run / jack shall be clearly labeled with an identifying Jack Number.

The installation of a data communication circuit between the field office and the ConnDOT Data Communication Center in Newington will be coordinated between the ConnDOT District staff, ConnDOT Office of Information Systems and the local phone company. The ConnDOT District staff will coordinate the installation of the data communication service with ConnDOT PC Support once the field office phone number is issued. The Contractor shall provide the field office telephone number(s) to the ConnDOT Project Engineer as soon as possible to facilitate data line and computer installations.

Computer Hardware and Software:

The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications, approved printer list and data wiring schematic as soon as possible after the contract is awarded.

Before ordering the computer hardware and software, the Contractor must submit a copy of their proposed PC specifications and the type of printer to the ConnDOT Project Engineer for review by the ConnDOT Data Center. If the specification meets or exceeds the minimum specifications listed below, then the Contractor will be notified that the order may be placed.

Before any equipment is delivered to the Data Center, arrangements must be made a minimum of 24 hours in advance by contacting 860-594-3500. All software, hardware and licenses listed below shall be clearly labeled, specifying the (1) Project No., (2) Contractor Name, (3) Project Engineer's Name and (4) Project Engineer's Phone No., and shall be delivered to the ConnDOT Data Center, 2710 Berlin Turnpike, Newington, CT, where it will be configured and prepared for field installation. Installation will then be coordinated with ConnDOT field personnel and the computer system specified will be stationed in the Department's project field office.

The computer system furnished shall have all software and hardware necessary for the complete installation of the latest versions of the software listed, and therefore supplements the minimum specifications below. The Engineer reserves the right to expand or relax the specification to adapt to the software and hardware limitations and availability, the compatibility with current agency systems, and to provide the Department with a computer system that can handle the needs of the project. This requirement is to ensure that the rapid changing environment that computer systems have experienced does not leave the needs of the project orphan to what has been specified. There will not be any price adjustment due to the change in the minimum system requirements.

The Contractor shall provide the Engineer with a licensed copy registered in the Department's name of the latest versions of the software listed and maintain customer support services offered by each software producer for the duration of the Contract. The Contractor shall deliver to the Engineer all supporting documentation for the software and hardware including any instructions or manuals. The Contractor shall provide original backup media for the software.

The Contractor shall provide the computer system with all required supplies, maintenance and repairs (including labor and parts) throughout the Contract life.

Once the Contract has been completed, the computer will remain the property of the Contractor. Prior to the return of any computer(s) to the Contractor, field personnel will coordinate with the Data Center personnel for the removal of Department owned equipment, software, data, and associated equipment.

A) Computer – Minimum Specification (*revised 11-1-14):*

Processor – Intel® Core i5 Processor (2.93 GHz, 1066 MHz FSB 3MB L2 Cache) to include Intel vPro™ Technology's Advanced Management Features
Memory – 6 GB DIMM DDR3 1333MHz.
Monitor – Dual 24.0 inch LCD color monitor.
Graphics – Intel Graphics Media Accelerator 4500 or equivalent. Video card must capable of accepting two monitors.
Hard Drive – 500 GB Ultra ATA/SATA hard drive (Western Digital, IBM or Seagate).
Optical Drive – CD-RW/DVD-RW Combo.
Multi-Card Reader – Must include SD
Multimedia Package – Integrated Sound Blaster Compatible AC97 Sound and speakers.
Case – Small Form or Mid Tower, capable of vertical or horizontal orientation.
Integrated Network Adapter – comparable to 3COM 10/100/1000 twisted pair Ethernet.
Keyboard – 104+ Keyboard.
Mouse – Optical 2-button mouse with scroll wheel.
Operating System – Windows 7 Professional 64 bit Service Pack 1.
Application Software – MS Office Professional Edition 2010.
Additional Software (Latest Releases, including subscription services for the life of the Contract) –

- Norton Anti-Virus,
- Blue-Beam Revu (*Must be original purchased Licensed Media CD/DVD or authentic digital down load certificate*).
    - Adobe Acrobat Professional may be specified as an alternative to Blue-beam Revu, upon request by administrating District (*Must be original purchased Licensed Media CD/DVD or authentic digital down load certificate*).

Resource or Driver CD/DVD – CD/DVD with all drivers and resource information so the computer can be restored to original prior to shipment back to the contractor.
Uninterrupted power supply – APC Back-UPS 500VA.

Note A1: All hardware components must be installed before delivery. All software documentation and CD-ROMs/DVD for Microsoft Windows 7 Professional, Microsoft Office 2010 Professional Edition, and other software required software must be provided. Computer Brands are limited to Dell (preferred) and HP (acceptable) brands only. No other brands will be accepted. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications and approved printer list as soon as possible after the contract is awarded.

B) Laser Printer – Minimum Specification:

Print speed – 20 ppm.
Resolution – 1,200 x 1,200 dpi. (with color capability)
Paper size – Up to 216 mm x 355 mm (8.5 in x 14 in).
RAM – 16 MB.
Print Drivers – Must support HP PCL6 and HP PCL5e.
Printer cable – 1.8 m (6 ft).
Network Ready

Note B1: Laser printer brands are limited to Hewlett-Packard and Savin brands only. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications and approved printer list as soon as possible after the contract is awarded.

Note B2: It is acceptable to substitute (1) a high-speed multi-function all-in-one printer/copier/scanner/fax machines listed on the approved printer list in place of one required laser printer and fax machine, and (2) a multi-function all-in-one printer/copier/scanner/fax machine listed on the approved printer list in place of the second required laser printer and fax machine. Only one of these devices is required to be set-up to function as the one required fax machine.

C) Digital Camera – Minimum Specification:

Optical – 5 mega pixel, with 3x optical zoom.
Memory – 2 GB.
Features – Date/time stamp feature.
Connectivity – USB cable or memory card reader.
Software – Must be compatible with Windows 7.
Power – Rechargeable battery and charger.

The Contractor is responsible for service and repairs to all computer hardware. All repairs must be performed with-in 48 hours. If the repairs require more than a 48 hours then a replacement must be provided. All supplies, paper and maintenance for the computers, laptops, printers, copiers, and fax machines shall be provided by the Contractor.

D) Smart Board- Minimum Specification
Min 70 in display Smart Board with integrated Projector or internal LCD or LED display to be installed on one of the computers in the conference room. Includes speakers all the necessary accessories.

*The Contractor is responsible for the service and repairs to all computer hardware. All repairs must be performed within 48 hours. If the repairs require more that 48 hrs then a replacement must be provided. All Supplies, paper and maintenance for the computers, laptops, printers, copiers, and fax machines shall be provided by the Contractor.

Concrete Testing Equipment: If the Contract includes items that require compressive strength cylinders for concrete, in accordance with the Schedule of Minimum Testing Requirements for Sampling Materials for Test, the Contractor shall provide the following. All testing equipment will remain the property of the Contractor at the completion of the project.

A) Concrete Cylinder Curing Box – meeting the requirements of Section 6.12 of the Standard Specifications.

B) Air Meter – The air meter provided shall be in good working order and will meet the requirements of AASHTO T 152.

C) Slump Cone Mold – Slump cone, base plate, and tamping rod shall be provided in like-new condition and meet the requirements of AASHTO T119, Standard Test Method for Slump of Hydraulic-Cement Concrete.

Insurance Policy: The Contractor shall provide a separate insurance policy, with no deductible, in the minimum amount of forty thousand dollars ($40,000.00) in order to insure all State-owned data equipment and supplies used in the office against all losses. The Contractor shall be named insured on that policy, and the Department shall be an additional named insured on the policy. These losses shall include, but not be limited to: theft, fire, and physical damage. The Department will be

responsible for all maintenance costs of Department owned computer hardware. In the event of loss, the Contractor shall provide replacement equipment in accordance with current Department equipment specifications, within seven days of notice of the loss. If the Contractor is unable to provide the required replacement equipment within seven days, the Department may provide replacement equipment and deduct the cost of the equipment from monies due or which may become due the Contractor under the contract or under any other contract. The Contractor's financial liability under this paragraph shall be limited to the amount of the insurance coverage required by this paragraph. If the cost of equipment replacement required by this paragraph should exceed the required amount of the insurance coverage, the Department will reimburse the Contractor for replacement costs exceeding the amount of the required coverage.

Maintenance: During the occupancy by the Department, the Contractor shall maintain all facilities and furnishings provided under the above requirements, and shall maintain and keep the office quarters clean through the use of weekly professional cleaning to include, but not limited to, washing & waxing floors, cleaning restrooms, removal of trash, etc. Exterior areas shall be mowed and clean of debris. A trash receptacle (dumpster) with weekly pickup (trash removal) shall be provided. Snow removal, sanding and salting of all parking, walkway, and entrance ways areas shall be accomplished during a storm if on a workday during work hours, immediately after a storm and prior to the start of a workday. If snow removal, salting and sanding are not completed by the specified time, the State will provide the service and all costs incurred will be deducted from the next payment estimate.

Method of Measurement: The furnishing and maintenance of the construction field office will be measured for payment by the number of calendar months that the office is in place and in operation, measured to the nearest month.

There will not be any price adjustment due to any change in the minimum computer system requirements.

Basis of Payment: The furnishing and maintenance of the construction field office will be paid at the listed unit price per month for the respective item “Construction Field Office, Extra-Large”, which price shall include all material, equipment, labor, utility services and work incidental thereto.

The cost of providing the parking area, external illumination, trash removal and snow and ice removal shall be included in the monthly unit price bid for the respective item “Construction Field Office, Extra-Large”.

The State will be responsible for payment of data communication user fees and for toll calls by State personnel.

Pay Item	Pay Unit
Construction Field Office, Extra-Large	Month

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Coordinate with the Earthwork and Dampproofing Sections of the Specifications to ensure that all selected fill and polyethylene vapor barriers have been placed as specified prior to placing slabs on earth.

C. Coordinate with Concrete Formwork, Expansion and Contraction Joints, Concrete reinforcement, Specialty-Finished Concrete, and other appropriate Sections of the Specifications to ensure that proper provisions for and contingent to cast-in-place concrete are performed prior to placing of the concrete specified herein.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, embed, and finishes, for the following:

1. Footings, Grade Beams, Walls (bldg & site), Columns, Slabs, Beams.
2. Slabs-on-grade.
3. PT slab and beam.
4. Composite slab construction with steel deck.
5. Equipment pads and bases.
6. Fill for steel pan stairs.

B. Related Sections:

1. Section 05 31 00 “Steel Decking” for steel deck construction.
2. Div. 01, High Performance Buildings Requirements Section 018113.13 for credits16a-38k-4(d)9,16a-38k-4(d)11,16a-38k-4(b)4:
   1. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.2-1.05.02 and NOTICE TO CONTRACTOR-SUMITTALS.

B. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Owner.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Comply with ACI 315 "Manual of Standard practice for Detailing Reinforced Concrete Structures" showing bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcing required for openings through concrete structures. SD works should be prepared by or under supervision of qualified professional engineer register in the Connecticut state.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer that has a record of successful in-service performance and who is legally authorized to practice in the jurisdiction where Project is located detailing fabrication and erection of forms for specific finished concrete surfaces. Show form construction including joining, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. A/E's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: In lieu of material laboratory test reports when permitted by the Owner and A/E. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

B. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI Publications: Comply with the latest editions of the following unless modified by requirements in the Contract Documents:
   ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."
   ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   ACI 318, “Building Code Requirements for Reinforced Concrete.”
   ACI 347, “Guide to Formwork for Concrete.
2. ACI 305R, "Hot Weather Concreting."
3. ACI 306R, "Cold Weather Concreting."
4. ACI 523.1R, “Guide for Cast-in-Place Low Density Concrete.”
5. ASTM C138, “Standard Test Method for Unit Weight, Yield, and Air Content of Concrete.”
6. ASTM C150, “Standard Specification for Portland Cement.”
7. ASTM C311, “Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.”
8. ASTM C494, “Standard Specification for Chemical Admixtures for Concrete.”
9. ASTM C495, “Standard Test Methods for Compressive Strength of Lightweight Insulating Concrete.”
10. ASTM C496, “Standard Test Methods for Splitting Tensile Strength of Cylindrical Concrete Specimens.”
11. ASTM C513, “Standard Test Methods for Securing, Preparing, Obtaining, and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.”
12. ASTM C796, “Standard Method of Testing Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.”
13. ASTM C869, “Standard Specification for Foaming Agents for Use in Making Preformed Foam for Cellular Concrete.”

14. Concrete Reinforcing Steel Institute (CRSI): “Manual of Standard Practice.”

E. Concrete Testing Service: The Owner will engage a qualified independent testing agency, approved by the Owner, who will make all concrete compression tests on the Project according to the standards described and listed in the “Field Quality Control” article of this Specification.

1. The costs of sampling and testing of cast-in-place concrete shall be paid for by the Owner.
2. The Contractor shall notify the testing laboratory, as selected by the Owner, 48 hours prior to each placing of concrete so that arrangements can be made for testing.

F. Preinstallation Conference: conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of

each entity directly concerned with cast-in-place concrete to attend, including the following:
Contractor's superintendent.
Independent testing agency responsible for field quality control.
Ready-mix concrete manufacturer.
Concrete subcontractor.
Special concrete finish subcontractor.
Structural engineer.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Drawings.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
High-density overlay, Class 1 or better.
B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent with a maximum of 350 g/L volatile organic compounds (VOC’s) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Deformed-Steel Wire: ASTM A 496/A 496M, flat sheet.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Use supports that will not puncture vapor barrier/retarder.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project unless otherwise acceptable to the Owner:
   1. Portland Cement: ASTM C 150, Type I. Contractor may use Type III cement in concrete as approved by the Owner. Supplement with the following:
      Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
      Low-alkali cement (less than 0.6% alkali): ACI 221.1R-98 testing to control ASR.

B. Silica Fume: ASTM C 1240, amorphous silica., proportioned in accordance with ACI 211.1

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded, with a total water soluble chloride ion content below 0.02 percent. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to the Owner.

D. Lightweight Aggregate: ASTM C 330.

E. Water: ASTM C 94/C 94M, clean, potable, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.5 ADMIXTURES

A. General: Provide concrete admixtures that contain less than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, ready-to-use air-entraining admixture formulated to improve stability of air entrainment, to increase resistance to damage from freeze/thaw cycles, and to scaling from de-icing salts, reduced permeability for increased watertightness, reduced segregation and bleeding, and improved plasticity and workablility, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:
   BASF Corporation – Admixture Systems; Micro Air, MB-VR, or MB-AE 90.
   Euclid Chemical Company (The), an RPM company; EUCON BCN.
   Grace Construction Products, W. R. Grace & Co.

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A, ready-to-use water-reducing liquid admixture formulated for flat and cast concrete work, to improve workability, reduce segregation, improve finishing characteristics, increase compressive and flexural strength, and not initiate or promote corrosion of reinforcing.
   Products: Subject to compliance with requirements, provide one of the following:

   BASF Corporation – Admixture Systems; Pozzolith Series or PolyHeed Series.

   Euclid Chemical Company (The), an RPM company; WR-75 or WR-91.

   Grace Construction Products, W. R. Grace & Co.

2. Retarding Admixture for Hot Weather: ASTM C 494/C 494M, Type B and D, ready-to-use, liquid admixture, formulated for concrete work to retard setting time, and facilitate placing and finishing.
   1) Products: Subject to compliance with requirements, provide one of the following:

BASF Corporation – Admixture Systems; Pozzolith Series or PolyHeed Series.

Euclid Chemical Company (The), an RPM company; WR-75 or WR-91.

Grace Construction Products, W. R. Grace & Co.

3. Non-Corrosive Accelerator for Cold Weather: ASTM C 494/C 494M, Type C and E, ready-to-use, non-chloride, liquid admixture formulated for concrete work to accelerate setting time, and increase early and ultimate strengths across a wide range of cold weather and sub-freezing temperatures.
4. 1) Products: Subject to compliance with requirements, provide one of the following:

   * BASF Corporation – Admixture Systems; Pozzutec 20+ or Pozzolith NC 534.
   * Euclid Chemical Company (The), an RPM company.
   * Grace Construction Products, W. R. Grace & Co.

5. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
7. High-Range, Water-Reducing Admixture for Cold Weather: ASTM C 494/C 494M, Type F, high-range, water-reducing admixture formulated to aid in the production of concrete with the following qualities in a plastic state:

   Plasticity range of 6inches to 9 inches.

   Normal setting characteristics.

   Extended slump retention.

   Controlled time of set.

   Cohesive and non-segregating.

   6) Minimal bleed water.
   In a hardened state, admixture shall provide the following engineering properties:

   1) Higher, earlier strengths than can be achieved with conventional superplasticizers.

   2) Increased ultimate compressive strength.

   3) Higher modulus of elasticity.

   4) Improved bond strength to steel.

   5) High durability.

   6) Reduced shrinkage and creep.

7) Highly reliable in-place structural integrity.
Typical Locations: Columns, elevated slabs, walls for temperatures 85 deg F and below.
Products: Subject to compliance with requirements, provide one of the following:

BASF Corporation – Admixture Systems; Rheobuild 1000 or Glenium Series.

Euclid Chemical Company (The), an RPM company; Eucon 37.

Grace Construction Products, W.R. Grace & Co.

7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
9. Workability-Retaining Admixture: ASTM C 494/C 494M, Type S.
   Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   1) BASF Corporation – Admixture Systems; RheoTEC Z-60.

   2) Euclid Chemical Company (The), an RPM company; EUCON BCN or EUCON CIA.

   3) Grace Construction Products, W. R. Grace & Co.

D. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C. Add to all concrete receiving traffic (SOG and topping)
   1. Products: Subject to compliance with requirements, provide one of the following:
      BASF Corporation – Admixture Systems; Rheocrete CNI.
      Euclid Chemical Company (The), an RPM company; EUCON BCN or EUCON CIA.
      Grace Construction Products, W. R. Grace & Co.; DCI.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, not less than 3/4 inch long, if required during construction.
   1. Products: Subject to compliance with requirements, provide one of the following:
      Monofilament Micro-Fibers:

      BASF Corporation – Admixture Systems; MasterFiber M Series.

      FORTA Corporation; FORTA Econo-Mono.

      Grace Construction Products, W. R. Grace & Co.; Grace.

B. Fibrillated Micro-Fibers:

BASF Corporation – Admixture Systems; MasterFiber F Series.

FORTA Corporation; FORTA Econo-Net.

Grace Construction Products, W. R. Grace & Co.; Grace Fibers.

2.7 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   Greenstreak.
   Williams Products, Inc.
   Vinylex Corp.

2. Profile: Flat, dumbbell-type or center-bulb type waterstops.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   Greenstreak.
   Paul Murphy Plastics Company.
   Vinylex Corp.
2. Profile: Flat, dumbbell-type or center-bulb type waterstops.

C. RX-Bentonite Waterstop: Furnish and install expanding bentonite-based waterstops , illustrated on the project drawings and comply with waterproofing section 071000.

2.8 VAPOR RETARDERS

A. Vapor Retarders: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.

B. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:
   Fortifiber Building Systems Group; Moistop Ultra 15.
   Raven Industries Inc.; Vapor Block 15.
   Reef Industries, Inc.; Griffolyn 15 mil Green.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

E. Sand Cushion: Clean, manufactured, or natural sand.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 4 (4.75-mm) sieve. This product shall be used at maintenance area E & F.

1. Available Products:
   Anti-Hydro International, Inc.; Emery.
   Dayton Superior Corporation; Emery Non-Slip.
   Emeri-Crete, Inc.; Emeri-Topcrete.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules. This product shall be used parking, bus washing, pump room, and bicycle stand areas.

1. Available Products:
   Anti-Hydro International, Inc.; A-H Alox.
   L&M Construction Chemicals, Inc.; Grip It AO.
   Sonneborn, Div. of ChemRex; Frictex NS.

C. Emery Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content. This product shall be used at Bus Traffic Pass on the 1st level shown on the sheet S-125, class 5 finish. The contractor is to sit pre-installation conference including the manufacturer Rep and his attendant at first application on the site.

1. Color: As selected by Architect from manufacturer's full range.
2. Available Products:
   - L&M Construction Chemicals, Inc. Emeryplate FF
   - Sika Construction, Sikafloor-1 Metaltop.
   - Dayton Superior, Emery Tuff.

D. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces on Battery room.

1. Available Products:
   Burke by Edoco; Titan Hard.
   ChemMasters; Chemisil Plus.
   ChemTec International; ChemTec One.

2.10 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Curing Paper: Provide regular reinforced composite kraft paper complying with ASTM C 171. Polyethylene film and burlene are not permitted.

C. Non-Insulated Curing Tarp: Provide reusable polypropylene (PP) or vinyl-caoted polyester covers by one of the following:
   1. Hamilton Form Company, Ltd.; Tarps.
   2. Reef Industries, Inc.; Transguard 4000.
   3. ChemTec International; ChemTec One

D. Insulated Curing Blankets: To prevent frost during cold weather pours, provide reusable polypropylene (PP) or vinyl-coated polyester covers having fully-bonded, closed-cell insulation core by one of the following:
   1. Hamilton Form Company, Ltd.; Concrete Curing Blankets.
   2. TVM Building Products; TVM Concrete Curing Blankets.
   3. ChemTec International; ChemTec One

E. Water: Provide fresh, clean, potable water free of oil, grease, waxy films, curing compounds, release agents and other deleterious materials that would negatively affect the quality, durability, and performance of the concrete.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
   1. Description: Apply nondissipating curing compounds to interior concrete slabs that will later receive resilient flooring, concrete toppings, epoxy or urethane based coatings, penetrating concrete sealer.
   2. Products: Subject to compliance with requirements, provide one of the following:
      BASF Corporation – Building Systems; Kure-N-Seal WB.
      Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
      L&M Construction Chemicals, Inc.; Dress & Seal WB.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
   1. Description: Apply nondissipating curing compounds to interior concrete slabs that will later receive resilient flooring, concrete toppings, epoxy or urethane based coatings, penetrating concrete sealer.
   2. Products: Subject to compliance with requirements, provide one of the following:
      BASF Corporation – Building Systems; Kure-N-Seal W.
      Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.
      L&M Construction Chemicals, Inc.; Dress & Seal WB.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Description: Apply membrane-forming curing and sealing compounds to interior concrete slabs within telecommunications, low voltage, and electrical rooms.
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   BASF Corporation – Building Systems; Kure 1315.
   L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
   Meadows, W.R., Inc.; Vocomp-30.
3. VOC Content: Curing and sealing compounds shall not exceed the VOC limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113. Architectural Coatings, rules in effect on July 1, 2008.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.
5. Products: Subject to compliance with requirements, provide the following:
   Ardex Engineered Cements; Ardex K-500 Self-Leveling Concrete Topping.
   Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.
   L&M Construction Chemicals, Inc.; Dress & Seal WB.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Do not use the same testing agency for field quality control testing.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with pozzolan not exceeding 25 percent.
4. Silica Fume: 10 percent below grade and 5 percent for slab construction.
5. Combined Pozzolans and Silica Fume: 35 percent with pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
6. Combined Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Submit written reports to Owner of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Owner.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.02 percent by weight of cement.

E. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture (HRWR) in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.14 DESIGN MIXES

A. Design Mixes to provide normal weight concrete with the following properties as indicated on Drawings and schedules:

5.
1. Minimum Compressive Strength: 5000 psi at 28 days.
   Maximum Water-Cementitious Materials Ratio: 0.40 (non-air-entrained); 0.35 (air-entrained). Typical concrete U.O.N.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum Water-Cementitious Materials Ratio: 0.44 (non-air-entrained); 0.35 (air-entrained). Foundation concrete.
4. Minimum Compressive Strength: 3500 psi at 28 days.
5. a.Maximum Water-Cementitious Materials Ratio: 0.50 (non-air-entrained); 0.40 (air-entrained). SOG of area D only.
6. Minimum Compressive Strength: 2500 psi at 28 days.
   a.Maximum Water-Cementitious Materials Ratio: 0.67 (non-air-entrained); 0.54 (air-entrained). Lean concrete.

B. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) rations as follows:

1. Subjected to freezing and thawing: W/C 0.45 max.
2. Subjected to deicers/watertight: W/C 0.40 max.
3. Subjected to brackish water, salt spray or deicers: W/C 0.40 max.

C. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, Slabs, and Sloping Surfaces: Not more than 3 inches.
2. Reinforced Foundation Systems: Not less than 2 inch and not more than 3 inches.
3. Concrete Containing High-Range Water-Reducing Admixture (Superplasticizer): Not more than 8 inches after adding admixture.
4. Other Concrete: Not more than 4 inches.

D. Lightweight Structural Concrete: Lightweight aggregate and concrete shall conform to ASTM C 330. Proportion mix to produce concrete with a minimum compressive strength of 4000 psi at 28 days and a calculated equilibrium unit weight of 110 pcf plus or minus 3 pcf as determined by ASTM C 567. Concrete slump at the point of placement shall be the minimum necessary for efficient mixing, placing, and finishing. Maximum slump shall be 6 inches for pumped concrete and 5 inches elsewhere. Air-entrain concrete exposed to weather according to ACI 301 requirements.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Owner. Laboratory test data for revised mix design and strength results must be submitted to and accepted by owner before using in Work.

F. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb per cu. yd.

2.15 FABRICATING REINFORCEMENT

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

2.16 ADMIXTURES

A. Use air-entraining admixtures in exterior exposed concrete, structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Standard Weight Concrete: The air content in all concrete exposed to weathering shall be maintained at 5% + or 1-1/2% for ground level exterior work. Other concrete exposed to weathering shall be 3% more or less 1- 1-1/2%. All slabs which are to receive a dust coat surface hardener shall have an air content not to exceed 3%.
2. Lightweight Concrete: The air content in all lightweight concrete exposed to weathering shall be maintained at 7-1/2% ± 1-1/2%.

B. Rate of Hardening:

1. Under 50 degrees F, Ambient Temperature
2. Over 90 degrees F, Ambient Temperature
3. Between 50 degrees F and 90 degrees F.

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces exposed to view.
   2. Class C, 1/2 inch for other concrete surfaces.

D. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms where slope is too steep to place concrete with bottom forms only, for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible before and during concrete placement. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently exposed concrete to produce uniform smooth lines and tight edge joints.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

J. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.4 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Owner.

3.5 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 VAPOR RETARDERS

A. Place vapor retarder in position with longest dimension parallel with direction of pour, according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

C. Cover vapor retarder with sand cushion, and compact to depth indicated.

3.7 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with metal chairs, runners, bolsters, spacers, and hangers as approved by Owner

D. Place reinforcement to maintain minimum concrete cover as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Provide keyways at least 1-1/2 inches deep into construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible, coordinate with typical details on S-301.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction (Control) Joints in Slabs-on-Grade: Form contraction joints in slabs-on-grade to form patterns as indicated. Use saw cuts 1/8-inch- wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.
1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and sealants are specified in Section 07 92 00 “Joint Sealants.”

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.9 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.10 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

3.11 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Bring slab surfaces to correct level with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature has fallen or is expected to fall below 40 deg F for three successive days, uniformly heat water and aggregates before mixing to obtain a concrete mix temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement, or as recommended by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R and as follows:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
4. Use water-reducing admixtures when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Owner.

3.12 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surface exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. No form ties should be used at exposed to view concrete surface.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast exposed concrete walls on the ground level of area D and E:
1. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white

portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep surface damp by fog spray for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.13 MONOLITHIC SLAB FINISHES

A. General: Concrete faces shall be finished in accordance with the following methods. The type of surface finish required on the structure or various portions of the building shall be as indicated on the Drawings. Strict compliance with the Specifications and their intent pertaining to finished surface shall be insisted on. Any surfaces of defective finish will not be accepted, until finishing has been completed in conformity with the Specifications. All concrete surfaces on which a rubbed finish is specified shall be finished within twenty-four hours after the forms are removed.

1. Rubbed Surface Finish: As soon as the pointing has set sufficiently the entire surface shall be thoroughly wet with a brush and rubbed with a No. 6 carborundum stone or an abrasive of equal quality, bringing the surface to a paste. The rubbing shall be continued sufficiently to remove all form marks and regular projections, producing a smooth dense surface without pits or irregularities. The material which, in the above process has been ground to a paste, shall now be carefully spread or brushed uniformly over the entire surface and allowed to take a “reset.” The final finish shall be obtained by a thorough rubbing with a No. 10 carborundum stone or abrasive of equal quality. This rubbing shall continue until the entire surface is of a smooth texture and uniform in color.
2. Brush Finish: After the concrete has been struck off, the surface shall be thoroughly worked and floated with a wooden, canvas, or cork float, the operation to be performed by skilled and experienced concrete finishers. Before this last finish is set, the surfaces shall be lightly striped with a fine brush to remove the surface cement film, leaving a fine-grained, smooth, but sanded texture.
3. Steel Trowel Finish: Steel trowel finish shall be produced by lightly tamping concrete to force coarse aggregate away from the surface then screed to proper level, providing a reasonably smooth surface. When water sheen has disappeared from the surface, concrete shall be floated and lightly trowelled. When concrete has set sufficiently to ring under the trowel, it shall be given a second steel troweling to produce a smooth, level, dense surface. Care shall be taken not to over trowel while the concrete is wet, causing an excessive amount of fines to be brought to the surface. Sufficient time shall be allowed for excess surface water to disappear. Dry cement or mixture or cement and sand shall not be sprinkled directly on slab. Particular attention shall be given to curing slabs as specified herein.

B. Prevention and Removal of Stains on Concrete: The Contractor shall prevent rust of structural steel, staining by bituminous materials or any other substance from discoloring and portion of the concrete. The Contractor, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the Contractor shall remove such stains and restore the concrete to its original color without damage to the concrete all at his expense and approved by the Owner.

C. Unspecified Finishes: When the type of finish is not specified on the Drawings, the following finishes shall be used as applicable:

1. Brushed Finish: With perpendicular to traffic 1/8" Amp. Max, For sidewalks, garage floors, ramps (interior and exterior), exterior platforms, exterior steps and landings.
2. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
   Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.
1. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
2. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.
3. Coordinate required final finish with Owner before application.

D. Finishing Tolerances:

1. Brush Finishes: Surfaces scheduled to receive either a float or brush finish shall be true planes within 1/4 inch in 10 feet, as determined by a 10 foot straightedge placed anywhere on the slab in any direction.
2. Steel Trowel Finish: Surfaces scheduled to receive either a steel trowel or hardened finish shall be true planes within 1/8 inch in 10 feet, as determined by a 10 foot straight edge placed anywhere on the slab in any direction.

E. Construction Joints: The use and location of monolithic construction joints shall be indicated on Shop Drawings and subject to prior approval by the owner. In general, they shall be in accordance with the following:

1. Preparation of Joints: The surface of the concrete shall be roughened, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted and slushed with coat of neat cement grout immediately before placing of new concrete.
2. Joints Between Horizontal Members and Walls or Columns: At least two hours must elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system and shall be placed monolithically unless otherwise specifically indicated on the plans.
3. Joints in Horizontal Members: Construction joints in floors shall be located in the middle one-third of the spans of slabs, beams, or girders, unless a beam

interacts a girder at this point, in which case the joints in the girders shall be offset a distance equal to twice the width of the beam. Provision shall be made for shear by use if inclined reinforcement.

3.14 DEFECTIVE CONCRETE WORK

A. Porous areas, open or porous construction joints and honey-combed concrete indicate that all the requirements for mixing, placing, and handling have not been complied with and shall be considered as sufficient cause for rejection of the members of the structure thus affected. Defective work exposed upon removal of forms shall be entirely removed or repaired as required within 48 hours after forms have been removed.

B. No repaired area will be accepted unless:
   1. The structural requirements have not been impaired by reducing the net section of compression members.
   2. The bond between the steel and the concrete has not been reduced.
   3. The areas shall be finished so as to conform in every respect to the texture, contour, and color of the surrounding concrete.

C. If the above limitations cannot be satisfied, the members or unit involved shall be removed and satisfactorily replaced entirely at the Contractor's expense.

D. Defective areas shall be cut out to such depth that all voids, honeycomb, or other defect shall be entirely removed. The edges of the material remaining in place shall be cut perpendicular to the finished surface to the full depth of the material removed but not less than one inch.

E. If the removal of defective concrete affects the structural requirements as above defined, the member likewise shall be removed and replaced.

F. The area to be repaired and a space at least 5 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. The patch shall be made with mortar, the mix of which shall be predetermined by making trial batches to secure mix matching the color and texture of surrounding concrete. The use of light colored or white Portland cement will be permitted in order to facilitate color matching. The amount of water used in mixing the mortar shall be as little as is consistent with the requirements of handling and placing. The mortar shall then be put aside for one hour during which time it shall be mixed with a trowel to prevent settling. No additional water shall be added to the mix. The area being repaired shall be thoroughly cleaned and brush coated with a slurry coat of one part Portland cement and one part sand. The mortar shall be thoroughly compacted in place and screeded off so as to leave the patch slightly higher than the surrounding area. It shall then be left undisturbed for a period of one to two hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface. On surfaces where unlined forms have been used the final finish shall be obtained with straightedge spanning the patch and held parallel to the direction to the form marks. After the patches have set sufficiently so that the surface will not be damaged curing and protection of concrete shall proceed as specified herein.

3.15 ACCEPTANCE OF CAST-IN-PLACE CONCRETE

A. Acceptance of cast-in-place concrete shall be in accordance with Chapter 18 of ACI 301.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.17 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R for cold-weather protection and ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

F. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Provide moisture curing by the following methods:
   Keep concrete surface continuously wet by covering with water. Accomplishments by use of mechanical sprinklers and standard portable tap water.
   Cover concrete surface with specified absorptive cover, water saturated, and kept continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.

1. 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 3 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Curing Compound: Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
   Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete and conforming to ASTM C 309.
1. Saturated Sand Curing: Sand for saturated sand curing shall be clean, sharp natural sand, containing no deleterious material that will stain the concrete.
2. Curing Paper: Waterproof paper conforming to ASTM C 171 or opaque polyethylene.

3.18 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Owner.

3.19 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas with cement mortar immediately after removing forms when approved by the Owner. Remove and replace concrete that cannot be repaired and patched to Owner's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
   1. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
   1. Where possible, repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Owner. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to the Owner.
4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, with Owner's approval for methods and procedure, using specified epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Owner's approval.

3.20 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Special Inspections: Special Inspections required are enumerated in the Schedule of Special Inspection Services.

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: 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 samples from the first three (3) batches at the start of placement for each day's pour of each concrete mixture exceeding 5 cu. Yd., plus one (1) set for each additional 50 cu. Yd. or fraction thereof.

   Should any portion of required testing and/or batch time not meet specified requirements, the concrete batch in question shall be rejected. Testing shall then be performed until three (3) consecutive batches of concrete meets all specified requirements, including batch time. Testing shall return to the specified frequency only when all testing requirements have been satisfied for there (3) consecutive batches of concrete.

   All appropriate parties shall be notified immediately of each failed test.

   Additional testing required due to concrete not meeting specified requirements shall be performed at contractors expense.

   When frequency of testing will provide fewer than five composite samples of each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if few than five are used.

   Slump: ASTM C 143/C 143M; one test at point of placement for each load's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

   Air Content: ASTM C 231, pressure method, for lightweight or normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each day's pour of each type of air-entrained concrete

   Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

   Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

   Compression Test Specimens: AST C 31.

   Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

   Cast and field cure one set of four standard cylinder specimens for each composite sample.

   Compressive-Strength Tests: ASTM C 39; for each set, test one specimen at 7 days, two specimens at 28 days, and hold one specimen in reserve for later testing if required.

   When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

   Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

   Test results shall be reported in writing to the Owner, Architect, Structural Engineer, ready-mix producer, and Contractor within 24 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, concrete type and class, 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.

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.

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 Owner. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 to 48 hours of finishing

2. a. Calculate the actual overall F numbers using the inferior/superior method.
3. b. Take measurements for elevated slabs before removal of any shores and formwork.
4. c. Provide the Architect and Contractor with the results of all profile tests, including a running tabulation of the overall F numbers to date, within 72 hours after the completion of each slab placement

3.21 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033610 - BONDED POST-TENSIONED CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract Documents, including General and Supplementary Conditions, apply to the work specified in this Section.

B. This Section includes all labor, material, equipment and related services necessary to furnish, install, stress and grout all post-tensioning indicated on the drawings or specified herein, including, but not limited to the following:

1. Furnishing all post-tensioning materials, including prestressing steel, anchorages (bearing plates, grout caps, anchor heads, strand and duct couplers, wedges, spirals), duct, grout tubes, support bars, bar chairs, grouting materials and all accessories.
2. Performing all post-tensioning operations, including placement, stressing, grouting of tendons, and finishing of stressing recesses.

C. Related Work specified elsewhere:

1. Cast-In-Place Concrete: Section 033000
2. Div. 01, High Performance Buildings Requirements Section 018113.13 for credits 16a-38k-4(d) (9),16a-38k-4(b)4,16a-38k-4(b)5:
   1. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.2 QUALIFICATIONS

A. All post-tensioned concrete work shall be under the immediate control of a person experienced in this type of work. He shall exercise close check and rigid control of all operations as necessary for full compliance with the Contract Documents.

B. The post-tensioning work shall involve a Post-Tensioning Specialty Contractor (P-T Organization) which specializes in post-tensioning and has successfully performed five previous building projects with bonded tendons that are similar to the one involved in this Contract. This P-T Organization shall supply its own post-tensioning system and shall have performed work under the same business name for the past five years. The P-T Organization shall employ a Superintendent who has a minimum of five years experience and technical knowledge of the type of post-tensioning system supplied and who shall oversee all field handling, placement, stressing, and grouting operations. The superintendent's resume shall be submitted to the Engineer of Record (Engineer) and approved prior to bid. The Superintendent and/or supervisor of the grouting operation must be a certified American Segmental Bridge Institute (ASBI) grouting technician.

C. The P-T Organization shall have a minimum Errors and Omissions Insurance coverage of $1,000,000.00.

D. The post-tensioning system shall be a bonded/grouted system that conforms to all material requirements of ACI 318. The system shall be fully encapsulated – no part or length of strand may be exposed to concrete at any point. The P-T Organization shall have a qualified registered professional engineer, licensed in the state in which the project is located, oversee the production of shop drawings and associated calculations, and certify that the post-tensioning system conforms in all aspects to the requirements of ACI 318. The professional engineer shall be a full-time employee of the P-T Organization.

E. Any P-T Organization intending to bid post-tensioning work shall submit the following to the Owner/Engineer for approval :

1. List of projects described in 1.2.B above, with the following information:
   - Consulting structural engineer, with name, address, and phone number of the individual in the company who was responsible for the project.
   - Contractor, with name, address and phone number of the Project Manager who was responsible for the project.
   - Value of post-tensioning subcontract.
   - Quantity of post-tensioning strand used on the project.

2. Resume of Professional Engineer referenced in 1.2.D. and Superintendent referenced in 1.2.B.

3. Details of anchorages as described in Section 2.3.

4. Sample of slab and beam ducts (12 inch minimum length).

5. Grout mix and properties (Re: 3.6.).

6. QA/QC plan for the supply and installation of the post-tensioning system. The QA/QC plan shall include manufacturing, assembling, plant and job site storage, handling, installation inspection, stressing, grouting and finishing.

F. Notice To Contractor – Specialized Work and Pre-Award Requirements/Qualifications

The work included in this contract involves specialized work. The Waterbury Bus Maintenance Facility Replacement includes a post-tensioned slab on the first floor of the facility and requires a person experienced in this type of work. It is highly important that the Contractor (prime or subcontractor) performing the work, understand the intended construction and details for this portion of the facility. In order to ensure the successful completion of this project, the Contractor (prime or subcontractor) performing the work must meet the requirements as stipulated within specification section 033610 BONDED POST-TENSIONED CONCRETE. The low bidder must submit written evidence of the items listed in the specifications within 7 days after award of the contract.

G. P-T Contractors/Organizations should provide a payment and bid bond on the project. The payment and bond should cover the entire contract amount with agreed percentage.

1.3 SUMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR-SUBMITTALS.

B. Shop Drawings

1. Complete shop drawings must be approved by the Engineer P.E. prior to starting the post-tensioning work. Once approved, shop drawings and data shall not be changed without prior, written approval of the Engineer. Post-tensioned concrete construction operations shall not commence without approved shop drawings on file at the job site.

   At a minimum, the shop drawings shall show:

   - Overall concrete dimensions and pertinent member concrete dimensions
   - Tendon profiles, support heights, chair types and sizes, method of support, quantity of support chairs and mild reinforcement
   - Details as are necessary for the fabrication and accurate placement and stressing of the post-tensioning tendons
   - Anchorage components and their assembly
   - Requirements for local zone confinement reinforcement at anchorages
   - Requirements for reinforcement around stressing pockets and closures
   - Placement sequences, stressing procedures, including notes regarding jack clearances, sequencing, initial tensioning forces, gauge pressures
   - Theoretical elongations
   - Grouting materials and methods
   - Identification of each tendon
   - Openings, shafts, ramps, etc.
   - Material summaries, including material certifications such mill test reports on the prestressing steel mentioned on 2.2-B.

   The drawings shall be signed and sealed by the P-T Organization's Professional Engineer.

   Along with friction and elongation calculations, the P-T Organization shall also provide signed and sealed design calculations of local and general anchorage zone reinforcing that may be required.

C. Loss and Local/general Anchorage Zone Calculations

1. The P-T Organization shall furnish to the Engineer, with the shop drawings, calculations of all losses to verify that design forces are obtainable for the number of strands detailed, and local anchorage zone calculations. The loss calculations shall clearly show the assumed friction and wobble coefficients and the basis for their use. The long-term losses, including shrinkage, creep and elastic shortening, shall be quantified by calculations. The calculations shall be signed and sealed by the P-T Organization's Professional Engineer. The P-T Organization shall assist the Engineer in general anchorage zone calculations if requested.

D. Approvals

1. The Engineer's approval shall not relieve the Contractor of his responsibility for performing the work in accordance with the Contract Documents.

1.4 INSPECTION

A. The P-T Organization shall submit QA/QC plan for review.
B. A Special Inspector shall be employed by the Owner for checking the placement and stressing of the post-tensioning, placement of reinforcing, grouting of the tendons, and placement and testing of concrete, and other items, as may be required by Local Codes.

C. Duties of the Special Inspector shall include:

1. Check duct integrity, anchorage positioning, tendon support locations, and size and placement of reinforcing in post-tensioned areas.

2. Check that tendon profiles are within the tolerances required (refer to section 3.3).

3. Verify that no concrete be placed in post-tensioned members until placement of tendons and conventional reinforcement steel have been inspected and approved.

4. Record elongations accurately for submittal to the Engineer. The Engineer shall approve stressing records prior to removal of stressing tails. Stressing records shall show a tendon reference mark, theoretical elongation, measured elongation, actual gauge pressure, date, signature of stressing operator, signature of project inspector witnessing the operation, and serial number of stressing ram and gauge.

5. Prior to stressing, verify that calibration charts are submitted for each set of stressing equipment used on the project to the Engineer. The calibration chart shall show the calibration curve for the combination of stressing jack and gauge used.

6. Observe grouting procedures and record that each duct is completely grouted. Inspect quality and testing of grout outlined in Section 3.6 .

2 PRODUCTS

2.1 The following post-tensioning materials and design procedures specifications apply and are considered to be a part of this section.

- ASTM A 416
- ACI 318
- AASHTO - "Standard Specifications for Highway Bridges" (latest edition)
- Post-Tensioning Institute "Specification for Grouting of Post-Tensioned Structures"

2.2 Prestressing Steel

A. Prestressing steel shall be ½" diameter (Aps = .153 sq. in) and 0.6" diameter (Aps = .217 sq.in), seven-wire, low-relaxation strand for prestressed concrete manufactured in accordance with ASTM A416, Grade 270, and shall have a minimum ultimate tensile strength of 41,300 pounds.

B. Certified mill test reports on the prestressing steel shall be submitted to the Engineer upon request and shall show the heat number and identification, ultimate tensile strength, yield strength at 1% extension under load, elongation at failure, modulus of elasticity, diameter and net area of strand, and type of material. These values shall conform to the latest revisions of ASTM A416.

2.3 Anchorages

A. The post-tensioning system anchorages shall be specifically suited for bonded tendons. The anchorages shall consist of a cast-in bearing plate and a separate anchor head that is placed after concrete placement; "slap-on" anchorages shall not be permitted. All post-tensioning system anchorages must be approved in writing as per Section 1.2. Grout tubes shall not project out of the top or bottom of the slab. Anchorages shall include details that completely encapsulate the post-tensioning steel, all connections shall be mechanical and not friction-type connections.

B. The load from the anchoring device shall be uniformly distributed to the concrete by approved devices. Such approved devices shall conform to the following requirements:

1. The final unit compressive stress on the concrete directly underneath the plate or assembly shall not exceed 3,000 pounds per square inch.

2. Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not cause visible distortion in the bearing plate when the ultimate strand load is applied as determined by testing.

3. Alternately, anchorages may be designed as special anchorage devices that use confinement reinforcement. Such special anchorage devices shall be subject to all testing requirements in AASHTO.

C. Information to be submitted for approval:

1. Complete description of the post-tensioning system anchorage and method proposed for use; such descriptions shall include tendon size, blockout dimensions, tendon layout and design calculations as required to fully substantiate any deviations from the method shown on the Contract Plans.

2. Certified Test Reports confirming the post-tensioning system anchorage meets or exceeds the minimum test requirements of AASHTO.

3. All post-tensioning system stressing anchorages shall be capable of lift-off, detensioning or retensioning a tendon at any time prior to removing the strand tails

D. Couplers

1. Coupling of bonded tendons shall be used only at locations specifically indicated and/or accepted by the Engineer.

2. Coupling of tendons shall not be used at points of sharp tendon curvature.

3. Tendon couplers shall be an integral part of the post-tensioning system and designed as such and they shall be subjected to similar requirements as the post-tensioning system anchorage.

4. Grout connections at couplers shall not project out of the top or bottom of the slab.

5. Lapping tendons at joints shall not be permitted as an effective tendon splice.

2.4 Tendons Ducts:

A. Duct shall be PT-Plus by VSL, Dywidag-System International USA, CCL-USA or preapproved equivalent.

B. Alternate plastic duct systems may be approved if documentation of test results indicating compliance (a letter of certification is not sufficient) with the following performance requirements is submitted to the Engineer at least 10 days prior to bid date:

1. Plastic duct shall be made of High Density Polyethylene (HDPE) according to ASTM D3350 cell classification 324420C, or Polypropylene with a specific gravity of 0.90 to 0.91.

2. Corrugation of ducts may be either spiral, concentric, or any other shape for which it has been demonstrated that the duct can be completely filled with grout.

3. Duct shall be mortar-tight and capable of transferring satisfactory bond stress. Duct shall be designed specifically for post-tensioning tendons.

4. The inside cross-sectional slab duct area shall be a minimum of five times the nominal area of the strands. Beam duct area shall conform to ACI-318 requirements.

5. The wall thickness of the duct shall be such that wearing through the wall by the strand during stressing is prevented. This requirement shall be met at specified minimum radius of curvature of the particular tendon size with a total strand movement of 3 feet and the full tendon stressed to 80% GUTS. The minimum remaining wall thickness of the duct after testing shall be at least 0.04 inches.

6. If couplers are required, ducts shall be coupled with specially designed couplers in a manner that is watertight without the use of tape.

7. Ducts with couplers shall be able to transfer longitudinal forces as follows without effecting watertightness : for duct diameter up to 2-1/2 inches, 200 pounds, and for duct diameter exceeding 2-1/2 inches, 400 pounds.

8. Ducts with couplers shall be capable of bending to a specified minimum radius of curvature without causing damage or sharp kinks in the duct. This requirement is met if at least three full cycles of reversed bending have been applied to the duct and watertightness is not affected (Re: 2.4.2.9). A minimum radius of curvature of 3 feet shall apply for ducts in prefabricated tendon applications.

9. Ducts including couplers shall be watertight. Watertightness is provided if water loss in 40 inch long duct specimens with couplers, tested according to 2.4.2.7 and 2.4.2.8, do not exceed 1.5% of the duct volume within 5 minutes. Water shall be kept at a pressure of 7 psi during the test.

10. Irreversible deformations of the duct cross-sectional dimensions, i.e. diameter, under a point load of 150 pounds shall not exceed 1/4 inch nor 5% of the duct cross-sectional dimensions, whichever is larger, one minute after removal of the load at 70ºF ambient temperature. The point load shall be applied without impact through a #4 reinforcement bar, bearing on the duct between corrugations.

11. Friction and wobble coefficients for the particular duct shall be submitted by the P-T Organization to the Engineer Frictional losses due to vertical and horizontal intentional or non-intentional variance from a straight line trajectory shall be based on experimentally determined curvature and wobble coefficients, and experience from previous jobs.

2.5 Grout

A. Refer to Section 3.6.

3 EXECUTION

3.1 Scheduling

A. A preconstruction conference shall be held. Attendees shall include the Engineer, Contractor’s representative, and the P-T Organization’s Professional Engineer and Superintendent. At this time, the post-tensioning operations shall be coordinated with the General Construction schedule. The Engineer shall approve all tensioning locations, construction joints, and the acceptability of the general plan of the field post-tensioning operations.

3.2 Fabrication

A. Post-tensioning tendons shall be manufactured in accordance with detailed shop drawings approved by the Engineer.

B. Post-tensioning tendons shall be of the non-fixed length type to allow for possible form adjustments in the field.

C. Tendon fabrication and delivery should be coordinated by General Contractor so as to prevent lengthy job site storage. All prestressing steel shall be satisfactorily protected from excessive rust or other corrosion prior to placement. Sufficient protection shall also be provided for exposed prestressing steel at the ends of members to prevent deterioration by corrosion.

3.3 Placing

A. All placement shall be under the immediate control of the P-T Organization's Superintendent. He shall exercise close check and rigid control of all operations as necessary for full compliance with all requirements.

B. Placement of mild steel reinforcement shall be coordinated with placement of post-tensioning tendons. Proper tendon location takes precedence.

C. Tendons shall clear openings and drains by a minimum of 3 inches.

D. Slight deviation in horizontal spacing of the slab tendons is permitted where required to avoid openings and inserts, as detailed on the placement drawings.

E. Post-tensioning tendons shall have parabolic profiles (unless otherwise required by the design) and shall conform to the control points shown on the drawings. Support heights locating these profiles shall account for the center of gravity of the strands within the ducts. Low points of the tendons are at mid-span and high point corresponds to the center line of support, unless otherwise noted.

F. Suitable horizontal and vertical supports or chairs shall be installed as shown on the shop drawings to hold the tendons in true position. Tendons shall be tied to supports or chairs at maximum spacings as recommended by the Post-Tensioning Institute. All strands in a given pour shall be full length without splices or couplers unless called for on the approved shop drawings.

G. Post-tensioning tendons and anchorages shall be placed with a vertical tolerance of 1/4 inch in concrete dimensions less than 8 inches, 3/8 inch in concrete dimensions of 8 inches to 24 inches, and 1/2 inch in concrete dimensions of greater than 24 inches.

H. All post-tensioning tendons shall have a grout vent at all anchorages. Grout vents shall not project out of the top of the slab.

I. Post-tensioning anchorages shall be installed perpendicular to the tendon axis and have the minimum required tangent length.

J. Duct materials shall be inspected prior to concrete placement. Damaged duct shall be repaired in accordance with procedures acceptable to the engineer of record.

K. Where the end of a post-tensioning tendon will not be covered by concrete, the anchorages shall be recessed so that the ends of the prestressing steel will be at least 1-1/2 inch inside the edge of the concrete.

L. Tendons shall not be subjected to excessive temperatures, welding sparks or electric ground currents. To insure that this requirement is met, burning and welding operations shall not be conducted in the vicinity of tendons without prior approval. Stressing tails may be removed by rapid oxyacetylene burning or friction blade cutting to within 1" of the face of the anchorhead.

M. Pre-placing of strands in flat duct is mandatory prior to concrete placement. Pre-placing of strands in round duct is recommended prior to concrete placement. Placing of strand in round duct after concreting is satisfactory provided that measures are taken to prevent movement or floatation of the duct during concreting.

3.4 Concrete Placement

A. Concrete shall be placed in conformance with the requirements as outlined in Division 3, Cast-In-Place Concrete.

B. Calcium Chloride shall not be used as an admixture in post-tensioned concrete.

C. No concrete shall be placed in a particular pour until the tendons and reinforcement have been inspected and approved by the Special Inspector or the Engineer or his designated representative. The approval of the engineer of record shall not relieve the Contractor from his obligation for proper placement, and stressing of tendons, or other terms of this contract.

D. Concrete shall be placed in such a manner as to insure that the position of the post-tensioning tendons and conventional reinforcement remains unchanged. If the post-tensioning tendons move out of their designed positions, they shall be adjusted to their correct positions prior to proceeding with concrete placing operations.

E. Special provisions shall be made to insure proper consolidation of concrete in anchorage zones to prevent any voids or honeycombing.

3.5 Stressing

A. All post-tensioning shall be under the immediate control of the P-T Organization's Superintendent. He shall exercise close check and rigid control of all operations as necessary for full compliance with all requirements.

B. Before post-tensioning operations begin, all equipment shall be carefully inspected and tested by the P-T Organization. Tests shall include calibration of gauges, capacity of jacks and rams, and general condition and working order of equipment.

C. The stressing operations shall not begin until tests of the concrete cylinders, cured under jobsite conditions, verify the minimum compressive strength specified on the Contract Drawings. However, if specified on the Contract Drawings, an early partial prestress force may be applied at a concrete compressive strength less than the minimum compressive strength to help minimize plastic shrinkage cracking. The partial prestress force shall be proportionately lower than the full prestress force according to the actual concrete strength at the time the partial prestress force is applied. The full prestress shall be applied when the concrete strength reaches the minimum compressive strength specified.

D. It is intended that the stressing operation begin at the earliest possible time so as to minimize the occurrence of shrinkage and temperature cracking. To this end, it is anticipated that measures be taken (such as low water/cement ratio concrete and proper curing) in order that the early strength gain is achieved within three days, but no longer than five days, from date of concrete placement.

E. Strength of concrete members will be determined by testing standard ASTM 6" diameter test cylinders for each representative pour of 100 cu. yds, or fraction thereof, a minimum of six field-cured, and two lab-cured specimens shall be made. Lab-cured cylinders will be tested at 28 days. Field-cured cylinders shall be maintained at the site and cured under conditions identical to the in-place concrete sections represented by them. They shall be tested in sets of two, at the Contractor's discretion. Such tests shall be the basis for determining when stressing operations may commence. When field-cured cylinders have attained the designated compressive strength, stressing operations may commence. Falsework removal and reshoring may commence when stressing operations are complete and prior to injection grouting of the tendons.

F. The post-tensioning tendons shall be stressed by means of hydraulic jacks equipped with calibrated hydraulic pressure gauges to permit the stress in the prestressing steel to be computed at any time. A calibration chart shall accompany each jack-pump-gauge unit. In no case shall a jack and gauge combination be used which have not been calibrated to each other. In order to insure that proper calibration is maintained, care shall be exercised in the handling of all stressing equipment.

G. The stressing operations shall be conducted so that accurate elongation of the prestressing steel can be measured and recorded to the nearest 1/8 inch and compared with predicted elongations. An agreement within + 7% between measured and predicted elongations shall be satisfactory. If inconsistencies exceeding + 7% occur, the Engineer, with the assistance of the P-T Organization, shall review and determine whether any additional action is required.

H. Stressing from both ends of the prestressing steel shall be performed when there is excessive friction between the prestressing steel and the duct, depending upon the location of construction joints and construction sequencing. Stressing locations for each tendon shall be shown on the approved shop drawings.

I. The maximum temporary tensile stress (jacking stress) in the prestressing steel shall not exceed 80% of the specified guaranteed minimum ultimate tensile strength of the prestressing steel. The prestressing steel shall be anchored at stresses (initial stress)

that will result in the ultimate retention of working forces of not less than those shown on the Contract Drawings

J. Records shall be kept by the Special Inspector of the elongation and force applied to each strand and this shall be submitted to the Engineer promptly upon completion of stressing of each pour.

K. Safety precautions shall be taken to prevent workers from standing over or behind the stressing jacks when tendons are being stressed. Only essential personnel shall be permitted in the area during stressing.

3.6 Grouting

A. The P-T Organization shall own and furnish all specialized equipment necessary to grout the tendons.

B. Grouting records certifying the proper grouting of each duct shall be submitted within 72 hours after grouting by the Special Inspector to the Engineer for review. Information shall include: grout materials and proportions, worker's names, date and time, ambient temperature, weather conditions, and concrete temperature, maximum pumping pressure at inlet. Additional information such as possible blockages, leaks in the system, or interruptions in the flow of grout, and procedures taken to correct the deficiency, shall be reported.

C. A trial grout mix shall be batched in advance of grouting operations to verify the grout properties and the compatibility of the cement, water and admixtures.

D. Type of grout: Class C grout is prepackaged grout and may exhibit thixotropic properties.

E. Materials and Equipment:

1. Portland cement shall conform to the following:
   a) Specifications for portland cement ASTM C150 Type I, II, or I/II.
   b) Cement used for grouting shall be fresh and not contain any lumps or other indications of hydration or "pack set".

2. Water:
   a) The water used in the grout shall be potable, clean and free of injurious quantities of substances known to be harmful to or incompatible with the Portland cement, prestressing steel, or admixtures.

3. Admixtures:
   a) Admixtures shall impart the properties of low water content, good flowability, adequate open time, minimum bleed, minimum permeability and adequate compressive strength to the grout. Admixtures shall contain no substances known to be harmful to or incompatible with the Portland cement or prestressing steel.

Admixtures containing chlorides, fluorides, sulfites, and nitrates shall not be used.

4. Grouting Equipment:
   a) The grouting equipment shall include a colloidal type mechanical mixer capable of continuous mixing which will produce a grout free of lumps and undispersed cement. The holding tank shall contain an agitator for the purpose of keeping the grout in continuous motion until injected into the tendon. When using thixotropic grout, the equipment shall consist of two identical charging/holding tanks.
   b) The pumping device shall be a positive displacement type capable of producing an outlet pressure at the pump of at least 145 psi.
   c) The grouting equipment shall have seals adequate to prevent the introduction of air, oil or other foreign substances into the grout.
   d) Accessory equipment which will provide for accurate solid and liquid measures of all grout components shall be provided to batch all materials.
   e) The grouting equipment shall contain a screen having clear openings of 1/8 inch maximum size to filter the grout prior to its introduction into the holding tank or immediately prior to Being injected into the tendon. A maximum screen opening of 3/16 inch can be used for thixotropic grouts. The screen shall be easily accessible for inspection and cleaning.
   f) The holding tank and/or mixing tank must be kept partially full of grout at all times during the pumping operation to prevent air from being drawn or siphoned into the grout hose or duct.

F. Grout Property Requirements:

1. The maximum water-cement ratio shall be 0.45.

2. The grout must remain pumpable for a minimum of 30 minutes. The initial flow cone efflux time of a non-thixotropic grout shall be a minimum of 11 seconds and a maximum of 30 seconds immediately after mixing. Refer to ASTM C939, Standard Test Method For Flow Of Grout. For thixotropic grouts, the efflux time shall have a minimum of 9 seconds and a maximum of 20 seconds for a 1-liter discharge. Use a modified version of ASTM C939 by filling the flow cone to the top instead of the standard level.

3. All classes of grout shall exhibit no measurable bleed after 3 hours when using a wick induced bleed test at 20°C (70°F). Refer to ASTM C940, Standard Test Method For Expansion And Bleeding Of Freshly Mixed Grouts. Class B and C grouts shall have a maximum bleed of 4 percent when using the Schupack Pressure Bleed Test with 20 psi and a vertical rise of 0 to 2 feet.

4. The minimum compressive strength of the grout at 7 days shall be 3,000 psi. The minimum compressive strength of the grout at 28 days shall be

5,000 psi. Refer to ASTM C942, Standard Test Method For Compressive Strength Of Grout.

5. The permeability of the grout shall be determined by referring to ASTM C1202, Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration. Grout at 28 days of age shall have a maximum value of 2500 Coulombs after 6 hours.

6. The volume change of grout shall be 0.0% to +0.1% at 24 hours. The volume change at 28 days shall not be greater than +0.2%. Refer to ASTM C1090, Standard Test Method for Measuring Changes in Height of Cylindrical Specimen from Hydraulic-Cement Grout.

7. The temperature of the freshly prepared grout shall not be less than 40F or greater than 100F, the optimal temperature range is 50F-70F.

8. The setting time of the grout shall be greater than 3 hours and less than 12 hours. Refer to ASTM C953, Standard Test Method for Time of Setting of Grouts for Preplaced Aggregate Concrete in the Laboratory.

G. Mixing and Injection of the Grout:

1. It is generally desirable that tendons be grouted as soon as practical after approval of the stressing operations.

2. After a period of freezing weather conditions, grouting may be carried out only when it is certain that no ice will be trapped in the ducts.

3. Grouting may proceed when the surrounding concrete temperature is a minimum of 35F and rising. The grout temperature shall be maintained between 40F-90F before entering the duct. Grout temperature must be maintained at a minimum of 35F after entering the duct for three consecutive days after grouting or until a minimum compressive strength of 800 psi is attained as determined by job-cured 2 inch cube tests.

4. Grout fittings shall be non-metallic and not project out of the top or bottom of the slab.

5. Mixing shall be of such duration as to obtain a uniform and thoroughly blended grout, approximately 2-3 minutes.

6. Grout shall completely fill the void space within the duct under a normal pumping pressure of 75 psi. For internal flat ducts, pumping pressure shall not exceed 100 psi. For internal circular ducts, pumping pressure shall not exceed 245 psi.

7. Grout shall be injected from the lower end of the tendon in a continuous manner until it is discharged from the opposite end. The grout shall be continuously ejected from the outlet until no slugs of water or air are

visible and the grout at the outlet is approximately the same viscosity as that at the inlet. Close the valve at the outlet followed by the valve at the inlet prior to relieving the pressure at the grout pump.

8. Grout injection shall be between 15ft. and 50 ft. per minute unless otherwise approved by Engineer.

9. Leaks at the grout fittings at each end of the tendon or at any intermediate locations shall not be permitted.

10. Grout fittings may be removed flush with the concrete such that there is no spalling, after the grout has set for 24 hours.

3.7 Field Testing

1. One bleed test shall be taken per day for Class B and D grouts. The test shall be taken from the mixer. The sample test shall be either a Wick Induced Bleed Test or Schupack Pressure Bleed Test.

2. Two mud balance tests shall be taken per day for all classes of grout. Mud balance tests shall be performed in addition to the two daily tests whenever an apparent change in the grout appears.

3. One strength test shall be taken during the grouting.

4. At least two flow cone tests – one at the mixer and one at the outlet, per every two hours of grouting operation for all classes of grout. The flow cone tests shall be either the ASTM C939 or the modified ASTM C939 tests.

3.8 Finishing of Stressing Recesses

1. Stressing recesses shall be properly prepared and then filled flush with a non-shrink, non-metallic, non-corrosive grout to give a satisfactory appearance per the project requirements.

END OF SECTION 033610

SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Precast architectural concrete trim units.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.

B. Related Sections:

1. Division 01, High Performance Buildings Requirements Section for credit 16a-38-4(d)11 and 16a-38-4(b)4.
   a. The above listed HPB credit is related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
4. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

   a. For Concrete Unit Masonry: f'm = 1900 psi

B. Delegated Design: Engage a qualified professional engineer, to design precast architectural concrete trim units.

C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

1.5 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each precast architectural concrete trim unit mixture. Include compressive strength and water-absorption tests.

D. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
2. Control Joints: Show locations, detail joint conditions and locations of special conditions. Refer to architectural drawings typical locations and spacing.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
4. Precast architectural concrete trim units:
   a. Detail fabrication and installation of architectural precast concrete units.
   b. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
   c. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
   d. Indicate details at building corners.

E. Samples for Initial Selection:

1. Precast architectural concrete trim units.
2. Colored mortar.
3. Weep holes/vents.

F. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.
2. Color mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes and vents.
4. Accessories embedded in masonry.
5. Precast architectural concrete trim units: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
   b. For masonry units, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.
8. Precast architectural concrete trim units:
   a. Include material test reports substantiating compliance with requirements for aggregates.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE (UNIT MASONRY)

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panel: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build sample panel of wall area as shown on drawings, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches (400 mm) long in exterior face.
    b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
    d. Include air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

5. Remove mock-ups in its entirety when directed by the architect.

F. Preinstallation Conference: Conduct conference at Project site.

1.8 QUALITY ASSURANCE (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant or designated as an APA-certified plant for production of architectural precast concrete products.
2. Fabricator is located within 500 miles (800 km) of Project site.

B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged and bullnose units for outside corners, where indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

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

1) ACM Chemistries; RainBloc.
2) BASF Aktiengesellschaft; Rheopel Plus.
3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi .
2. Density Classification: Medium weight unless otherwise indicated.
3. Size : Manufactured to dimensions 3/8 inch less than nominal dimensions.
   a. Nominal Dimensions: Unless otherwise noted, provide 8 inch high x 16 inches wide x depth indicated on the drawings.

D. Decorative CMUs: ASTM C 90.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ravenstone, Trendstone Ground Face Masonry Units; Trenwyth Industries, Inc.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
3. Density Classification: Normal weight.
4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
5. Pattern and Texture:

   a. Standard pattern, ground-face finish.

6. Colors: As selected by Architect from manufacturer's full range.

2.3 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 PRECAST ARCHITECTURAL CONCRETE TRIM UNITS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

2. Alkali Silica Reactivity (ASR) Requirements: Low-alkali cement (less than 0.6% alkali) per ACI 221.1R-98 testing.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C 618, Class N.
3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.

4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

D. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Finish:
1. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach.
2. Finish exposed surfaces of architectural precast concrete units to match face-surface finish.

H. Color: As selected by Architect from manufacturer's full range.
1. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

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

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

E. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

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

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Lafarge North America Inc.; Eaglebond Portland & Lime.
3) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.

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

a. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

I. Water: Potable.

2.6 REINFORCEMENT (UNIT MASONRY)

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Exterior and Interior Walls in Rooms S102, S103, S104, S105, S106, S107, S108, S108A, S109, S110, S111, S112, S114, Stair R: Stainless steel.
4. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
5. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
6. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
7. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
8. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.7 REINFORCING MATERIALS (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
3. Wire: Fabricate from 3/16-inch- (4.76-mm-), hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel-wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

   a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- (1.90-mm-) thick steel sheet, galvanized after fabrication.
3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch-(4.76-mm-)diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
5. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

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

      1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213.
      2) Wire-Bond; RJ-711.

   b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (76 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.

6. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

7. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.

2.9 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Headed or L-shaped 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; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Post-installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Chemical anchors are not to be used that support sustained tensile loads.

2. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
4. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide matching splice plates at joints
3. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
        2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
        3) York Manufacturing, Inc.; Multi-Flash 500.

2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).

    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
        2) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
        3) Hohmann & Barnard, Inc.; Textroflash.

    b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use flexible flashing with stainless steel metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, as specified in Division 7 Section “Joint Sealants.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
         2) Heckmann Building Products Inc.; No. 85 Cell Vent.
         3) Hohmann & Barnard, Inc.; Quadro-Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

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

      a. Advanced Building Products Inc.; Mortar Break.
      b. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
      c. Mortar Net USA, Ltd.; Mortar Net.

   2. Provide one of the following configurations:

      a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

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

      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

2.12 CAVITY-WALL INSULATION

A. Refer to Division 07 Section “Thermal Insulation”.

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

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

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced and loadbearing masonry, use Type S.
3. For exterior, above-grade, non-load-bearing walls and parapet walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Application: Use colored aggregate mortar for exposed mortar joints with the following units:

a. Decorative CMUs.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1orparagraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

2.15 FABRICATION (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

B. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

F. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

G. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

I. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.16 FABRICATION TOLERANCES (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
5. Unless otherwise indicated, provide 3/8 inch high joints.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using the following method:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity atreturns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
3. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block as indicated on the architectural drawings.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches (100 mm), and 1-1/2 inches (38 mm) into the inner wythe..
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 32 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.14 PRECAST ARCHITECTURAL CONCRETE TRIM UNIT INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Set architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

1. Maintain horizontal and vertical uniform joint width as erection progresses.
2. Unless otherwise indicated, maintain uniform joint widths of 3/8 inch.

C. Connect architectural precast concrete units in position by grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

D. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

E. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 2 special inspections according to the "2005 Connecticut Supplement with 2009 Amendment – State Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency for Vertically Reinforced Masonry: One set of tests for each 1500 sq. ft. (140 sq. m) of wall area or portion thereof, with a minimum of one test per day.

E. Testing Frequency for Non-loadbearing Masonry: One set of tests for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Test (Compressive Strength): For each mix provided, according to ASTM C 780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.16 REPAIRING, POINTING, AND CLEANING (UNIT MASONRY)

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 REPAIRS (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.18 CLEANING (PRECAST ARCHITECTURAL CONCRETE TRIM UNITS)

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

3.19 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Refer to Section 017419 “Construction Waste Management and Disposal”.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 057500 - DECORATIVE FORMED METAL

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 metal wall cladding.
2. Interior metal wall cladding accessories.
3. Decorative metal infill panel.

B. Related Sections:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(6)4 and 16a-38k-4(b)5.
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.
2. Section 055000 "Metal Fabrications" for non-decorative metal fabrications.
3. Section 057300 "Decorative Metal Railings."
4. Section 076200 "Sheet Metal Flashing and Trim" for items made of formed metal for flashings and trim.
5. Section 077100 "Roof Specialties" for items made of formed metal for parapets and copings.
6. Section 081113 "Hollow Metal Doors and Frames" for flush hollow-metal doors and frames receiving decorative metal cladding.
7. Section 142100 "Machine-Room-Less Traction Elevators" for elevator cab and entrance components made from sheet metal.

1.3 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated. Include finishing materials.

C. Shop Drawings: Show fabrication and installation details for decorative formed metal.

1. Include plans, elevations, component details, and attachments to other work.

2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of decorative formed metal with adjacent construction.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

2.2 MISCELLANEOUS MATERIALS

A. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.

B. Backing Materials: Provided or recommended by decorative formed metal manufacturer.

C. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning and is compatible with substrate and noncombustible after curing.

2.3 FABRICATION, GENERAL

A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.

D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

E. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

2.4 INTERIOR METAL WALL CLADDING (PNL-1)

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tread Plate, pattern XTP; Rigidized Metals Corporation.

B. Form interior metal wall cladding from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.

1. Stainless-Steel Sheet: 0.050 inch (1.27 mm).

a. Finish: No. 4. (satin, polish directional finish)

2.5 DECORATIVE METAL INFILL PANEL

A. Panels consisting of decorative metal face, spacers and metal backer. Form decorative metal face and backer from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.

1. Aluminum Sheet: 5005-H34, 0.063 inch .

a. Type: Perforated
1) Perforation Type: Round.
2) Perforation Size: 5/32 inch.
3) Perforation Spacing: 3/16 inch centers.
4) Perforation Pattern: Staggered.

b. Finish: Clear Anodized.

2. 18 inches x 18 inches.

3. Panel Thickness: 1 inch.

4. Air Flow Requirements: 1,000 CFM.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish items indicated on Drawings after assembly.

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.

2.7 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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 decorative formed metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare the surfaces using the methods recommended by the manufacturer.

3.3 INSTALLATION

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

B. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

C. Use concealed anchorages where possible.

D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

E. Install reveal trim and accessories as the Work progresses.

3.4 ADJUSTING AND CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.5 PROTECTION

A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057500

SECTION 071616 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes crystalline waterproofing for positive-side application to concrete elevator pits and negative side application to concrete alignment bay pits and concrete inspection bay pits in the Maintenance Bay area.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for finishing concrete walls and slabs to receive waterproofing.
2. Section 079200 "Joint Sealants" for elastomeric sealants in concrete walls and floors.

1.3 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated. Include material descriptions and installation instructions for crystalline waterproofing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for crystalline waterproofing.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE SUBMITTALS

A. Manufacturers Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance**,** and that employs workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.

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

   a. Euclid Tamms; HEY'DI K-11
   b. Kryton Group of Companies (The); Krystol T1 & T2 Waterproofing System.
   c. Xypex Chemical Corporation; Xypex.

2. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to CE CRD-C 48.
3. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

C. Portland Cement: ASTM C 150, Type I.

D. Sand: ASTM C 144.

E. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and not to create a vapor barrier.

F. Water: Potable.

2.3 MIXES

A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

B. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water gaged with a polymer admixture. Blend together with mechanical mixer to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.

D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.

1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch (25.4 mm) deep. Fill reveal with patching compound flush with surface.

E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D 4258.

a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application and curing.

1. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to elevator pits.
3. Number of Coats: Number required for specified water permeability.
4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
5. Dampen surface between coats.

B. Final Coat Finish: Spray Textured.

C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

D. Protective Topping: Apply 1-inch- (25.4-mm-) thick, protective topping over floor surfaces.

3.4 FIELD QUALITY CONTROL

A. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 071616

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Vapor retarder.
3. Roof insulation.

B. Related Requirements:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(e)12 and 16a-38k-4(b)4.
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

2. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 077200 "Roof Accessories" for precast concrete splashblock to be installed as part of this section.
5. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck

Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product.

C. FM Global Requirements:

1. FM RoofNav Assembly Numbers
2. Application for Acceptance of Roofing: A copy of this document immediately follows this section.

D. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

E. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Thermoplastic Polyolefin (TPO) Roofing to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

B. Warranty: For Thermoplastic Polyolefin (TPO) Roofing specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.8 QUALITY ASSURANCE SUBMITTALS

A. Manufacturers Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof expansion joints and other components of roofing system.
2. Warranty Period: 30 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Carlisle SynTec Incorporated.
2. Firestone Building Products.
3. GenFlex Roofing Systems.

B. Source Limitations: Obtain components including roof insulation fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. FM RoofNav Assembly Numbers: Equivalent to 294816-0-0 and 294815-0-0.

2. Design Criteria:
   a. 95 mph wind speed
   b. Ground Roughness Coefficient: C
   c. Wind Importance factor: 1.15

3. Fire/Windstorm Classification: Class 1-60
4. Hail-Resistance Rating: SH.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.

1. Thickness: 80 mils (2.0mm), nominal.
2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick.

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

a. CertainTeed Corporation; GlasRoc Sheathing.
b. Georgia-Pacific CorporationDens Deck Prime.
c. USG Corporation; Securock Glass Mat Roof Board.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.6 VAPOR RETARDER

A. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
2. Adhesive: Manufacturer's standard lap adhesive, FM Global approved for vapor-retarder application.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

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

a. Firestone Building Products.
b. Hunter Panels.
c. Johns Manville.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Full-spread spray-applied, low-rise, two-component urethane adhesive.

C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.

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

a. CertainTeed Corporation; GlasRoc Sheathing.
b. Georgia-Pacific Corporation; Dens Deck Prime.
c. USG Corporation; Securock Glass Mat Roof Board.

2.9 WALKWAYS

A. Walkway Membrane: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway and rolls where indicated, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Size: 30 inches wide x 10 foot long strips.

B. Walkway Pad: Walkway pad consisting of overlapping strips of UV resistant, 100%TPO compound with embossed surface to provide slip-resistance equal to X-Tred; Firestone Products.

1. Size: 30 inches wide.x 10 foot long strips.

2.10 ROOF WARRANTY SIGNS

A. Materials: Materials: Provide cast (not extruded or continuous cast) methyl methacrylate monomer psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F and of the following general types:

1. Opaque Sheet: Provide plaque sign that is manufactured from 1/8” thick laminated engraving stock.
2. Engraved Copy: Engraved copy characters through the first background layer to expose the contrasting color of the inner core of the engraving stock.

a. Panel Size: 18”x20”, long side horizontal.
b. Engraving Stock Thickness: 1/8inch minimum.
c. Engraved Letter proportion: Letters and Numbers on signs shall have a width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between1:5 and 1:10.
d. Engraved Letter Size: Characters shall be 5/8 inch high.
e. Background or first layer of engraving stock: Black
f. Inner core of engraving stock: White
g. Engraved letter style: Helvetica Medium with all upper case letters.
h. Mounting Methods: Mechanical mounting as indicated in PART 3.11 of this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof.

3.5 VAPOR-RETARDER INSTALLATION

A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Continuously seal side and end laps.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and adhere to roof insulation.

1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

I. Install slip sheet over cover board and immediately beneath roofing if recommended by the roofing manufacturer.

3.7 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars if required by roofing manufacturer.

3.9 WALKWAY INSTALLATION

A. Walkway Membrane: Install walkway rolls in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions. Provide 2 inch wide gap between rolls.

Walkway Pads: Install walkway pads in locations indicated. Thread strips of TPO through pad and heat weld strips to roof membrane according to roofing system manufacturer's written instructions. Space strips at a maximum of 36 inches on center on both sides of the pads and at the roll end. Provide 2 inch wide gap between pads.

3.10 SPLASHBLOCK INSTALLATION

A. Splashblocks: Install splashblocks in locations indicated. Install an additional protective layer of membrane below splashblocks extending a minimum of 6 inches beyond the perimeter of the splashblock. . Heat weld to substrate or adhere additional protective layer substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.11 INSTALLATION OF WARRANTY SIGN

A. The Roof Warranty Sign shall be permanently anchored to the facility in an extruded aluminum with clear anodized finish frame, with stainless steel fasteners, adjacent to the roof hatch ladder, unless otherwise directed by the Engineer. Panel sign shall include the following information:

1. NEW ROOF INSTALLATION WARRANTY
2. CTDOT (Project 0431-0006): (District Name, coordinate with CDDOT)
3. WARRANTY START DATE: (X/X/XX) (Date of the issuance of the Certificate of Compliance)
4. ROOF TYPE: (Type of roof installed), (i.e. JoeSmith International, Inc. PVC Membrane)
5. WARRANTY: (Manufacturer’s name and type of warranty), 20 yr NDL
6. WARRANTY NUMBER: (Actual Warranty number)
7. INSTALLER: (Contractor's name, town located, and telephone number.)
8. AFTER 2 YEARS CONTACT MANUFACTURER: (Manufacturer’s name and telephone number of warranty service).

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

C. Perform pull-out test per ASTM E907.

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 078123 - INTUMESCENT FIREPROOFING

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 mastic and intumescent fire-resistive coatings (MIFRC).

B. Related Requirements:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(b)5
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and <u>NOTICE TO CONTRACTOR – SUBMITTALS.</u>

B. Product Data: For each type of product.

C. FM Global Requirements: Products must be listed in FM Global's "Building Materials Approval Guide".

D. Shop Drawings: Structural framing plans indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

E. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of fireproofing.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE SUBMITTALS

A. Manufacturers Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. Firm must also be approved by FMG according to FMG 4991, “Approval of Fireproofing Contractors”.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. MIFRC: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.

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

a. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.
b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Firefilm III andr Nullifire S607.
c. Isolatek International; Cafco SprayFilm-WB 3 and Cafco SprayFilm-WB 4.

2. Application: Designated for "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

5. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.
6. Finish: Spray-textured finish.Consider retaining "Color and Gloss" Subparagraph below if important to Project's appearance; consult manufacturer for recommendations.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

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. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written recommendations.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

L. Where non-fire-resistance rated members attach to fire resistance rated members, the non-rated member shall be protected in the same manner as the rated member for a distance of not less than 12 inches from the point of connection.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.11.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

SECTION 080671 – DOOR HARDWARE SCHEDULE

DOOR HARDWARE SETS

A. The door 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. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.

1. Section 08 71 00 – Door Hardware.

D. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. MR - Markar
4. RO - Rockwood
5. RU – Corbin Russwin
6. ME - Medeco
7. RF - Rixson
8. LC - LCN
9. VD – Von Duprin
10. HS – HES
11. OT – Others

Hardware Schedule

Set: 1.0

Doors: A101-1, A113-1, A114-1, A203-1, A204-1, A205-1, A206-1, A207-1, A208-1, A209-1, A210-1, A211-1, A211-2, A211-3, A211-4, A218-1, A219-1, M109-1, M114-1, S107-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Office Lock	ML2051 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100

1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 2.0

Doors: A102-1

6	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
2	Flush Bolt	557	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop (inactive leaf)	9-X36 5458	689	RF	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
2	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
2	Silencer	608		RO	087100
1	Gasketing	S773D		PE	087100

Set: 3.0

Doors: A111a-1

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 4.0

Doors: A102c-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36 5458	689	RF	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100

3	Silencer	608		RO	087100

Set: 5.0

Doors: A103-1, A104-1, M101-1, A212-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Pull Plate	BF 110x70C	US32D	RO	087100
1	Push Plate	70C	US32D	RO	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 6.0

Doors: A111-1, A112-1, S113-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Silencer	608		RO	087100

Note: Armor plate at S113-1 in lieu of kickplate.

Set: 7.0

Doors: R-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 7.1

Doors: S113c-2

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100

1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 8.0

Doors: A106-1, A106a-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Passage Set	ML2010 NSM	626	RU	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100
1	Door Bottom	434ARL		PE	087100

Set: 9.0

Doors: A202-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36 5458	689	RF	087100
3	Silencers	608		RO	087100

Set: 10.0

Doors: A105-1, A110-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100

3	Silencer	608		RO	087100

Set: 11.0

Doors: A115-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100
1	Door Bottom	434ARL		PE	087100

Set: 12.0

Doors: A115a-1, B1-1

6	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
2	Flush Bolt	557	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36 5458	689	RF	087100
1	Surface Overhead Stop	9-X36 5459	689	RF	087100
2	Silencer	608		RO	087100

Set: 13.0 and 13.1

Doors: A102a-1, A102b-1, A111a-1, A118-1, A110a-1, A202a-1, A212a-1, A213-1, A224-1, M102-1, M112c-1, G3-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100
1	Door Closer	4110 SCNC MS (at doors A224-1, A213-1, A102b-1, M102-1, M112c-1 only)	689	LC	
1	Gasketing	S773D(at doors A224-1, A213-1, A102b-1, M102-1, M112c-1only)		PE	

Note: NRP Hinges at A102a-1 and G3-1.

Set: 14.0

Doors: M130-1

6	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
2	Wall Stop	400	626	RO	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Gasketing	S773D		PE	087100

Set: 15.0

Doors: A220a-1

1	Sliding Door Hdwe	HBP200A/ 5'-4"		PE	087100
1	Sliding Door Hdwe	PF134KIT		PE	087100
2	Flush Pull	BF97	US32D	RO	087100

Set: 16.0

Doors: A225-1, A226-1

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
3	Silencer	608		RO	087100

Set: 17.0

Doors: A-1, A-2, D-1, D-2, D-4, G-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device	99L-F BE	US26D	VD	087100

1	Door Closer	4110 EDA MC	689	LC	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Notes: Additional gasketing by frame manufacturer where required.

Set: 18.0

Doors: M002-1, M002-2

2	Continuous Hinge	CFM83HD1		PE	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36 5458	689	RF	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
2	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
2	Silencer	608		RO	087100
1	Gasketing	S773D		PE	087100

Set: 18.1

Doors: S113b-1

2	Continuous Hinge	CFM83HD1		PE	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
2	Surface Overhead Stop	9-X36 5458	689	RF	087100
1	Door Closer	4010 MC	689	LC	087100
2	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 19.0

Doors: S113-7, G-3 , M106-2, M107-2, M108-2, M114-2, M115-2, S113-4, S113A-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Exit Device	ELR 99L-NL	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Power Supply	PS914		VD	087100
1	Door Closer (surface)	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Coordinate hardware with Security Contractor.

Set: 19.1

Doors: A108-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Exit Device	ELR 99NL	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Power Supply	PS914		VD	087100
1	Door Closer (surface)	4110 SCNS MC	689	LC	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Coordinate hardware with Security Contractor.

Set: 19.2

Doors: G-1, G2, S113A-3

1	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device	ELR 99L-NL-F	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Power Supply	PS914		VD	087100
1	Door Closer	4110 EDA MC	689	LC	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Coordinate hardware with Security Contractor.

Set: 20.0

Doors: G2-1, M110-1, S105-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Privacy Set	ML2030 NSM	626	RU	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 21.0

Doors: S102-1, S103-1

1	Continuous Hinge	FM300 7'0	630	MR	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC SRI	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100

1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 21.1

Doors: S107-1

1	Continuous Hinge	FM300 7'0	630	MR	087100
1	Office Lock	ML2051 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC SRI	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100

Set: 22.0

Doors: M103-1

1	Continuous Hinge	FM300 7'0	630	MR	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC SRI	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100

Set: 23.0

Doors: M003-3, M006-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Exit Device	ELR 99L-NL	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder	33K076041H	626	ME	087100

	Housing				
1	Power Supply	PS914		VD	087100
1	Door Closer (surface)	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Sweep	18061CNB		PE	087100

Set: 24.0

Doors: D-3, S113-3

1	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device (exit only)	99 EO	US26D	VD	087100
1	Door Closer (surface)	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100

Set: 24.1

Doors: S113A-2

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Exit Device (exit only)	99 L	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Door Closer (surface)	4110 EDA MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400		RO	087100
3	Silencers	608		RO	087100

Set: 25.0

Doors: S100-1, S104-1, S114-1

1	Continuous Hinge	FM300 7'0	630	MR	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC SRI	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 25.1

Doors: M112-2

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Armor Plate	K1050 48"	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 25.2

Doors: M105-2, S110-1

3	Hinge	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Armor Plate	K1050 48"	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 26.0

Doors: M107-3, M132-1

2	Continuous Hinge	CFM83HD1		PE	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100

1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
2	Armor Plate	K1050 48" (At M107-3 only)	US32D	RO	087100
2	Silencer	608 (At M107-3 only)		RO	087100
1	Gasketing	S773D		PE	087100

Set: 27.0

Doors: M112-1, M116-1, M114B-2

3	Hinge	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010/4110 MC	689	LC	087100
1	Armor Plate	K1050 48"	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 28.0

Doors: M114B-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device	99L	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Door Closer	4110 EDA MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 29.0

Doors: M114C-1

2	Continuous Hinge	CFM83HD1		PE	087100
2	Exit Device	99L BE	US26D	VD	087100
1	Mullion	KR 4954	SP28	VD	087100
2	Door Closer	4110 EDA MC	689	LC	087100

2	Armor Plate	K1050 48"	US32D	RO	087100
2	Wall Stop	400	US32D	RO	087100
2	Silencer	608		RO	087100

Set: 30.0

Doors: M115-1, M117-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Armor Plate	K1050 48"	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 31.0

Doors: M118-1

6	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
1	Wall Stop	400	US32D	RO	087100
2	Silencer	608		RO	087100

Set: 32.0

Doors: M121-1

2	Continuous Hinge	CFM83HD1		PE	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
2	Silencer	608		RO	087100

Set: 33.0

Doors: M123-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Armor Plate	K1050 48"	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 34.0

Doors: M124-1, M125-1, M126-1, M127-1, M129a-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Kick Plate	K1050 10" x WOD -2"	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100

Set: 35.0 Not Used

Set: 36.0

Doors: M130-2

1	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device (exit only)	99EO	US26D	VD	087100
1	Door Closer (surface)	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100

Set: 37.0

Doors: M131-1

1	Continuous Hinge	CFM83SLF-HD1		PE	087100
1	Classroom Lock	ML2055 NSM CLS7	626	RU	087100

1	Construction Core	As Specified	626	ME	087100
1	Surface Overhead Stop	9-X36	689	RF	087100
1	Door Closer	4010 MC	689	LC	087100

Set: 38.0

Doors: S101-1, S101-2, S111-3

1	Continuous Hinge	FM300 7'0	630	MR	087100
1	Exit Device	99L-F	US26D	VD	087100
1	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Door Closer	4110 SCNS MC SRI	689	LC	087100
1	Door Closer	4110 EDA MC SRI (at S101-2 only)	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400 (at S101-2 only)	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 39.0

Doors: S106-1, S109-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100

Set: 40.0

Doors: G1-1

1	Continuous Hinge	CFM83HD1		PE	087100
1	Office Lock	ML2051 NSM CLS7	626	RU	087100
1	Door Closer (surface)	4110 HSCNS MC	689	LC	087100
1	Threshold	171A		PE	087100
1	Sweep	18061CNB		PE	087100

Note: Balance of weather-strip by aluminum manufacturer.

Set: 41.0

Doors: S108a-1, S108-1, A116-1

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Electric Strike	1006	630	HS	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
3	Silencer	608		RO	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100
1	Gasketing	S773D		PE	087100

Note: Power to electric strike by Security Contractor. Coordinate hardware with Security Contractor.

Set: 41.1

Doors: M132-2

3	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK	087100
1	Electric Strike	1006	630	HS	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4110 SCNS MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
1	Sweep	18061CNB		PE	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Power to electric strike by Security Contractor. Coordinate hardware with Security Contractor.

Set: 42.0

Doors: S108a-1, S113-9

3	Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK	087100
1	Electric Strike	1006	630	HS	087100
1	Storeroom Lock	ML2057 NSM CLS7	626	RU	087100
1	Construction Core	As Specified	626	ME	087100
1	Door Closer	4010/4110 MC	689	LC	087100
1	Kick Plate	K1050 10" x WOD -2" B4E	US32D	RO	087100
1	Wall Stop	400	US32D	RO	087100
1	Gasketing	S773D		PE	087100
1	Door Bottom	434ARL		PE	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Power to electric strike by Security Contractor. Coordinate hardware with Security Contractor.

Set: 43.0

Doors: A201-1

2	Continuous Hinge	CFM83HD1		PE	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Exit Device	ELR 99L-NL	US26D	VD	087100
1	Exit Device	99L-DT	US26D	VD	087100
2	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Mortise Cylinder Housing	33K076025	626	ME	087100
1	Mullion	KR 4954	SP28	VD	087100
1	Power Supply	PS914		VD	087100
2	Door Closer	4110 SCNS MC	689	LC	087100
1	Card Reader	By Security Contractor		OT	087100
1	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Balance of weather strip by aluminum manufacturer. Coordinate hardware with Security Contractor.

Set: 43.1

Doors: M114A-1

2	Continuous Hinge	CFM83HD1		PE	087100
1	Power Transfer	CEPT	US32D	HS	087100
1	Exit Device	ELR 99L-NL	US26D	VD	087100
1	Exit Device	99L-DT	US26D	VD	087100
2	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Mortise Cylinder Housing	33K076025	626	ME	087100
1	Mullion	KR 4954	SP28	VD	087100
1	Power Supply	PS914		VD	087100
2	Door Closer	4110 SCNS MC	689	LC	087100
1	Threshold	171A		PE	087100
1	Gasketing	2891APK		PE	087100
2	Sweep	18061CNB		PE	087100
1	Card Reader	By Security Contractor		OT	087100
2	Door Position Switch	By Security Contractor		OT	087100
1	Request to Exit Switch	By Security Contractor		OT	087100

Note: Balance of weather strip by aluminum manufacturer. Coordinate hardware with Security Contractor.

Set: 44.0

Doors: A201a-1

2	Continuous Hinge	CFM83HD1		PE	087100
1	Exit Device	99L	US26D	VD	087100
1	Exit Device	99L - DT	US26D	VD	087100
2	Construction Core	As Specified	626	ME	087100
1	Rim Cylinder Housing	33K076041H	626	ME	087100
1	Mortise Cylinder Housing	33K076025	626	ME	087100
1	Mullion	KR 4954	SP28	VD	087100
2	Door Closer	4110 SCNS MC	689	LC	087100
2	Door Bottom	434ARL		PE	087100

1	Threshold	171A	PE	087100

END OF SECTION 080671

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors and door-frame units.
5. Horizontal Sliding windows.

B. Related Requirements:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(b)4 and 16a-38k-4(d)9
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

2. Section 087100 “Door Hardware” for door hardware.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and <u>NOTICE TO CONTRACTOR – SUBMITTALS.</u>

B. Product Data: For each type of product.

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

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Connecticut, responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field testing agency.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Aluminum-Framed Entrances and Storefronts to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

B. Warranty: For Aluminum-Framed Entrances and Storefronts specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

D. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.

c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Connecticut, to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.

2. Other Design Loads:
a. Lateral Pressures:
1) Field: 26.3 psf inward pressure, 28.5 psf outward pressure.
2) Corner: 26.3 psf inward pressure, 35.1 psf outward pressure.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
4. Lateral Pressures: 26.3 psf inward pressure, 28.5 psf outward pressure.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:

   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on structural Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 69 as determined according to NFRC 500.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.2 MANUFACTERERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide YWW 45 TU Thermal Window Wall System; YKK AP America Inc. or comparable product by one of the following:

1. Kawneer North America.
2. Oldcastle Building Envelope.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: High-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) min. to 2-1/2 inch (63.57-mm) max. overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: As indicated.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

2.5 HORIZONTAL SLIDING WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide YSW400 T Horizontal Sliding Window; YKK AP America Inc..

B. Window Framing System:

1. AAMA Designation: HS-AW 40.
2. Description: Overall frame depth to be 4”. Fixed and sliding panels shall have overlapped joints, sealed, and dual screw spline joinery for extra strength and weatherability. Sliding panels shall not be removable when in a locked position. Windows including sliding as well as fixed panels, and frames shall be factory fabricated.
3. Thermal barrier shall consist of 6/6 nylon polyamide glass fiber reinforced pressure extruded bars. Systems employing non-structural thermal barriers are not acceptable.
4. Configuration: As indicated on drawings.
5. Glazing: Preformed EPDM glazing gasket.

C. Materials:

1. Extrusions: Aluminum Alloy 6063-T5 Temper (ASTM B 221).
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), 3003-H3 Aluminum Alloy, 0.080” (1.95) mm) minimum thickness.

2.6 HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."."

B. Horizontal Sliding Window Hardware: Standard adjustable acetal roller in stainless steel housing, cast aluminum cam-type sweep lock and stainless steel keeper.

2.7 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers**.**

C. Glazing Sealants: Comply with Section 088000 "Glazing."

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads**,** finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Horizontal Sliding Window:

1. Fabricate frame using two screws and adhesive backed gaskets at corner joints. Fixed and sliding panels shall have over lapped joints, sealed, and dual screw/spline joinery for extra strength and weatherability. Sliding panels shall not be removable when in a locked position.
2. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
3. Fabrication Tolerances:
   a. Material Cuts: Square to 1/32 inch (0.8 mm) off square, maximum, over largest dimension; proportionate amount of 1/32 inch (0.8 mm) on other two dimensions.
   b. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.
   c. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch (1.6 mm).
   d. Flatness: +/- 1/16 inch (1.6 mm) off neutral plane.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: [As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
    c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

B. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

    a. Perform a minimum of two tests in areas as directed by Architect.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084113

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. Windows.
2. Doors.
3. Glazed curtain walls.
4. Storefront framing.
5. Glazed entrances.
6. Interior borrowed lites.
7. Vacuum Insulation Panel.

B. Related Sections:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(b)4 and 16a-38k-4(b)5
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.
2. Section 086200 "Unit Skylights” for glazing in unit skylights
3. Section 088300 "Mirrors."
4. Section 088853 "Security Glazing" for glazing units resistant to ballistic attacks.

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. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, licensed in the State of Connecticut, using the following design criteria:

1. Design Wind Pressures: As indicated on Structural Drawings.
2. Design Snow Loads: As indicated on Structural Drawings.
3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
4. Glass Type Factors for Acid Etched Glass:

   a. Short-Duration Glass Type Factor for Acid Etched: 0.5.
5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. 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 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and <u>NOTICE TO CONTRACTOR – SUBMITTALS.</u>

B. Product Data: For each glass product and glazing material indicated.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

D. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

F. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Connecticut, responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency and] sealant testing agency.

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.

1.7 QUALITY ASSURANCE SUBMITTALS

A. Manufacturers Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.8 CLOSEOUT SUBMITTALS

A. Warranty: For Glazing specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.9 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 coated float glass, laminated glass and 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. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" and Section 084413 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

L. 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.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 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).

1.12 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 Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

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

C. 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.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

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.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

A. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, and complying with other requirements specified.

B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

C. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

1. Glass: Clear float.
   Ceramic Coating Color: As selected by Architect from manufacturer's full range.

D. Tempered Acid Etched Glass: ASTM C 1048 Kind FT (fully tempered) , Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F2 (etched both sides), [Pattern P3 (random)].

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

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

2.4 INSULATING GLASS

1. Basis-of-Design Product: Subject to compliance with requirements, provide Solarban z75; PPG Industries, Inc.

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 polyisobutylene and silicone primary and secondary.
2. Spacer: Box type, desiccant filled, perforated aluminum in color selected by Architect. Use of “U” shaped spaces (in cross section) is not permitted..
3. Desiccant: Molecular sieve or silica gel, or blend of both.

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

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.

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

   a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite NT.
   b. Safti First; SuperLite C/SP.

c. Schott North America, Inc.; Filmed Pyran Star or Filmed Pyran Crystal.

2.6 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. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber 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.

2.7 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. 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. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
b. Pecora Corporation; 890.
c. Sika Corporation, Construction Products Division; SikaSil-C990.

2. Applications: Exterior glazing where recommended by glazed product manufacturer.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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

   a. GE Advanced Materials - Silicones; SilGlaze II SCS2800 or SilPruf NB SCS9000 orSilPruf SCS2000 or UltraPruf II SCS2900.
   b. Pecora Corporation; 864 or895 or898].
   c. Sika Corporation, Construction Products Division; SikaSil-C995.

2. Applications: Exterior glazing where recommended by glazed product manufacturer.

D. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.8 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.

2.9 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.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

H. Vacuum Insulation Panel: High efficiency insulation made of high performance inorganic fumed silica core material with aluminized multilayer barrier with thermal welded seams

1. Basis-of-Design Product: Vacuum Insulation Panel; Dow Corning.

a. Thickness: ½ inch.
b. R-Value: 39 per inch thickness.
c. Flamespread Index: 25 or less.
d. Smoke Developed Index: 20 or less.

2.10 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.

2.11 LAMINATED-GLASS TYPES

A. Glass Type G5 and G7: Clear laminated glass with two plies of float glass.

a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

2. Thickness of Each Glass Ply: 3.0 mm.
3. Interlayer Thickness: 0.060 inch (1.52 mm).
4. One glass ply to be acid etched at glass type G5.
5. Provide safety glazing labeling.

2.12 INSULATING-GLASS TYPES

A. Glass Type G1: 1” insulated clear vision glass. Low-e-coated.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.

a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

4. Interspace Content: Air or Argon.
5. Indoor Lite: Float glass.

a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible Light Transmittance Outside: 8 percent minimum.
8. Visible Light Transmittance Inside: 11 percent minimum.
9. Winter Nighttime U-Factor: .29 maximum.
10. Summer Daytime U-Factor: .27 maximum.
11. Solar Heat Gain Coefficient: .25 maximum.
12. Provide safety glazing labeling.

B. Glass Type G2: 1" insulated spandrel glass. Ceramic-coated, low-e. laminated glass.

1. Overall Unit Thickness: 1 1/16 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
4. Interspace Content: Vacuum Insulation Panel.
5. Indoor Lite: Clear laminated glass with two plies of float glass.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Opaque Coating Location: Second and third surface.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .27 maximum.

C. Glass Type G12: 1" insulated clear vision glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.

a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

4. Interspace Content: Air or Argon.
5. Indoor Lite: Float glass.

a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

6. Visible Light Transmittance Outside: 8 percent minimum.
7. Visible Light Transmittance Inside: 11 percent minimum.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .27 maximum.
10. Solar Heat Gain Coefficient: .25 maximum.
11. Provide safety glazing labeling.

2.13 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type G4: 1 inch insulated safety glass. Low-e-coated, laminated glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Outdoor Lite: 6.0 mm.
   a. Outdoor Lite: Float Glass.
      1) Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
3. Interspace Content: Air orArgon.
4. Indoor Lite: Clear laminated glass with two plies of float glass.
   a. Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

   b. Thickness of Each Glass Ply: 3.0 mm.
   c. Interlayer Thickness: 0.060 inch (1.52 mm).

5. Low-E Coating: Pyrolytic or sputtered on second surface.
6. Visible Light Transmittance Outside: 8 percent minimum.
7. Visible Light Transmittance Inside: 11 percent minimum.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .27 maximum.
10. Solar Heat Gain Coefficient: .25 maximum.
11. Provide safety glazing labeling.

B. Glass Type G13: 1 inch insulated safety glass. Laminated glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Outdoor Lite: 6.0 mm.
   a. Outdoor Lite: Float Glass.
      1) Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
3. Interspace Content: Air orArgon.
4. Indoor Lite: Clear laminated glass with two plies of float glass.
   a. Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.

   b. Thickness of Each Glass Ply: 3.0 mm.
   c. Interlayer Thickness: 0.060 inch (1.52 mm).
5. Visible Light Transmittance Outside: 8 percent minimum.
6. Visible Light Transmittance Inside: 11 percent minimum.
7. Winter Nighttime U-Factor: .29 maximum.
8. Summer Daytime U-Factor: .27 maximum.
9. Solar Heat Gain Coefficient: .25 maximum.
10. Provide safety glazing labeling.

2.14 FIRE-PROTECTION-RATED GLAZING TYPES

A. Glass Type G6: 120-minute fire-rated glazing; film-faced ceramic glazing.

1. Provide safety glazing labeling.

2.15 FIRE PROTECTION-RATED INSULATING-GLASS TYPES

A. Glass Type G8: 1" insulated fire protection rated glass. Low-e-coated.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
4. Interspace Content: Air or Argon.
5. Indoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible Light Transmittance Outside: 8 percent minimum.
8. Visible Light Transmittance Inside: 11 percent minimum.
9. Winter Nighttime U-Factor: .29 maximum.
10. Summer Daytime U-Factor: .27 maximum.
11. Solar Heat Gain Coefficient: .25 maximum.
12. Provide safety glazing labeling.

B. Glass Type G9: 1" insulated fire protection rated spandrel glass. Ceramic-coated, low-e.

1. Overall Unit Thickness: 1 1/16 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
4. Interspace Content: Vacuum Insulation Panel.
5. Indoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Opaque Coating Location: Fourth surface.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .27 maximum.

C. Glass Type G14: 1" insulated fire protection rated glass. Low-e-coated, laminated glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.

3. Outdoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
4. Interspace Content: Air or Argon.
5. Indoor Lite: Clear laminated with two plies of 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible Light Transmittance Outside: 8 percent minimum.
8. Visible Light Transmittance Inside: 11 percent minimum.
9. Winter Nighttime U-Factor: .29 maximum.
10. Summer Daytime U-Factor: .27 maximum.
11. Solar Heat Gain Coefficient: .25 maximum.
12. Provide safety glazing labeling.

D. Glass Type G15: 1" insulated fire protection rated spandrel glass. Ceramic-coated, low-e. laminated glass.

1. Overall Unit Thickness: 1 1/16 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
4. Interspace Content: Vacuum Insulation Panel.
5. Indoor Lite: Clear laminated with two plies of 60 minute fire rated glazing; film faced.
   a. Annealed or Kind HS (heat strengthened), if required, Kind FT (fully tempered), where indicated.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Opaque Coating Location: Second and third surface.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .27 maximum.

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.

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

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Warm-air dryers.
4. Underlavatory guards.
5. Custodial accessories.

B. Related Sections:

1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(b)4
   a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

2. Section 088300 "Mirrors" for frameless mirrors.
3. Section 093000 "Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated. Include the following:
1. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
2. Material and finish descriptions.
3. Features that will be included for Project.
4. Manufacturer's warranty.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Toilet, Bath and Laundry Accessories to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

B. Warranty: For Toilet, Bath and Laundry Accessories specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

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

1.7 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.

1.8 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, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Jumbo-Roll) Dispenser (TTD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-2890.
2. Description: One-roll unit.
3. Mounting: Surface mounted.
4. Capacity: 10-inch- (228- or 254-mm-) diameter roll.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. Lockset: Tumbler type.
7. Refill Indicator: Pierced slots at front.

B. Combination Towel (Folded) Dispenser/Waste Receptacle (PTD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-380349.
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Surface mounted.
4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 3.8 gal. .
6. Liner: Reusable, vinyl waste-receptacle liner.
7. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

C. Liquid-Soap Dispenser (SD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-2111 .
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 fl. oz. .

5. Materials: Stainless steel with No.4 finish. Black molded plastic push button and spout..
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

D. Grab Bar (GB and VGB):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-6806.99 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18- gauge (1.2 mm) thick.

   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

E. Swing Grab Bar (SGB):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-4998.99
2. Mounting: Backplate with four screw holes for attachment to wall.
3. Material: Stainless steel, 18- gauge (1.2 mm) thick.

   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Length: 29 inches.

F. Mirror Unit (MR):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-290 Series.
2. Frame: Stainless-steel angle.

   a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain and Rod (SC):

1. Basis-of-Design Products:
   a. Shower Curtain Rod: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-6047 x 36 and B-6047 x 60.

b. Shower Curtain: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-204-2 and 204-3.

2. Shower Current Rod Description: Size: 1-1/4-inch (32-mm) OD; fabricated from nominal 0.05-inch- (1.3-mm-) thick stainless steel.
3. Shower Curtain Rod Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
4. Shower Curtain Rod Finish: No. 4 (satin).
5. Shower Curtain Size: Minimum 6 inches (152 mm) wider than opening by 72 inches (1828 mm) high.
6. Shower Curtain Material: Vinyl, minimum 0.008 inch thick, opaque, matte with hemmed edges and corrosion resistant grommets at min. 6 inches o.c. through hem.
7. Color: White.
8. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
9. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

B. Folding Shower Seat (SS):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-5181.

2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect..
4. Frame and Mounting Bracket: Stainless steel, with self-locking mechanism..
5. Dimensions: 33 inches wide x 22 inches deep..
6. Supports minimally 360 lbs.

C. Soap Holder (SH):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-680.
2. Description: Without washcloth bar.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Towel Pin (TP):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc., Model B-6777.
2. Description: Projecting minimum of 3 inches (75 mm) from wall surface.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 WARM-AIR DRYERS

A. Warm-Air Dryer (HD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide XLERATOR, Model XL-SB; Excel Dryer Corporation.
2. Mounting: Recessed. Provide manufacturers standard recess kit.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

    a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
5. Electrical Requirements: 115 V, 13 A, 1500 W.

2.5 UNDERLAVATORY GUARDS

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

1. McGuire Manufacturing, Inc.
2. Plumberex Specialty Products, Inc.
3. Truebro by IPS Corporation.

B. Underlavatory Guard :

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

2.6 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder (MBH):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment; Model 244.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Three.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch (1.3-mm) thick stainless steel.
    b. Rod: Approximately 1/4-inch (6-mm) diameter stainless steel.

2.7 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. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 10300- DOORWAY SPILL BARRIER

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. Automatic closing doorway spill barriers.

1.3 QUALITY ASSURANCE

A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

B. Each product shall be provided by a single manufacturer.

C. All components shall be factory tested and documented to operate as a complete system

D. Manufacturer's Representative: The manufacturer authorized representative shall be factory trained and certified personnel providing service, startup, and quality control field labor for the project from their local office.

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location.
2. Indicate locations, dimensions, and profiles of wall and floor reinforcements.
3. Indicate locations and installation details of built-in anchors.

D. Field test reports, indicating and interpreting test results relative to compliance with specified requirements, for information.

E. Sample Warranty- warranty information for each piece of equipment and contractors general warranty.

F. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.
b. Provide approved submittal as part of O&M clearly identifying manufacturer and provided model number.
c. Manufacturer's printed operating instructions.
d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.
e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.
f. Include vendor contact information for service and warranty
g. Include all testing reports

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Drawn to scale, and coordinated with door openings.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Seals: One set(s) for each size unit.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Doorway Spill Barrier to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

B. Warranty: For Doorway Spill Barrier specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.8 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

PART 2 – PRODUCTS

2.1 AUTOMATIC CLOSING DOORWAY SPILL BARRIERS

A. Doors S110-1, M115-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Model R14-0312; Denios Inc.

a. Sealed width: 40 inches.
b. Overall dimensions: 48 inches wide by 28 inches deep by 37 inches high.
c. Barrier height; 12 inches of liquid retention behind the closed barrier.
d. Construction: Galvanized steel, HRS.
e. Seals: PTFE encapsulated seals, temperature resistant and inert to most chemicals.
f. Load capacity: 3.25 tons per wheel = 6.5 tons.
g. Safety procedures: Surface / Cover Plate provided with anti-skid diamond plate.

B. Door M115-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Model R14-0612; Denios Inc.

a. Sealed width: 76 inches.
b. Overall dimensions: 96 inches wide by 22 inches deep by 37 inches high.
c. Barrier height; 12 inches of liquid retention behind the closed barrier.
d. Construction: AISI 304 stainless steel.

e. Finish: natural, mat finish stainless steel, glass beaded blasted to provide uniform scratch free surface.
f. Seals: PTFE encapsulated seals, temperature resistant and inert to most chemicals.
g. Sump Depth: 6 inches.
h. Load capacity: 3.25 tons per wheel = 6.5 tons.
i. Safety procedures:

1) Surface / Cover Plate provided with anti-skid diamond plate.
2) Vertical piers on either side of opening provided with yellow and black diagonal visual warning stripes.

C. Door M115-3:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Model R14-1212; Denios Inc.

a. Sealed width: 148 inches.
b. Overall dimensions: 168 inches wide by 22 inches deep by 37 inches high.
c. Barrier height; 12 inches of liquid retention behind the closed barrier.
d. Construction: AISI 304 stainless steel.
e. Finish: natural, mat finish stainless steel, glass beaded blasted to provide uniform scratch free surface.
f. Seals: PTFE encapsulated seals, temperature resistant and inert to most chemicals.
g. Sump Depth: 6 inches.
h. Load capacity: 3.25 tons per wheel = 6.5 tons.
i. Safety procedures:

1) Surface / Cover Plate provided with anti-skid diamond plate.
2) Vertical piers on either side of opening provided with yellow and black diagonal visual warning stripes.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely as per manufacturers written instructions, to prevent damage resulting from inadequate fastening.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, check operation of the equipment and components for operation and performance as specified and examine the finish for damage. Provide report in writing that the installation meets the requirements and shall include information concerning minor adjustments and minor repairs, which may be required before final acceptance by the Owner.

2. Test and adjust controls. Replace damaged and malfunctioning controls and equipment

B. Prepare test and inspection reports

3.4 CLEANUP

A. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

B. Clean area around equipment installation and remove packing or installation debris from job site.

3.5 TRAINING

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

END OF SECTION 103000

SECTION 115100 - SHOP EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.2 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. BUFFER/GRINDER, 8 INCH, WITH DUST COLLECTOR
   Equipment Mark Number: 2080
   Submittal requirements: PD, OM

2. CAGE, INFLATION, TIRE
   Equipment Mark Number: 2110
   Submittal requirements: PD

3. CHARGER, BATTERY, FIXED
   Equipment Mark Number: 2130
   Submittal requirements: PD, OM

4. DRILL PRESS, VARIABLE SPEED, 18 INCH
   Equipment Mark Number: 2210
   Submittal requirements: PD , OM

5. ABRASIVE BLASTING CABINET
   Equipment Mark Number: 2270
   Submittal requirements: PD, OM

6. BUS TIRE MOUNTER/DEMOUNTER
   Equipment Mark Number: 2450
   Submittal requirements: PD, OM

7. PARATRANSIT TIRE MOUNTER/DEMOUNTER
   Equipment Mark Number: 2451
   Submittal requirements: PD, OM

8. PRESS, ELECTRIC/HYDRAULIC, 80 TON
   Equipment Mark Number: 2535
   Submittal requirements: PD, OM

9. REFRIGERANT RECLAMATION SYSTEM, PORTABLE, R-12/22/134
   Equipment Mark Number: 2640
   Submittal requirements: PD, OM

10. METAL HAND BREAK
    Equipment Mark Number: 2670
    Submittal requirements: PD, OM

11. METAL SHEAR
    Equipment Mark Number: 2671
    Submittal requirements: PD, OM

12. PORTABLE BRAKE LATHE
    Equipment Mark Number: 2674
    Submittal requirements: PD, OM

13. BUS BRAKE LATHE
    Equipment Mark Number: 2675
    Submittal requirements: PD, OM

14. LATHE
    Equipment Mark Number: 2680
    Submittal requirements: PD, OM

15. SAW, BAND
    Equipment Mark Number: 2690
    Submittal requirements: PD, OM

16. ABRASIVE METAL MITRE SAW
    Equipment Mark Number: 2714
    Submittal requirements: PD, OM

17. VISE
    Equipment Mark Number: 2832
    Submittal requirements: PD

18. WELDER, MIG
    Equipment Mark Number: 2900
    Submittal requirements: PD, OM

19. OXYACETYLENE TORCH
    Equipment Mark Number: 2920
    Submittal requirements: PD, OM

20. PLASMA CUTTER
    Equipment Mark Number: 2925
    Submittal requirements: PD, OM

21. WELDER, TIG
    Equipment Mark Number: 2935
    Submittal requirements: PD, OM

22. FLOOR SCRUBBER
Equipment Mark Number: 3357
Submittal requirements: PD, OM

23. TANK, PARTS CLEANING
Equipment Mark Number: 3560
Submittal requirements: PD, OM

24. PORTABLE VACUUM SYSTEM
Equipment Mark Number: 3624
Submittal requirements: PD, OM

25. WASHER, PARTS, SMALL
Equipment Mark Number: 3785
Submittal requirements: PD, OM

26. WHEEL BALANCER, ELECTRONIC, BUS
Equipment Mark Number: 4912
Submittal requirements: PD, OM

27. WHEEL BALANCER, ELECTRONIC, PARATRANSIT
Equipment Mark Number: 4913
Submittal requirements: PD, OM

28. CART, BATTERY LIFT
Equipment Mark Number: 5015
Submittal requirements: PD

29. WHEEL DOLLY
Equipment Mark Number: 5312
Submittal requirements: PD, OM

30. JACK STAND-TALL
Equipment Mark Number: 5313
Submittal requirements: PD

31. JACK STAND- SHORT
Equipment Mark Number: 5314
Submittal requirements: PD

32. ALIGNMENT MACHINE
Equipment Mark Number: 5705
Submittal requirements: PD, OM, SD, T

33. ALIGNMENT CONTROLLER
Equipment Mark Number: 5706
Submittal requirements: PD, OM, SD, T

34. BOOTH, PAINT, OPEN FACED
Equipment Mark Number: 6108
Submittal requirements: PD, OM, SD, T

35. PERSONNEL FALL PROTECTION
Equipment Mark Number 6235
Submittal requirements: PD, OM, SD, T

36. SHAKER, PAINT
Equipment Mark Number: 6670
Submittal requirements: PD, OM

37. DRAIN PAN, PORTABLE, USED OIL
Equipment Mark Number: 8165
Submittal requirements: PD, OM

38. DRAIN PAN, PORTABLE, USED COOLANT
Equipment Mark Number: 8166
Submittal requirements: PD, OM

39. OIL FILTER PRESS
Equipment Mark Number: 8492
Submittal requirements: PD, OM

40. FILTER, ELCTROSTATIC, PORTABLE
Equipment Mark Number: 9350
Submittal requirements: PD, OM

41. SPILL KIT
Equipment Mark Number: 9985
Submittal requirements: PD

B. Provide roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

1. Coordinate and verify all electrical and utility connections with all trades prior to equipment ordering and purchase.

C. Piping, wiring, and switching between equipment and utilities.

1.3 QUALITY ASSURANCE

A. All components shall be factory tested and documented to operate as a complete system

B. Manufacturer's Representative: The manufacturer authorized representative shall be factory trained and certified personnel providing service, startup, and quality control field labor for the project from their local office.

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

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.

D. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

E. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS

B. Refer to above submittal requirements. The following abbreviations are used to indentify submittals required:

1. PD- Product Data

2. SD- Shop drawings

3. OM- Operation and Maintenance manual

4. T- Training of owners personnel on specific equipment items.

C. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical requirements, wiring diagrams, and provided accessories.

1. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

D. Shop drawings and schematics detailing fabrication, installation, piping layout, materials and finishes, system interconnections, and utility connections of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1.5 INFORMATION SUBMITTALS

A. Factory tests and inspection reports prior to shipping.

B. Field test and start-up reports, indicating and interpreting test results relative to compliance with specified requirements, for information.

C. Certificates: For certification required in "Quality Assurance" Article

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For the equipment identified to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

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. Belts: One set(s) for each belt-driven unit

2. Filters: one set for each unit containing a filter

1.8 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. All parts shall be readily available locally in the United States.

E. Any units or parts which prove defective during the warranty period will be replaced with OEM parts and transportation prepaid

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.10 LABELING

A. Nameplate: Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate with stamped figures showing manufacturer's name, address, model number, serial number and pertinent utility or operating data.

B. Lifting capacity shall be painted with letters and numbers 3 inches high Minimum on both sides of lifting mast assembly.

C. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant

PART 2 – PRODUCTS

2.1 BUFFER/GRINDER, 8 INCH, WITH DUST COLLECTOR
Equipment Mark Number: 2080

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Cincinnati Electrical Tool, Inc.

B. Capacities and Dimensions:

1. Buffer/grinder:

a. Motor: 3/4 HP, 3600 RPM.

b. Minimum Wheel dimensions:

1) Diameter: 8 inches.

2) Thickness: 1 inch.

3) Bore: 3/4 inch.

2. Dust collector:

a. Motor: 1/2 HP, 3,600 RPM.

C. Features and Construction:

1. Motors: Motors shall be totally enclosed, direct drive, and rated for continuous service, with permanently lubricated ball bearings.

2. Wheels: Unit shall be provided standard, with two grinding wheels; one coarse and one medium grit.

3. Wheel guards: Telescoping guards shall be adjustable for wheel wear, and provided with exhaust outlets, adjustable work rests, and spark breakers.

4. Dust collector with reusable filters: The collector shall be an integral part of the cabinet base, provided with front-opening doors for access to motor and filters, and removable dust drawer. Entire unit shall meet OSHA ventilation standards.

5. Conduits: Flexible dust collection conduits shall permit guard adjustment without disturbing connections.

6. Tool tray and water pot: Pot shall be mounted on grinder base between wheels.

7. Power cord: Unit shall be provided with connections for hookup to fused disconnect.

D. Controls: Pushbutton safety starter shall have ON/OFF pushbutton switch; motor thermal overload and under voltage protection. Switching and other electrical controls shall meet applicable National Electrical Code requirements.

E. Accessories:

1. Illuminated eyeshields installed with transformer, Cincinnati No. 000-131, one set of two each per grinder.

2. Magnetic starter, Cincinnati No. 000-532.

F. Utilities Available: 480 VAC, 3 phase, 1-1/4 HP.

G. Finish: Durable enamel in manufacturer's standard color.

2.2 CAGE, INFLATION, TIRE
Equipment Mark Number: 2110

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Branick Industries, Incorporated

B. Capacities and Dimensions:

1. Tire capacity: 12.00-24 inches (maximum 50 inch outside diameter).

C. Features and Construction: 5 bar all welded steel construction with high tensile 2-1/4” diameter steel tubing, base plate, and side plates.

D. Finish: Durable enamel in manufacturer's standard color.

2.3 CHARGER, BATTERY, FIXED
Equipment Mark Number: 2130

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Associated Equipment Corporation

B. Capacities and Dimensions:

1. DC output rating: 70 amps

2. Charging capacity: 1 to 15, 12 VDC batteries.

3. Clamp rating: 400 amps.

C. Features and Construction:

1. Battery Types: 12 Volt Flooded, AGM, and Gel Cell batteries- including Spiral Cell, Orbital, or Optima batteries.

2. Cabinet: Unit shall be enclosed in bonderized steel cabinet with reinforced frame and gasketed access panel.

3. Display: Analog meter and 3 LED display indicating charge status.

4. AC cord: 6’ 16 gauge-3

5. DC leads: 6.5’, 4 AWG

6. Electrical stability system technology

7. Program for deep discharge recovery of flooded batteries.

8. Diagnostic capability to indicate weak or defective batteries.

D. Accessories: Bus bar set with fiberglass backboard assembly shall be complete with connecting cables, insulated clamp storage bar, and 10 pair of 10 gauge, 300 amp rated charging leads, 36 inches long premounted at bus bar end with vinyl insulated safety clamps on other end Provide with three foot 4 AWG cables to connect to charger or additional bus bars. Associated No. 6075, quantity two of four each.

E. Utilities Available: 120 VAC, 1 phase,.

F. Finish: Durable enamel in manufacturer's standard color.

2.4 DRILL PRESS, VARIABLE SPEED,
Equipment Mark Number: 2210

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Clausing Industrial or approved equal

B. Capacities and Dimensions:

1. Motor: 1-1/2 HP, 1,725 RPM.

2. Working dimensions:

a. Drill to center of circle: 20 inch diameter.

b. Table travel: 20 inches.

c. Spindle to table, maximum: 33.125 inches

d. Spindle to base, maximum: 43.375 inches

3. Minimum table working surface, ground:

a. Width: 22 inches.

b. Depth: 19.5 inches

4. Table travel- 20 inches

5. Column dimensions

a. Ground steel, 4” diameter, 3/8 inch thick wall

6. Quill, ground steel:

a. Minimum Stroke: 0 to 6.5 inches.

b. Minimum Diameter: 2-1/2 inches.

7. Spindle: No. 3Mt

8. Speeds: 300 to 2,000 RPM.

9. Chuck capacity: 5/8”

C. Features and Construction:

1. Speed control: Speed control shall be operable while machine is running and shall hold speed setting constant under all rated load conditions.

2. Bearings: Spindle assembly shall be supported by not fewer than eight permanently lubricated ball bearings.

3. Work table: Parallel T-slots for clamping and a removable center insert for through table drilling.

a. Capacity- Two 15.5” long, for .5 inch T-bolt.

4. Table lock: Expanding bushing table lock shall be provided for rigid positioning of table at any angle.

5. Floor base: Two full-length T-slots shall permit insertion of T-bolts from front and rear.

a. Capacity- Two 13” long, for .5 inch T-bolt

6. Micro- Adjustable Depth Stops and independent Depth Scale allows the user to zero scale the set up for repetitive drilling, quickly and easily.

7. Flexible light to illuminate the work surface.

8. Safety features:

a. Chuck key: Unit shall include self-ejecting chuck key.

b. Guard: Steel clip on guard shall completely enclose drive.

9. Spindle: No. 3 Morse Taper shall accept accessory Jacobs type chuck for use with standard bits.

10. Motor: Unit shall be totally enclosed, fan cooled.

11. Depth control: Self-locking adjustment depth stop shall be provided for feed.

12. Table adjustment: Hand gear crank shall permit table elevation.

13. Power cord: Provided a minimum 6-foot power cord and plug compatible with facility's receptacles.

D. Controls: 24 volt pushbutton control station with shrouded START button and protruding STOP button, magnetic starter with transformer and no voltage/low voltage and three leg overload protection. Switches and other electrical controls shall meet applicable National Electrical Code requirements.

E. Accessories: Drill Chuck

F. Utilities Available: 208 VAC, 3 phase.

G. Finish: Durable enamel in manufacturer's standard color

2.5 ABRASIVE BLASTING CABINET
Equipment Mark Number: 2270

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by TP Tools and Equipment

B. Capacities and Dimensions:

1. Motor: 7 Amp vacuum motor

2. Minimum working Dimensions:

a. Width: 46 inches

b. Depth: 28 inches

c. Height: 28 inches

C. Features and Construction:

1. Cabinet: 20 gauge steel
2. Door: Right-hand side-loading 11 gauge steel with angle iron frame work.
3. Lens: 12”x33” side tempered glass lens and frame with inner lens protector.
4. Lights: two 120 watt, 115 V adjustable flood lamps
5. Vacuum: 7 amp Vac-40 vacuum to remove dust
6. Nozzles: 1 steel and 2 ceramic nozzles.
7. Gloves: 28”L double-strength cabinet gloves
8. 50 pounds fast-cutting Skat Magic Abrasive
9. Automatic abrasive recycling system.
10. Expanded metal screen to hold objects up to 200 pounds
11. Quick change trap door for fast abrasive changes.
12. Power cord: Unit shall be provided with a minimum 6-foot power cord and plug compatible with facility's receptacles.

D. Controls:

1. C-25 foot-pedal-operated power gun and foot pedal with 7 ft of air hose.

E. Accessories:

1. Provide 1 additional steel nozzles and 2 additional ceramic nozzles.
2. Provide 50 pounds additional fast-cutting Skat Magic Abrasive.
3. Provide 5 ft of vacuum hose.

F. Utilities Available:

1. Electrical: 120VAC, 1 phase
2. Air: 10-15 cfm @ 80 psi

G. Finish: Epoxy coated red

2.6 BUS TIRE MOUNTER/ DEMOUNTER
Equipment Mark Number: 2450

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hennessy Industries

B. Capacities and Dimensions:

1. Wheel capacity:

a. Width: Greater than 25 inches.

b. Max tire diameter: 76 inches

c. Rim Diameter range: 15 inches to 38 inches

C. Features and Construction:

1. Adaptability: Changer shall be capable of mounting and demounting tubeless tires for all 15 degree single piece highway truck rims demountable (Dayton), standard disc wheels, and reverse disc (Budd) wheels and shall also break beads for tube type tires.

2. Positioning: Pivoting work table shall permit operation at any angle.

3. Wheel clamping: 3 jaw chuck

4. Rotation: Mounting/demounting rotates in either direction at 6 RPM.

5. Bead breaking: Designed with pinch action to loosen both beads simultaneously.

6. Function controls: Two way foot pedal for bead loosening; PUSH/PULL control stick for table pivot; twist control stick for wheel clamping; dual two way foot pedals for mounting/demounting.

7. Table: Moving table centered in frame

8. Mount and demount: Independent hook and roller

9. Provide the following standard features:

a. Five foot pry bar
b. Lube bucket
c. Lube applicator
d. Earth mover bead loosener roller shaft
e. Tubeless tire iron
f. Lock ring iron
g. Drop center iron

h. Bead starting tool
i. Vise grip
j. Stud piloted budd wheel plate

10. Provide the following optional features
a. Portable ramp
b. Offset roller assembly for wider applications

11. Power supply: Connections for hookup to junction box.

D. Controls: ON/OFF switching and other electrical controls shall meet applicable National Electrical Code requirements.

E. Utilities Available:

1. Electrical: 208 VAC, 1 phase, 20 Amp.

F. Finish: Durable enamel in manufacturer's standard color.

2.7 PARATRASIT TIRE MOUNTER/DEMOUNTER
Equipment Mark Number: 2451

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hennessy Industries

B. Capacities and Dimensions:

1. Wheel capacity:

a. Rim width: 1 ½ inches to 19 inches

b. Tire Diameter: 38 inches max outside

c. Rim diameter: 10 inches to 17 ½ inches

C. Features and Construction:

1. Operation: single positioning bead loosening and changing

2. Mount/demount: Separate tool

3. Table shape: contoured

4. Wheel clamping method: Center cone

5. Bead sealing reservoir: 7.5 gallon tank

6. Inflation gauge : 60 psi

7. Air supply gauge: 0-300 psi

8. Standard Protectors: tool bar covers, mount and demount ends

9. Provide the following standard features:

   a. Lube applicator
   b. Lube bottle
   c. Bead lift tool
   d. Hose with air chuck
   e. Inflation safety limiter
   f. Filter lubricator

10. Provide the following optional features:
   a. Positioning pin extension
   b. 4 inch center post extension
   c. 8 inch center post extension
   d. Deep hub adaptor
   e. 5” small hold down cone

D. Controls:

1. Bead loosening: Foot-controlled tower

E. Utilities Available:

1. Air: 5 scfm @ 110 to 175 psi

F. Finish: Durable enamel in manufacturer's standard color

2.8 PRESS, ELECTRIC/HYDRAULIC, 80 TON
Equipment Mark Number: 2535

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Nugier Press Company, Inc.

B. Capacities and Dimensions:

1. Minimum capacity: 80 tons.

2. Minimum inside width: 48 inches.

3. Minimum width between table rails: 8 inches.

4. Table travel: 32 inches.

5. Maximum vertical clearance: 41 inches

6. Ram travel: 14 inches.

7. Approximate ram speed:

   a. Advance: 100 IPM.

   b. Return: 182 IPM.

8. Minimum ram diameter: 3-1/4 inches.

9. Minimum cylinder bore: 3-1/2 inches.

10. Minimum table spacing increments: 4 inches.

11. Minimum left to right cylinder movement: 34 inches.

12. Pump motor size: 7.5 HP.

C. Features and Construction:

1. Hydraulic pump and motor: The hydraulic pump, motor, and reservoir shall be contained in module located outside the press frame.

   a. Pump: The hydraulic pump shall be a high quality, constant flow, radial piston type without packing and shall be direct coupled to the drive motor.

   b. Motor: The pump drive motor shall be a 7.5 HP pump flange mounted motor with a 1.15 service duty rating, single acting.

2. Movable cylinder: The press head and cylinder (ram) shall be movable from side to side of the head rails. Quick acting 90 degree locking cams shall lock the head at desired location.

3. Table: The press table shall be vertically adjustable with a self-locking table winch and cable that is mounted outside of frame.

4. Construction: Press shall have all channel ends and corners cut and ground for safety.

   a. Frame uprights: The press frame uprights shall be fabricated of steel channels.

   b. Head and table rails: Head and table rails shall be fabricated of steel.

   c. Base members: Both press and pump module base members shall be fabricated of steel angle.

   d. Table locking pins: Press shall have a minimum of four locking pins.

5. Equipment protection: The press shall have a ram travel limit valve to prevent overextension of ram and a maximum capacity relief valve to prevent loading more than 110 percent of press capacity. An adjustable pressure relief valve shall also be provided to allow press operator to set maximum pressure at any point between zero and maximum capacity.

6. Power supply: Connections for hookup to junction box

7. Controls: Press controls shall be mounted on the pump module located outside the press frame so that the front of the press is clear.

   a. Hydraulic controls: There shall be two hand operated hydraulic valves.

   b. ON-OFF control: Pump motor shall be controlled by a pushbutton magnetic starter with overload protection.

   c. Gauge: A large, dial type pressure gauge shall be mounted on the outside of the press frame to isolate gauge from mechanical shock.

8. Standard accessories: Press shall include two flat parallels with "V" grooves, two "V" ram noses, and two flat ram noses as standard accessories.

D. Accessories: Round ram nose, Hypress No. FRN-80, one each.

E. Utilities Available: 480 VAC, 3 phase, 7.5 HP.

F. Finish: Durable enamel in manufacturer's standard color.

2.9 REFRIGERANT RECLAMATION SYSTEM, PORTABLE, R-12/22/134
Equipment Mark No. 2640

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Robinair

B. General Description: Combination portable recovery, recycling, evacuation, and recharging for R-12, R-134a, R-22, R-502, MP, and HP type refrigerant fluids.

C. Capacities and Dimensions:

1. Tanks: Two 50 pound tanks ..

2. Operating range: 50 to 105 F.

3. Recovery rate:

   a. Vapor: ½ pound per minute.

   b. Liquid: 1 pound per minute.

4. Sub-cooled refrigerant recirculation rate: 4 pounds per minute flow rate.

5. Pump free air displacement- 6 cfm

D. Features and Construction:

1. Float chamber: Unit shall posses a float chamber that automatically adjusts from liquid to vapor.

2. . Electronic scale- Helps recharge to factory specifications. Weighs recovered refrigerant and provides tank overfill protection.

3. Lockout panel: Unit shall include a lockout panel to prevent mixing of refrigerants. Rotates to one side for ¼ inch fittings and to the other for ½ inch ACME fittings

4. Recycling: Unit shall be capable of recycling, making an initial pass through the filter-drier. Additional recycling shall be programmable in case of compressor burnout or other conditions.

5. Filter-drier: Unit shall include a filter-drier capable of removing moisture and acid from the refrigerant..

6. Chill chambers- capable of sub-cooling refrigerant to 15 to 40 degrees F.

7. Liquid injection during vapor removal- pump a cylinder or system to atmosphere pressure without harm to the compressor.

8. .

9. Provide with casters

10. Provide with three sets of charging hoses- one for R-12, one for automotive R-134a (with field service couplers), and one for other refrigerants using ¼" SAE fittings.

11. Power cord: Unit shall be provided with a minimum 6-foot power cord and plug compatible with facility's receptacles.

E. Utilities Available: 120 VAC, 1 phase,

2.10 METAL HAND BREAK
Equipment Mark Number: 2670

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Roper Whitney Corporation.

B. Capacities and Dimensions

1. Capacity: 12 gauge mild steel

2. Maximum bending length: 97 inches

3. Maximum jaw opening: 1.75 inches

4. Minimum reverse bend: 3/8 inches

5. Minimum flange bend: 1 inch

6. Maximum bend angle (past horizontal): 45 degrees

C. Features and Construction
1. Hand brake to accommodate combination bending. In addition to straight bending, box and pan work, inside bending, radius bending and other intricate forming operations can be performed.

2. Provide with lower beam clamping

D. Controls:
1. Manually hand operated by the user

E. Finish
1. Durable enamel in manufacturer's standard color

2.11 SHEAR, METAL
Equipment Mark Number: 2671

A. Manufacturers
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Roper Whitney Corporation.

B. Capacities and Dimensions:

1. Maximum shearing length: 52"
2. Maximum back gauge range: 25"
3. Maximum front gauge range: 30"
4. Maximum slitting gauge range: 18"
5. Floor space, gauges in position: 91" x 78"
6. Max. rated capacity, mild steel: 16 Ga.
7. Weight: 1850 lbs
8. Overall Dimensions:
   a. Width: 91 inches
   b. Depth: 55 inches
   c. Height: 60 inches

C. Features and construction:

1. Heavy cast metal bed and frame. Shear frame shall incorporate gap-in-housing feature to

permit slitting sheets of any length by successive cuts up to 18 inches wide.

2. Safety features: Shear shall include shatterproof transparent finger guards, treadle stops, and well guards for safety.
3. Shearing: Triple action shearing shall include relief on both edges of both the fixed and moving blades.
4. Gauges: Front and back gauges shall be adjustable -with 1/16 inch engraved graduations. Shear shall have an adjustable side slitting gauge.
5. Hold downs: Shear shall be designed to automatically engage lever actuated holddown before shearing.
6. Treadle: Shearing operation shall be accomplished by foot operated treadle.

D. Finish: Durable enamel in manufacturer's standard color.

2.12 PORTABLE BRAKE LATHE
Equipment Mark Number: 2674

A. Manufacturers
   a. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hunter Engineering Company

B. Capacities and Dimensions
   1. Trolley range:
      a. High position: 32-45 inches
      b. Low position: 22-32 inches
   2. Rotor maximum:
      a. Diameter: 17.5 inches
      b. Width: 3.5 inches
   3. Feed distance: 5.75 inches
   4. Spindle speed: Adjustable and automatically variable: 0-120 rpm

C. Features and Construction
   1. Machine to provide bub-mounted service to eliminate the need to disassemble the hub to remove the rotor.
   2. Medium and heavy duty applications.
   3. Lathe to be provided with anti chatter technology to minimize machining problems by virtually eliminating chatter. The computerized system oscillates the speed of the lathe while machining the rotor to prevent the buildup of vibration.
   4. Computerized compensation adjusts for lateral runout to assist the technician with meeting OEM specifications.

5. Power cord: Unit shall be provided with a minimum 6-foot power cord and NEMA L6-20P plug compatible with facility's receptacles.

6. Lockable caster wheels allow the unit to be moved into place.

7. Unit to be provided with pivoting control module allowing operation in the upright position on either side of the vehicle.

D. Accessories
1. 22 mm socket wrench

2. Micro-runout insert kit

3. Right and and left hand tool holder

4. 6mm T-wrench

5. 8mm wrench

6. Shaft extension

7. Extended twin cutter tool assembly

8. Quckcomp adaptor kit

9. Provide one adaptor and lug nut kit for each type of rotor serviced by the client.

E. Controls: ON/OFF switching and other electrical controls shall meet applicable National Electrical Code requirements.

F. Utilities Available
1. Electrical: 208 VAC, 1 phase, 9 amp, 1.5 Hp

G. Finish
1. Durable enamel in manufacturer's standard color Finish

2.13 LATHE
Equipment Mark Number: 2680

A. Manufacturers
a. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Republic Lagun Machine Tool Company.

B. Minimum Capacities and Dimensions
1. Swing over bed: 14 inches

2. Swing over cross slide: 8-3/8inches

3. Distance between centers:40 inches

4. Spindle bore: 2.066 inches

5. Number of spindle speeds: Electronic Variable Speed

6. Range of spindle speeds: 2-2,500 rpm

7. Width of bed: 10-1/4 inches

8. Swing in gap: 23 inches

9. Tailstock

   a. Quill diameter- 2.5 inches

   b. Quill travel: 6-1/2 inches

C. Features and Construction

1. Purpose: lathe shall turn bus, truck, car, and small motor armatures

2. Construction: heavy cast steel

3. Tri-way design with three Vee ways.

4. Headstock with hardened ground gears.

5. Spindle nose- camlock type, DI-6

6. Removable gap block

7. Apron controlled lead screw/feed rod reverse

8. Full length foot brake

9. Full length rear splash guard

10. Safety clutch on feed shaft

11. Cross slide nut with backsplash eliminator

12. Inch/metric dual dials on cross slide; compound and tailstock

13. Graduated tailstock barrel with tang slot

14. Flood coolant system

15. Manual indexing square 4-position tool post

16. Rear mounted NEMA electrical enclosure, fully wired to motors, including low voltage to headstock mounted e-stop and RPM indicator.

17. Thread chasing dial

18. Leveling pads

D. Accessories
1. 8” 3-jaw chuck with threaded backplate, steel body

2. Heavy duty stand

3. Provide two steel centers, and two carbide tipped tool bit

4. Digital readout system, 2 axis 40” centers

5. Drill chuck ½” with arbor and ¾” with MT#4 shank

6. Live center

a. 5-piece thru-coolant tool post Square tool capacity- ¾”-1”

E. Controls: ON/OFF switching and other electrical controls shall meet applicable National Electrical Code requirements.

F. Utilities Available
1. Electrical: 208 VAC, 3 phase, 5 Hp

G. Finish
1. Durable enamel in manufacturer's standard color Finish

2.14 SAW, BAND
Equipment Mark Number: 2690

A. Manufacturers
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Wellsaw

B. Capacities and Dimensions:

1. Motor: 1/2 HP OPD.

2. Minimum horizontal cutting capacity:

a. Rectangular cut: 9-1/2 by 11 inches wide.

b. Round cut: 9-1/2 inches diameter.

c. 45 degree cut: 5-1/2 by 5-1/2 inches.

3. Minimum vertical cutting capacity:

a. Work table: 8 by 10 inches.

b. Throat: 9-1/2 inches high by 6-1/4 inches deep.

4. Blade speeds: 76, 141, and 268 feet per minute.

5. Minimum blade size: 1/2 by 93 inches.

6. Band Wheels: minimum 11” cast iron.

7. Minimum height to top of bed: 26 inches.

C. Features and Construction:

1. Conversion: Saw shall be capable of operation in either vertical or horizontal mode. Conversion from one mode to the other shall be accomplished by self-locking frame release latch and installing or removing vertical work table.

2. Blade support: Ball bearing blade guides shall be provided for full three-way blade support.

3. Drives: There shall be a three speed V-belt drive system from motor with gear and pinion drive to blade.

4. Blade speed change: A stepped pulley shall provide for blade speed change.

5. Frame feed: Frame feed downward motion shall be adjustable.

6. Coolant system: A submersible coolant pump and four gallon capacity reservoir shall be provided.

7. Vise: Manual screw/quick action- A dog and ratchet mechanism type vise with locating pins for modification to 45 degree cuts shall be provided.

8. Fabrication: Saw frame shall be constructed of welded angle steel with sheet steel panels.

9. Mobility:

   a. Retractable wheel assembly: Two rubber wheels shall be mounted on front legs of saw frame with foot actuated jacking lever.

   b. Pull Handle

10. Handle: A pull-out type handle shall automatically lock saw head in down position.

11. Adjustable stock stop

12. Replaceable pivot bar and bushing

13. OSHA blade guards

14. Power cord: A 6 foot, three wire power cord shall include a grounded plug.

15. Provide stock stand

D. Controls: ON/OFF switch shall be mounted in a control box, equipped with overload and low voltage protection.

E. Utilities Available: 120 VAC, 1/2 HP.

F. Finish: Durable enamel in manufacturer's standard color.

2.15 ABRASIVE METAL MITRE SAW
Equipment Mark Number: 2713

A. Manufacturers
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Kalamazoo Industries, Incorporated.

B. Capacities and Dimensions:

1. Motor Hp: 5 Hp

2. Minimum cutting capacities:

a. 2 ½” Solids

b. 3” pipe

c. 3.5” at 45 degrees

3. Blade diameter: 14 inches.

4. Arbor shaft: 1 inch. Sealed ball bearings.

5. Spindle RPM: 4400.

C. Features and Construction:

1. Miters either direction 45 degrees

2. Positive index holes and up/down stops

3. Heavy duty stand

a. 12 gauge plain steel top

4. Front table lock

5. Dual cam vises

D. Controls: Manual starter with integral ON/OFF switching, overload protection.

E. Accessories:

1. Abrasive wheel 14 inch diameter, 3/32 inch thickness, medium grit fiberglass reinforced

F. Utilities Available:

1. Electrical: 208 VAC, 3 phase, 5 hp.

2. Provide motor starter disconnect switch mounted to unit for single point connection.

G. Finish: Durable enamel in manufacturer's standard color.

2.16 VISE
Equipment Mark Number: 2832

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Reed Manufacturing Company.

B. Capacities and Dimensions:

1. Minimum jaw width: 5 inches.

2. Minimum jaw opening: 6 inches.

3. Minimum throat depth: 6-1/4 inches.

4. Minimum pipe capacity: 1/8 to 4-1/2 inches.

C. Features and Construction:

1. Slide bar: Machined steel slide bar with oil port shall operate in machined channel.

2. Base: 360 degree swivel base shall include locking device.

3. Construction: Semi-steel cast body shall include hardened tool steel nut and screw.

4. Jaws: Main and pipe jaw facings shall be replaceable.

5. Wear compensation: Adjustable collar shall eliminate handle slack.

D. Finish: Durable enamel in manufacturer's standard color.

2.17 WELDER, MIG
Equipment Mark Number: 2900

A. Manufacturers
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Miller Electric Manufacturing Company

B. Capacities and Dimensions:

1. Rated output:

a. 250 amps at 28 VDC, 40 percent duty cycle.

b. 200 amps at 28 VDC, 60 percent duty cycle.

2. Open circuit voltage, maximum: 38.

3. Amps input at rated output, single phase, 60 hertz:

a. 208 volts: 48.

b. KVA: 9.8.

c. KW: 7.5.

4. Amperage range: 30 to 300.

5. Wire feed speed: 50 to 700 IPM.

6. Wire type and diameter:

a. Solid steel: .023 to .045 inches.

b. Stainless: .023 to .045 inches.

c. Flux cored: .030 to .045 inches.

C. Features and Construction:

1. Operation: Welder shall be DC output device capable of performing MIG and Flux-Cored welding operations from 22-gauge to 1/2 inch thick in a single pass.

2. Wire feeder: Welder shall include a built-in wire feeder mounted in a compartment with hinged door to protect components. The drive system shall be aluminum dual gear and quick-change reversible drive rolls with a scaled tension knob.

3. MIG gun: Welder shall include a 15-foot, 250 amp, MIG gun with durable one-piece handle, one million cycle rated trigger and steel spring coils protecting cable ends.

4. Auto gun detect- Automatically detects and recall voltage, wire feed speed and timer of the active gun.

5. Dual front handles- split handle with rubber grips designed to move machine easily and allow work lead and MIG gun to be stored independently

6. Angled wire drive- industrial aluminum dual-gear drive system.

7. Extra drive rolls stored next to drive motor.

8. Flip-down compartment hold parameter chart and storage for consumables.

9. Fan-on demand cooling system only operates when needed.

10. Run-in control: Run-in control shall be adjustable and individually settable for both MIG and spool guns and located on the front panel, allowing the user to optimize starts to their application.

11. Voltage/speed meters: Meters shall be digital self-calibrating digital capable of presetting voltage and wire feed speed. Wire feed speed meter shall be capable of displaying feed speed rate of spool reels.

12. Work cable: Welder shall include a 10-foot work cable with clamp.

13. Housing: Welder components shall be enclosed in a heavy formed sheet metal housing with two 8 inch fixed polyolefin wheels, two four inch swivel front wheel, handle assembly, capable of mounting and securing two shielding gas cylinders at rear of unit. Cooling fan motor shall be a totally enclosed, permanently lubricated, sleeve bearing type. All controls shall be front-mounted for easy access and visibility.

14. Power cord: Welder shall be provided with a 10 foot power cord and NEMA 6-50R plug compatible with the facility's welding receptacles.

15. Spool gun for aluminum welding with 30 foot cable assembly, built-in gas valve, adjustable barrel assembly, 180 degree spool canister, gun handle wire speed adjustment and reversible drive roll. Model Spoolmatic 30A, No. 130 831, one each.

16. Dual cylinder rack for welder mounting of two shielding gas cylinders, Model No. 300 337, one each.

17. Regulator/flow gauge with hose for additional shielding gas cylinder, Model No. 195 050, one each.

18. One pack of ten contact tips, 0.035 inch, Model No. 000 068.

19. One pack of ten contact tips, 0.045 inch, Model No. 000 069.

20. One pack of two nozzle adapters, Model No. 169 729.

21. One pack of two contact tip adapter, Model No. 169 728.

22. One 5/8 inch diameter orifice nozzle, Model No. 169 726.

D. Controls: Controls shall be located on the front panel of welder and include built-in digital timers menu to preset voltage and Wire Speed Control. Standard run-in, pre/postflow, burnback, spot/delay (stitch) timer menu. Front panel to include Power Switch, Voltmeter and Wire Feed Speed Meter.

E. Utilities Available: 208 VAC, 1 phase, 48A.

F. Finish: Durable enamel in manufacturer's standard color.

2.18 WELDING CURTAIN
Equipment Mark Number: 2910

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Steiner Industries

B. Capacities and Dimensions

1. Minimum length: 20 feet

2. Minimum height: 7 feet

C. Features and Construction:

1. Curtain material: 13 oz flame retardant vinyl laminated polyester. Coordinate color with owner prior to ordering.

2. Installation method: wall mounted

3. 16 gauge galvanized steel track system with durable, smooth rolling nylon roller-hooks.

4. Metal chain to be sewn into bottom hem to reduce curtain movement in drafty areas.

5. Curtain section to incorporate hook and loop closures sewn along the vertical edges to provide seamless connections and easy access to enclosed spaces.

D. Accessories

1. Provide all required mounting hardware

2.19 PORTABLE WELDING CURTAIN
Equipment Mark Number: 2915

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Steiner Industries

B. Capacities and Dimensions

1. Maximum length: 4 feet

2. Maximum height: 5 feet

3. Three sections

C. Features and Construction:

1. Curtain material: 13 oz flame retardant vinyl laminated polyester. Coordinate color with owner prior to ordering.

2. Framing: Heavy duty 18 gauge steel 1 inch square tube frame, 1-1/8 inch tube corners and legs with quick snap connections.

3. 2 inch high locking caster wheels attached to platform leg to accommodate mobility.

4. Slip-fit construction

5. Any screen to be used horizontally or vertically

6. Provide with 24 inch study platform legs. Legs to be adjustable 90 degrees to prevent worker interference.

2.20 OXYACETYLENE TORCH
Equipment Mark Number: 2920

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by WCTA / Lincoln Electric Company.

B. Capacities and Dimensions:

1. Acetylene working pressure: 0 to 15 PSI.

2. Acetylene tank pressure: 0 to 200 PSI.

3. Oxygen working pressure: 0 to 80 PSI.

4. Oxygen tank pressure: 0 to 3,000 PSI.

5. Cuts up to 1” thick and welds up to 1/8”

6. Torch hose: Twin oxy acetylene 3/16-inch diameter by 240 inches long.

C. Features and Construction:

1. Materials: Regulator bodies, torch handles, and flow and pressure valves shall be brass and stainless steel construction.

2. Seals: Double "O" ring seals shall be used on all attachments to permit hand tighten of connections.

3. Welding specification: Ready to weld up to 1/4-inch material.

4. Cutting specification: Ready to cut up to 1/2-inch material.

5. Standard equipment:

a. Safety check valves:

1) Acetylene.

2) Oxygen.

b. Goggles.

c. Torch handle.

d. Cutting attachment.

e. Gas mixer.

f. 20 feet of double lined hose.

g. Flint torch lighter.

h. Regulators with gauges:

1) Acetylene.

2) Oxygen.

i. Spark lighter.

D. Accessories:

1. Welding tips: No.0 Part:1600840; No.2 Part:1600860; No.4 Part: 1600880.

2. Cutting tips: No.0 Part:1500830.

3. Heating tips: No.6 Part:1800710.

4. Soapstone holder: KH541, one each.

5. Soapstone: KH542, one set of ten each.

6. Lighter flints: KH571, one box of five single flints.

7. Tip cleaners: KH575, one case of 10 each.

8. Gas dual cylinder cart: Model No. K1702-1, one each.

2.21 PLASMA CUTTER
Equipment Mark Number: 2925

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Miller Electric Manufacturing Company.

B. Capacities and Dimensions:

1. Rated output: 60 amps at 140 VDC, 50 percent duty cycle (230V).

2. Open circuit voltage, maximum: 230 VDC.

3. Amps input at rated output, single phase, 60 hertz:

a. 208 volts: 47 amps

b. KVA: 9.9.

c. KW: 9.8.

4. Plasma Gas Flow/Pressure: 6.75 CFM at 90 PSI.

C. Features and Construction:

1. Operation: Welder shall be an air plasma device with a rated cutting capable of 7/8 inch mild/stainless steel and a maximum severe cutting capable of 1-1/4 inch mild/stainless steel.

2. Cutting torch: Welder shall include ICE-60T hand-held plasma-cutting torch with 50 foot cable, epoxy shield cup, cup mounted drag shield and quick-disconnect.

3. Line votage compensation- provides peak performance power under variable input voltage conditions (+-15%) for steady and cleaner ending cuts.

4. Fan on-demand cooling circuit: cooling system operates only when needed. Welder shall include a post flow circuit that calculates the length of postflow time to provide shielding gas after the torch trigger is released to extend the life ofconsumables and welding torch.

5. Pilot arc switch: Welder shall allow the operator to cut grates, chain link fence and other perforated metals automatically without re-triggering the gun.

6. Gas/air supply: Welder shall include a built-in automatic gas/air filter and regulator and a quick connect gas/air fitting.

7. Work cable: Welder shall include a 50-foot work cable with clamp.

8. Housing: Welder components shall be enclosed in a heavy formed sheet metal housing. Cooling fan motor shall be a totally enclosed, permanently lubricated, sleeve bearing type. All controls shall be front-mounted for easy access and visibility.

9. Power cord: Welder shall be provided with a minimum 10 foot power cord and NEMA 6-50R plug compatible with the facility's welding receptacles.

D. Controls: Controls shall be located on the front panel of welder and include Pilot Arc Switch, Gas/Air Pressure Gauge, Output Control, Trouble Lights (Pressure Light, Cup Light and Temperature Light), Ready Light, Power Light and Power Switch.

E. Accessories:

1. Plasma circle-cutting guides: Guide set for cutting straight lines or circles up to 12 inches in diameter, Model No. 195-981, one each.

2. Roller guide to assist operator in obtaining recommended standoff distances, to maximize cutting performance and improve tip life, Model No. 194-883, one each.

3. Running gear and cord warp, Model No. 300-511, one each.

4. Cart, model 300-511, one each.

F. Utilities Available: 208 VAC, 1 phase, 47A.

G. Finish: Durable enamel in manufacturer's standard color.

2.22 WELDER, TIG
Equipment Mark Number: 2935

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Miller Electric Manufacturing Company

B. Capacities and Dimensions:

1. Rated output:

a. 250 amps at 30 VAC, 40 percent duty cycle.

2. Open circuit voltage, maximum: 80 VDC.

3. Amps input at AC balance, rated load, single phase, 60 hertz (without Power Factor Correction):

a. 250 amps at 30 VAC, 40percent duty cycle.

1) 480 volts: 48.

2) KVA: 21.98.

3) KW: 11.76.

4. Welding amp range: 3 to 310.

C. Features and Construction:

1. Syncro start: Welder shall have a syncro start feature that allows the operator to choose three different starting conditions to optimize the application according to tungsten diameter and material thickness.

2. Integrated cooler: Welder shall include an integrated 3-gallon cooler with cool-on-demand that monitors coolant and temperature. A visual indicator ensures that the coolant is flowing. Cooler only runs when necessary to prevent torch damage by monitoring coolant flow and temperature. An external coolant filter stops foreign objects from entering the water cooled torch cable for better flow and longer life.

3. Squarewave output with AC balance control: Welder shall include squarewave output with AC balance control which features adjustable penetration and cleaning action while increasing arc stability on various aluminum alloys, and helps eliminate tungsten spitting and arc rectification.

4. Dual digital meters: Allow for quick and easy viewing of actual and preset values of amperage and voltage. Allows for greater accuracy and repeatability in the welding procedure.

5. Built-in cable hanger: Welder shall include a built-in cable hanger that conveniently folds out of power supply to allow all weld cables to be neatly stored to prevent torch or cable damage.

6. Built-in preflow and built-in postflow: Welder shall include a calculated built-in preflow that will protect the weld area prior to striking an arc and built-in postflow that will protect the weld area and tungsten when welding is complete.

7. Help message: Welder shall include help messages that provide assistance to the operator about output status for machine circuitry.

8. Last procedure recall: Welder shall feature last procedure recall that automatically recalls the last procedure set-up when switching polarity to simplify process changes.

9. Fan-on-demand: Welder shall feature fan-on-demand which improves power efficiency, reduces noise and maintenance by reducing the amount of airborne contaminants pulled through the machine.

10. Housing: Welder components shall be enclosed in a heavy formed sheet metal housing. All controls shall be front-mounted for easy access and visibility.

11. Running gear: Welder shall include a No. 37 Running gear which includes two 10 inch wheels, two 5 inch caster, two-compartment rack (for gas cylinders or coolant system), and handles.

12. Remote foot control: Welder shall include foot control with a larger base and a heavy 20-foot cord with 14-pin plug that can exit the front, back, or either side of the pedal that can provide remote current and contactor control.

13. Power cord: Welder shall be provided with a minimum 20 foot power cord and plug compatible with the facility's welding receptacles.

14. Low conductivity coolant: Solid in cases of four one gallon recyclable plastic bottles of coolants that contains a base of ethylene glycol and deionized water to protect against freezing to -37°F or boiling to 227°F. Miller No. 043 810, one each.

15. Water-cooled torch with torch accessories, including: torch with 23ft cable, cable cover, accessory kit, regulator/flowmeter, gas hose, torch adaptor, weld lead with clamp and dinse connector, shielding cups, and Collets and Collet Bodies at 1/16 inch, 3/32 inch, 1/8 inch increments.

16. Work lead with clamp, 15 feet.

17. Gas hose, 12 feet

18. Dinse 50mm connectors, two each.

D. Controls: Controls shall be located on the front panel of welder and include Voltmeter Display, Start Mode Control, Output Control, Amperage Control, Process Control, Balance/Dig Control, Postflow Time Control, Ammeter Display, Pulser Control, Background Amps Control, Pulse-Per-Second Control, Peak Time Control, Spot Time Control, Final Slope Control, Initial Time Control, Final Amperage Control, Initial Amperage Control, Amperage Adjustment Control, Power Switch, Output Selector Switch.

E. Accessories:

1. Remote contactor and current control: Side-to-side, rotary-motion, torch mounted, fingertip remote contactor and current control. Miller No. 151 086, one each.

2. Pulser module: Field kit for welding of thin materials. Provides a heating and cooling effect of the weld puddle to reduce heat input and control distortion of the material. Provides 0.25 to 10 pulses per second. Miller No. 195 344, one each.

3. Water-cooled torch kit- includes torch with 23ft cable, cable cover, accessory kit, regulator/flowmeter, gas hose, torch adaptor, and weld lead with clamp and dinse connector.

4. Sequencer module: Field kit that provides a starting current higher or lower than the welding current. Provides final slope and final current for trailing the weld. Provides a spot timer for the TIG spot application. Miller No. 195 345, one each.

F. Utilities Available: 480 VAC, 1 phase, 48A.

G. Finish: Durable enamel in manufacturer's standard color.

2.23 FLOOR SCRUBBER
Equipment Mark Number: 3357

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Tennant Company

B. Capacities and Dimensions:

1. Scrubbing paths: 36 inches

2. Forward speed: 0 to 3.1 MPH

3. Brushes:

a. Type: 36 inch cylindrical, two each

b. Motors: 3/4 hp, two each

c. Down pressure: 0 to 90 pounds

4. Solution tank: Minimum 30 gallons

5. Recovery tank: Minimum 40 gallons

6. Batteries: 6 volt, 335 AHC, six each

7. Minimum aisle turn: 67-1/2 inches, maximum

8. Maximum overall dimensions, nominal:

   a. Length: 63 inches

   b. Width (body): 28.25 inches

   c. Width (scrub head): 38.25 inches

   d. Height: 43 inches

9. Gradeability (full/empty): 6 degrees/8 degrees

10. Features and Construction:

    a. Construction: Frame shall be glass fiber reinforced and high impact resistant. Brush housing shall be 3/16 inch aluminum with the scrub head being impact resistant. Tanks shall be rotationally molded polyethylene.

    b. Operating system: The operators console shall be height adjustable and water resistant with an hour meter gauge and battery discharge indictor. Unit shall have power forward and reverse and brushes and water shall automatically shut off when the machine is stopped.

    c. Scrubbing system: Brushes shall be designed for use on rough textured floors and attached with a spring clip system requiring no tools for changes. Brushes shall pick up small debris commonly found on floors during scrub operation without operator adjustment. For easy serviceability, the scrub head shall be modular and removed with four pins and three disconnects, requiring no tools.

    d. Recycling system: Unit shall be equipped with a system that recycles the solution, which enables up to three hours of continuous runtime. Recovery and pick up systems that do not leave the floor virtually dry will not be accepted.

    e. Vacuum fan: The vacuum fan shall be a 14,000 rpm, dual 0.8 hp, two-stage, 73-inch water lift with stainless steel permanent lint filter and tangential discharge. Fan shall be at least 4 inches above the waterline with the recovery tank having a 10-gallon demisting system that causes air to change direction at least four times.

    f. Squeegee: The squeegee shall be of parabolic breakaway design. The squeegee assembly shall be a free floating swing type constructed of non-rusting stainless steel and aluminum with the squeegee capable of swinging to wrap around front wheels to allow all water to be picked up

on 180 degree turns. No tools shall be required on either the front or rear squeegee for change outs.

g. Propelling system: The transaxle shall be completely sealed, maintenance free gear-type with two pneumatic, foam filled, non-marking, 4.1 x 3.5 x 6 inch tires and two 5 inch neoprene, non-marking casters.

h. Battery charger: 30 amp with automatic shut off.

i. Power cord: provide with a minimum 6 foot power cord and plug compatible with the facility's welding receptacles

11. Utilities Available: 120 VAC, 30 A

12. Finish: Durable enamel in manufacturer's standard color

2.24 TANK, PARTS CLEANING
Equipment Mark Number: 3560

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Better Engineering.

B. Capacities and Dimensions:

1. Pump motor: 5 HP.

2. Minimum pump output: 100 GPM/50 PSI

3. Turntable diameter: Minimum 37 inches

4. Work height: Minimum 48 inches

5. Load height capacity: Minimum 28 inches

6. Fluid capacity: Minimum 110 gallons.

7. Weight capacity: Minimum 1500 lbs

8. Heat: 18kW

C. Features and Construction:

1. Non solvent based.

2. .

3. Vertical (seal-less) pump- No bearings or seal below the solution level. .

4. TEFC pump motor with extended shafts that connect directly to the pump impellers (no couplings).

5. Automatic water level controls: Unit shall have electronic solution control that monitors and maintains solution levels. Monitor shall terminate power to unit when fluid level is not at correct operational height .

6. Jam-free turntable drive system.

7. Oil skimmer.

8. Slide-out filter basket

9. Low water warning and shut-down

10. 12 hr heat timer and 30 min wash timer

11. Sealed cleaning chamber

12. Mid-swing cleaning manifold

13. Construction: Unit shall be constructed of 14 gauge and 16 gauge stainless steel.

14. Clean out: 2-inch NPT bottom drain plug and removable sludge trays shall be included.

15. Power supply: Hardwire with electrical disconnect .

D. Controls: Recessed switch with amber POWER ON light. Switching and other electrical controls shall meet applicable National Electrical Code requirements.

E. Accessories:

1. Automatic 7-day/24 hour timer

2. Steam exhaust

3. . Stainless steel bag filter. Provide three (3) initial start-up filters to determine which filter capacity best suites the washing needs and provide four (4) additional replacement filters after start-up has been complete.

4. Insulation

5. Brush and pump for hand cleaning

6. Automatic low water shut down and automatic water fill

7. Bag Filter installed between the pump and the spray manifolds

8. Hydro-air rinse gun for manual rinsing

9. Small parts basket with lid (12x6x6)

10. Small parts basket (15x9x6)

11. Removable center rod to stabilize part

12. Removable parts “tree” to hang small parts

F. Utilities:

1. Electric: 480 VAC,60 hz, 3 phase, 31 FLA

2. Water: 1/2 inch.

3. Drain: 2 inch NPT

G. Finish: Durable enamel in manufacturer's standard color.

H. Construction: Provide all stainless steel construction.

2.25 PORTABLE VACUUM SYSTEM
Equipment Mark Number: 3624

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Dynabrade.

B. Capacities and Dimensions:

1. Storage capacity: Minimum 9.9 gallons

2. Water pressure static lift: Minimum 90 inches

3. Sound level: Maximum 76 Decibels

C. Features and Construction

1. Number of vacuum outlets: 2

2. Number of pneumatic outlets: 2

3. Construction: stainless steel drum with plastic and metal components

4. Variable speed vacuum control

5. HEPA filtration (0.3 micron) with felt insert and paper bag.

6. Power cord: Provide with a minimum 26 foot power cord and plug compatible with the facility's welding receptacles

D. Controls: Variable speed vacuum control. Electronic thermal protection device prevents heat overload of motor.

E. Accessories:

1. x2- 1 1/4 inch I.D. x 20’ long light weight coaxial hose with built in 3/8 inch I.D air supply tubing.

2. Wall mount bracket

3. One disposable paper bag

F. Utilities:

1. Electric: 120 VAC,60 hz, 1 phase, 27 foot plug connection

2.26 WASHER, PARTS SMALL
Equipment Mark Number: 3785

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Zep equipment

B. Capacities and Dimensions:

1. Pump:

a. Pump output: Maximum 168 gph.

2. Minimum tank size

a. Width: 36”

b. Depth: 24”

c. Height: 28”

3. Reservoir capacity: 35 gallons.

4. Agitating capacity: 400 pounds

a. 10 cfm @ 100 psi to agitate

C. Features and Construction:

1. Cabinet: 10 gauge steel

2. Adjustable agitation speed up to 160 strokes per minute

3. Spring-loaded lid for easy opening and closing

4. Flow through brush with on-off control

5. Two particulate filtration systems, 100 micron and 50 micron

6. Visible filter bowls and change indicator signal when filters need to be changed

7. 165 degree F UL approved fire link. In the event of a fire the platform will lower and the lid closes automatically.

8. Connection for filter bag

9. Power supply: Provide 115 volt 10’ grounded power cord.

D. Accessories:

1. Provide Dyna 170 solvent based cleaner to fill unit.

2. Provide Dyna-trap filter bag

E. Utilities Available:

1. Electrical: 120 VAC, 1 phase, 1 amp

F. Finish: Baked-on epoxy powder coated.

2.27 WHEEL BALANCER, ELECTRONIC, BUS
Equipment Mark Number: 4912

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hennessy Industries

B. Capacities and Dimensions:

1. Motor:

a. 1.5 HP direct drive, forced air cooling, large housing for heat dissipation, and heavy duty class F insulation for high temperatures applications.

b. Rated for 850 RPM.

2. Rim diameter: 16 to 26 inches.

3. Rim width: 4-1/2 to 18 inches.

4. Maximum tire diameter: 46 inches

5. Wheel weight: 45 pounds minimum to 350 pounds maximum.

C. Features and Construction:

1. Cycle time: Cycle time shall be an average 31 seconds (200 lbs), start to finish. Average time for truck tires is 12 seconds.

2. Accuracy: Calibration accuracy shall be 1/2 ounce in truck mode.

3. Displays: LED display shall indicate weight and position for both planes of the wheel.

4. Guard hood: Hood shall be included as standard equipment with micro-switch interlock to prevent tire spinning unless guard hood is in position over wheel.

5. Start button: Unit shall be equipped with push ON to start spin balance and automatic stop.

6. Emergency stop: Emergency STOP button shall be mounted on front of base cabinet.

7. Power cord: Unit shall be provided with a minimum 6-foot power cord and plug compatible with facility's receptacles.

8. Bud wheel adaptor: Hennessy PN 143935, one each.

9. Truck hub centered cone set, model 109877.

10. Self calibration.

11. Single spin dynamic, static, and RV balancing modes.

12. Automatic hub nut loosening feature, a back/front cone mounting system, and a removable stub shaft.

13. Controls: LED digital display with keypad data entry and computerized control panel.

14. Standard accessories:

    a. 5/16 allen wrench

    b. Weight hammer

    c. 6401 threaded stud

    d. Accessory peg

    e. Hood springs

    f. Caliper

    g. Small cone

    h. Medium cone

    i. Large cone

    j. Truck cone

    k. Truck cone spacer

    l. Back cone spring

    m. Pressure drum

    n. Hubnut wrench, large

o. Bubnut wrench, small

p. Hubnut

D. Utilities Available: 208 VAC, 3 phase, .

E. Accessories:

1. Dayton wheel adaptor: (Hennessy PN 8110785) 20 to 22-1/2 inches, one each.

2. Wheel lift, model 0501.

3. Combi adapter for most truck wheels.

F. Finish: Durable enamel in manufacturer's standard color.

2.28 WHEEL BALANCER, ELECTRONIC, PARATRANSIT
Equipment Mark Number: 4913

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hennessy Industries

B. Capacities and Dimensions:

1. Motor:

a. 1.5 HP direct drive, forced air cooling, large housing for heat dissipation, and heavy duty class F insulation for high temperatures applications.

b. Rated for 900 RPM.

2. Rim width: 2 to 19 inches.

3. Maximum tire diameter: 40 inches

4. Wheel weight: 45 pounds minimum to 150 pounds maximum.

C. Features and Construction:

1. Cycle time: 5 seconds average

2. Accuracy: Calibration accuracy shall be .01 ounces

3. Resolution shall be .01 ounces and 1.4 degrees

4. Provide up to 8 balance modes- static and dynamic modes, RV and four different alloy modes, plus match mount.

5. 16 bit microprocessor

6. Automatic distance parameter entry

7. Operator “A” and “B” features to accommodate two technicians using it at one time.

8. Ounce/gram selectable readings with roundoff

9. Automatic self calibration

10. Weight and adaptor storage.

11. Displays: LED display shall indicate weight and position for both planes of the wheel.

12. Guard hood: Hood shall be included as standard equipment with micro-switch interlock to prevent tire spinning unless guard hood is in position over wheel.

13. Start button: Unit shall be equipped with push ON to start spin balance and automatic stop.

14. Emergency stop: Emergency STOP button shall be mounted on front of base cabinet.

15. Power cord: Unit shall be provided with a minimum 6-foot power cord and plug compatible with facility's receptacles.

16. Controls: LED digital display with keypad data entry and computerized control panel.

17. Standard Accessories

    a. Graduated Cone Assortment (hardened, 3 piece)

    b. Large adapter (truck cone)

    c. Cone spring

    d. Hub nut

    e. No-mar ring

    f. Rim width calipers

    g. Wheel weight pliers

D. Utilities Available: 208 VAC, 3 phase.

E. Accessories:

1. Extra large truck cone kit

2. 3,4, and 5 lug universal adapters

3. Combi-adapter for bolt hole mounting

F. Finish: Durable enamel in manufacturer's standard color.

2.29 CART, BATTERY LIFT
Equipment Mark Number: 5015

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Global Industrial Equipment.

B. Capacities and Dimensions:

1. Load capacity: 750 pounds.

2. Lowered height: 5 3/4 inches.

3. Lift: 54 inches.

4. Minimum platform dimensions:

a. Width: 30 inches.

b. Depth: 22 inches.

C. Features and Construction:

1. Construction: Steel frame and braces shall be welded construction.

2. Table adjustments: Foot operated hydraulic pump shall raise and lower table 1-1/4 vertical inches with each stroke of the fold away foot pedal. Hydraulic pump shall have valve for selection of RAISE or LOWER mode.

3. Wheels: Rubber tread 8”x2” rear tires shall be mounted on metal wheels with roller ball bearing hubs. Front lower truck frame shall be equipped with two 3-1/2” casters for positioning of vehicle.

D. Finish: Durable enamel in manufacturer's standard color.

2.30 WHEEL DOLLY
Equipment Mark Number: 5312

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Stretil Koni.

B. Capacities and Dimensions:

1. Lifting capacity: Minimum 1000 pounds.

2. Extended height: Maximum 74 inches.

3. Lifting speed- maximum 78 inches per minute

4. .

C. Features and Construction:

1. Construction: Heavy steel welded construction.

2. Lifting forks to include rollers to allow for rotation of the wheel assembly

3. Powered by 12VDC battery

4. Fully hydraulic operation

5. Lifting forks to have the capacity to tily 10 degrees above and 4 degrees below horizontal.

6. Provide nylon rollers

7. provide with a nylon strap to secure the wheel assembly to the dolly.

8. Rear mounted swivel casters for tight turning radius

D. Finish: Durable enamel in manufacturer's standard color.

2.31 JACK STAND- TALL
Equipment Mark Number: 5313

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by SEFAC

B. Capacities and Dimensions:

1. Height adjustment: 53 inches to 80 inches

2. Capacity: Minimum 36,000 pounds.

3. 8 positions- 21 inch

4. Fine adjustments- 6 inches

C. Features and Construction:

1. Construction: Heavy steel welded construction.

2. Tri pod stand with 2 fixed wheels for portability.

3. Spring assisted support adjustment

4. 6 inches of threaded adjustment for flexible height adjustment

5. 7-1/2 inch diameter head for safe and secure engagement with the vehicle

6. 2-1/2 inch incremental pin adjustment

D. Finish: Durable enamel in manufacturer's standard color.

2.32 JACK STAND- SMALL
Equipment Mark Number: 5314|

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by SEFAC

B. Capacities and Dimensions:

1. Height adjustment: 26-1/2 inches to 44 inches

2. Capacity: Minimum 36,000 pounds.

3. 7 positions at 2-1/2 inch centers

4. Fine adjustments- 4 inches

C. Features and Construction:

1. Construction: Heavy steel welded construction.

2. Tri pod stand with 2 fixed wheels for portability.

3. 4 inches of threaded adjustment for flexible height adjustment

4. 7-1/2 inch diameter head for safe and secure engagement with the vehicle

5. 2-1/2 inch incremental pin adjustment

D. Finish: Durable enamel in manufacturer's standard color.

2.33 ALIGNMENT MACHINE
Equipment Mark Number: 5705

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hunter Engineering Company.

B. Capacities and Dimensions:

1. Minimum axle capacity: 18,000 lbs front axle rating.

2. Full 58” pit depth.

3. Pit Size: 18’-0” long x 15’-0” Wide x 58”Deep.

4. T-Extension : 22’3” long x 2’-10” wide x 58” deep

5. Radius gauge load capacity, each: 9,000 lbs (18000 lbs per pair.)

6. Runway length, nominal: end of pit to center of radius gauge 61.50 inches.

7. Runway width: 18 inches.

8. Adjustable tread width range: 52 inches to 102 inches (min.- max center line.)

9. Runway and Pedestal Width Adjustment: 34” to 120”, cable operated.

C. Features and Construction

1. T-extension with full length rail support system and HD pit jack to provide both front and rear axle lifting. Rail support to extend full length of t-pit and into alignment pit to accommodate front axle lifting.

2. Removable heavy-duty runways.

3. Two (2) sets of stairs, one on either side.

4. Two (2) Wheel Stops.

5. Complete with all anchors and installation hardware.

6. Material: Steel construction

D. Accessories:

1. . Heavy duty auto-locking electronic truck turnplates to input angle measurements directly into alignment controller software with built-in turnplate bridges for rolling compensation- Part No. 20-2875-1.

2. Provide extra rail kit as required.

3. Provide HD pit jack

   a. Air powered and hydraulically driven

   b. Cylinders to be individually adjusted from side to side

   c. Choice to use both cylinders or just one cylinder for center point lifting

   d. Capacity rating of 17,500 pounds per cylinder or 32,500 pounds total

   e. Provide with built in storage area for accessories.

E. Finish: Powder coated for maximum protection and appearance in Manufacturers standard color.

2.34 ALIGNMENT CONTROLLER
Equipment Mark Number: 5706

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Hunter Engineering Company

B. Features and Construction:

1. Standard PC Hardware/Software

2. Personal Computer.

a. Processor: 3.06 GHz Intel Core i3 (or greater)

b. Memory: 5 GB Sata hard drive (or greater)

c. Monitor class: 24” Widescreen LCD

d. Wireless Network Module

e. Operating system: Windows 7

f. DVD-RW/CD-RW Drive

g. Power cord: Unit shall be provided with a minimum 6-foot power cord and plug compatible with facility's receptacles

3. Standard Accessories:

a. Color Printer

b. Keyboard

c. Mouse

d. Wireless Remote Control

e. Steering Wheel Holder

f. Brake Pedal Depressor

4. Software:

a. WinAlign HD Alignment Software for Heavy-Duty Trucks

b. Vehicle Specification Database

c. Color measurement display- color coded camber, toe and thrust angle measurements after compensation.

5. Sensors:

a. . Four (4) Cordless Optical Sensors.: Part No. DSP740T. XF transmitter in each sensor sends data to the control console. Provide with rolling compensation, on-screen leveling, sensor locking mechanism, interrupted measurement retention, and light weight construction.

b. Rechargeable batteries power sensors for full day continuous operation. Provide docking stations to charge batteries between jobs

c. Self Centering Adaptors to fit wheels 15 to 28 inches. Provide with optional extensions to accommodate owners wheel diameters.

d. Tire Diameter Measuring Tool

e. Optical infrared emitter/CCD's read cross-toe, front-to-rear and wheelbase/trackwidth

f. Solid state digital inclination transducers measure caster. Camber, and SAI

6. . Icon Cordless Remote Indicator- Part No. 20-2882-1.

7. Adaptor (for Mounting sensor to hub center)- Part No. 175-284-1

8. Two (2) Rim Stud Extension Kits – Part No. 20-823-1

9. Two (2) Rim Stud Sleeve Kits – Part No. 20-1522-1

10. HD Frame Offset Measuring Tool – Part No. 221-646-1

11. Calibration Fixture: 221-625-1-T

12. Equipment Cover: Part No. 69-1025-2

C. Utilities Available:

1. Electrical: 120 VAC. 1 phase

2.35 BOOTH, PAINT, OPEN FACED
Equipment Mark Number: 6108

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Global Finishing Solutions.

B. General Description: Open face type paint booth for use in painting 8'x4' panels. Booth air shall be supplied through the use of a makeup unit. Air intake chamber shall supply the booth with the necessary airflow for painting operations. Clean air is introduced into the booth through an intake plenum at the end of the room, and is exhausted through a plenum at the rear of the booth. Air is pulled horizontally from the front of the room

through the working depth at an average velocity of approximately 125 fpm.. The intake plenum is designed with high efficiency intake filters to remove dust and dirt before it enters the paint booth. Air entering the room will be ducted directly from the intake air source (Heated AMU) into the booth intake plenum, bypassing potentially contaminated shop air. The booth is designed with the maximized filter quantity to assure efficient particulate filtration from the intake and exhaust filters. The air shall then be drawn from the exhaust chamber and exhausted from the system and facility by means of ductwork and plenums.

C. Paint booth to be UL listed. Provide in field inspection by certified inspector to provide required UL listing

D. Capacities and Dimensions:

1. Minimum interior clearances:

a. Width: 10 feet 0 inches.

b. Depth: 6 feet 0 inches.

c. Height: 8 feet 0 inches.

2. Maximum exterior dimensions:

a. Width: 10 feet 4 inches.

b. Depth: 9 feet 2 inches.

c. Height: 8 feet 2 inches

E. Airflow rate: 125 FPM average over cross sectional area of empty booth

F. Lighting fixtures:

a. Type: Fluorescent four tube NFPA and OSHA code approved, inside access, 265 mA, 32 watt, 120 VAC, Class I, Division II, ETL and ETL-C approved fixtures with T-8 ballast and clear tempered glass. Provide calculations confirming acceptable light levels.

b. Lights to listed for locations having deposits of readily combustible paint residue.

c. Instant start (starting temperatures at 0 degrees F)

d. Lamp holders to be twist in style

e. Front/inside access for easy lamp replacement and equipped with an interlock switch to disable painting operations when light access door is opened.

f. Lamps: 48 inch 85% color correct fluorescent tubes, four tube

G. Features and Construction:

1. Construction: Paint booth shall be constructed of minimum 18-gauge galvanized steel sheets and supported by structural I-beams at regular intervals for rigidity and integrity. Panels are to be pre-punched, companion flanged, bolted on six inch centers, and have exterior flanges to provide a smooth interior surface. Booth shall be mounted directly to the concrete slab.

2. Booth structural design to accommodate installation of booth as shown on drawings.

3. Intake/exhaust system: A fully filtered exhaust air system shall be adequate for specified airflow rate and static pressures, complete with exhaust fan, make-up air unit, and TEFC motor assembly. Provide exhaust stacks, ductwork, weather caps, roof curbs, automatic dampers, counter flashings, and hardware necessary for a complete and operable installation
   a. Industrial style exhaust filter chamber:

      1) Exhaust filters: Continuous filament glass fibers with open weave pattern. UL Class 2 approved. Provide adequate quantity to permit one complete filter change. Provide draft gauge for exhaust chamber to monitor filter restriction

   b. Solid back intake filter chamber

      1) Intake filters: Two-ply resilient polyester fibers with a better tackifier capable of extracting 100 percent of visible dust and removing 90 percent of micron particles. Internal welded steel frame with self-sealing gasket. Internal wire support and heat-sealed seams. Provide adequate quantity to permit one complete filter change. Provide draft gauge for intake chamber to monitor filter restriction.

H. Exhaust system:

1. Exhaust fan to be provided by booth manufacturer

2. Exhaust capacity: 10,000 CFM total at .6 inch water column static pressure.

3. Fan will be roof mounted

4. Tube axial- Continuously welded housing for an airtight seal and painted with a thermal setting polyester urethane coating (Permatector).

5. Propellers are to be non-sparking cast aluminum for consistent air velocity at higher static pressures.

6. Adjustable belt tensioning

7. Bearings- premium air handling quality, self-aligning, 400,000 hour life at maximum operating speed.

8. Totally enclosed belt guard

9. Provide motor starter disconnect switch

10. Provide 18” high roof curb with counter flashing to support fan

11. Provide 30” diameter spiral ductwork from the booth to the exhaust fan with connecting rings on both ends.

12. Provide 30” diameter spiral ductwork attached to fan discharge with access doors. Extend ductwork such that top of ventilator is 10 feet above the finished room. Provide required guy wire supports and anchor to provide required structural supports to withstand snow and wind loading.

13. Provide motorized insulated damper at the roof penetration. Damper to open when fan is energized and close when fan is de-energized. Damper to have a maximum leakage rate of 4 cfm per square foot at 1.0 inch water gauge and tested in accordance with AMCA 500D. Damper size to match roof opening. Actuator to be spring open power closed.

14. Provide automatic roof ventilator with relief dampers to prevent rain and snow intrusion. Provide required guy wire supports and anchor to provide required structural supports to withstand snow and wind loading.

15. Motor:

    a. 3 HP - 480/3 phase, 60 Hz

    b. TEFC high efficiency

    c. Motor out of airstream.

    d. Variable pitch drive sheave

    e. Heavy gauge steel frame, double sealed ball bearings mechanically locked on the shaft end, and bolt on motor base.

    f. 1.15 service factor

    g. UL recognized and CSA certified

16. Fan diameter: 30 inches

I. Heated air makeup system: Indirect gas fired type heated air makeup unit suitable for installation outside the building to provide tempered air as required for comfortable working conditions. Unit shall be factory assembled, flame tested, pre-wired for automatic operation, and complete as a packaged assembly with the booth.

1. Make-up air unit to be provided by booth manufacturer.

2. Volume capacity: 10,000 CFM total at 1.0” total external static pressure

3. H2 horizontal unit arrangement with down discharge

4. 100% replacement air make-up air unit to be provided by booth manufacturer

5. Heat output: 90 degree temperature rise, 1,215 MBTUH input, 7” min natural gas pressure, 14” max

6. Motor: Constant air volume 10 HP heavy duty ball bearing type.

    a. Open Drip Proof

    b. High Efficiency EPACT

    c. High temperature motor

    d. 480 volt/3 phase

    e. Motor and fan to be mounted on 1” deflection spring vibration isolators. Provide a flexible duct connection from the fan outlet to the units casing

    f. Class F insulation

7. ETL labeled

8. Horizontal arrangement

9. ABB ACH550 VFD NEMA 12

10. V-bank filter section with permanent filters

11. Casing:

    a. Double walled G-90 16 gauge cold rolled steel, painted, enamel

        1) Color selected by architect

    b. Roof panel shall be a minimum of 16 gauge cold rolled steel.

    c. Interlocked wall seam and roof panels

    d. Weatherproof construction

    e. Hinged double wall insulated access doors with continuous flush mount stainless steel hinges.

    f. Insulation- 1”, 1.5 lb density insulation adhered and mechanically fastened to casing.

    g. Welded steel frame

12. Gas burner and heat exchanger: The gas burner shall be indirect fired, push-through type, designed for natural gas, FM approved gas train, including modulating main gas proportioning valve, main and pilot gas regulators, and main gas automatic safety shut-off. Pilot assembly shall include flame rod and automatic spark ignition.

    a. Burner shall be a tubular in-shot fired design.

b. Burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold.

c. Each burner ignition module shall be pre-programmed with a ignition sequence comprised of a 1 minute pre-purge, 1 min inter-purge, 2 minute post-purge, 15 second ignition, 3 trials for ignition, and 60 min lockout.

d. Direct-sparking sequence shall last through the complete during of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

e. Burner shall be of stainless steel construction.

f. All furnaces shall be controlled by an electronic vernier-type fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit

g. Burner shall be modulating and have a minimum turn down ratio of 10:1 for natural gas

h. Each furnace heat exchanger shall be made entirely of type 409 stainless steel. he secondary heat exchanger surface shall be made of stainless steel. Heat exchanger is to incorporate primary surface drum and secondary surface tubes in a three pas design. Baffles are to be used to assure proper air distribution on the heat echanger at low air volumes. The primary surface is to be not less than 16 gauge the secondary tubes are to be no greater than 3” in diameter and no less than .055” wall thickness. The front and rear headers as well as the intermediate headers are to be a minimum of 16 gauge. The front and rear collector boxes shall be a minimum of 8" (20.3 cm) deep. The front and rear collector boxes shall overhang the drum and include an integral directional baffle to direct air to cover the entire box as well as the box to tube joint.

i. Each furnace shall include a blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.

j. Each Furnace shall include a power-vent assembly for exhausting flue gases with a type PSC type motor that is securely mounted with rubber vibration isolators and easily accessible/removable for service

k. Each Furnace shall be accessible from both sides of unit

l. Gas train components:

1) Modulating gas valve

2) On/off redundant gas valve

3) Burner

4) Main gas shut-off valve

5) Main gas regulator

6) Two solenoid valves

m. All gas manifold components shall be piped and wired at the factory.

13. Provide painted galvanized intake hood with a 1 inch mesh stainless steel intake birdscreen

14. Provide removable filter section:

a. Provide hinged access door

b. 2 inch pleated MERV 8 filter

c. Casing to match unit casing.

15. Provide galvanized steel insulated discharge air damper installed at the roof penetration with a power open spring close actuator with end switch. The motor-damper end switch will energize the starter circuit when the damper is in the full open position and returns to a closed position when the unit is shut down. Damper blades to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals to be flexible metal, compression type

16. Heater housing: Unit shall be enclosed in a completely galvanized sheet steel enclosure with reinforcing members, lifting lugs, burner access plate, and flame and pilot observation port.

17. Fans and drivers: Unit shall be equipped with dynamically and statically balanced in two planes centrifugal blower and motor assembly with V-belt drive.

a. Heavy duty solid steel shaft. Precision ground and polished.

b. Provide Forward curved double width double inlet centrifugal blower assembly constructed of G-90 galvanized steel.

c. Drives are to be mounted outside of the airstream.

d. Wheel blades shall be securely attached to the wheel inlet ring.

e. The wheel shall be firmly attached to the fan shaft with set screws and keys.

18. Bearings: Heavy duty, pre lubricated bearings with a minimum L50 life in excess of 200,000 hours. The shall be designed for and individually tested specifically for use in air handling operations.

19. Belts and drives: Belts shall be oil and heat resistant, non static, grip notch type. Drives shall be cast type, precision machined, double groove, keyed and securely attached to fan and motor shaft. Fan operating speed shall be factory set using adjustable pitch motor pulley.

20. Control panel: Unit shall be complete with an UL listed factory pre wired electrical NEMA 3R weather tight control panel/vestibule containing necessary disconnect switches, starter, relays, fuse blocks, and primary flame guard with alarm contacts, automatic pilot valve, electronic modulating control system and interlock system with booth exhaust air fan. Panel to be NEMA 3R rated weather tight construction mounted to exterior of unit. Provide with the following features and safety controls:

    a. 115 volt control transformer, fuses, terminal strip, and motor starter with overload protection. Fan/blower motor to be prewired to the motor starter.

    b. Flame relay: A manual reset of the burner shall be necessary in the event of shutdown due to flame failure.

    c. Audible alarm for flame failure mounted in remote panel

    d. Burner on/off duct thermostat

    e. Carbon dioxide detector in ductwork to disable unit on high level alarm

    f. Carbon monoxide detector in ductwork to disable unit on high level alarm

    g. Clogged filter switch with LED indicator light on the remote panel

    h. Exhaust fan interlock

    i. Low limit control thermostat, time and relay

    j. Magnehelic filter gauge

    k. Post purge timer and relay

    l. Pre-purge timer and relay

    m. Service receptacle

    n. Unit-mounted on/off toggle switch

    o. Main air-flow safety and combustion air proving switch.

    p. Burner and blower service switches.

    q. High gas pressure switch

    r. Low gas pressure switch

    s. Flame roll-out switch

t. Freeze-stat shall be provided with adjustable dials for time and temperature settings to shut down the main blower in case of burner failure

21. Unit mounted control panel to control make-up air unit, paint booth safety interlocks, and booth exhaust fan. Refer to control specification below.

22. Provide remote control panel within the paint room

    a. Summer-off-winter switch.

    b. Blower on light

    c. Burner on light

    d. Booth lights on

    e. Booth EF status lights

    f. Dirty Filter indication light

    g. Discharge temperature dial setpoint adjustment

23. Provide extended grease lines: Lubrication lines from blower bearings to common point on unit exterior.

24. Roof curb

    a. 24 inch high, 14 gauge structural steel, provided as a complete welded assembly. Provide 3” of insulation mechanically fastened to inside of curb. Provide cant strip and wood nailer. Secure unit to curb with stainless steel hardware per manufacturers requirements.

25. Electrical:

    a. The control circuit voltage shall be 24V

    b. Provide all required control transformers

    c. Unit to be completely factory wired for single point electrical connection in the field.

    d. All control wiring shall be installed within galvanized conduit.

    e. Wiring within the control enclosure shall be in accordance with the National Electrical Code and the local code

    f. Provide variable frequency drive within unit control cabinet to control the paint booth MAU and EF. VFD to be provided for balancing purposes only. Unit is constant volume.

g. Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation.

h. All factory-mounted controls shall be factory prewired to the unit control panel

i. Convenience outlet shall be provided on the control board with 120 Vac service.

26. Miscellaneous: Unit shall include filter section, dirty filter indicating system, , ducting, transitions, and other hardware and incidentals necessary for complete and operable installation.

27. Manufacturers

a. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Bananza

J. Controls: Provide a Pre-wired control panel with NEMA 3R UL listed enclosure mounted within the MAU control cabinet. Unit mounted control panel to control entire system including make-up air unit, paint booth safety interlocks, and booth exhaust fan.

1. All switching and controls shall meet applicable National Electrical Code requirements

2. UL industrial listing

3. MAU and EF to run at 100% OA during spraying operations. System to operate based on remote control panel selector switch:

a. Summer position

1) EF to be energized, MAU heating burner to be disabled and blower to be energized.

b. Off position

1) MAU and EF to be de-energized

c. Winter position

1) EF to be energized, MAU heating burner to modulate to maintain discharge temperature and blower to be energized

2) Discharge Temp Control: For building exhaust-air replacement to maintain a constant discharge temperature of supply air of 70 deg F (adj). The burner flame modulates to compensate for outdoor temperatures. Discharge temperature setpoint to be limited to a maximum of 110 deg F.

4. Provide ¾" 3- way solenoid valve to prevent spraying in booth when fans are off or light tube access door is opened per NFPA-33 requirements. Compressed air between valve and the spray equipment to be vented out when exhaust is shut off

5. Automatic safety shut-down system: Provide a safety shut down system with audible alarm that automatically turns off compressed air to spray booth paint gun supply line when paint accumulation in exhaust air filters reaches an adjustable preset load point and whenever exhaust fan stops running to prevent buildup of fumes to hazardous levels.

6. Dwyer Mark II Manometer (Required per NFPA-33 Fire Code to monitor paint over spray build up on exhaust filters) with automatic dirty filter shut down with alarm.

K. Utilities Available:

1. Electrical:

a. Single point connection to controller: 480 VAC, 3 phase. 30 amp breaker. Controller to power exhaust fan, heated make-up air unit, and lighting fixtures. Controller to be provided with all required transformers, relays, safety circuiting, control circuiting, programming, and contacts to make a complete and operable system.

2. Natural gas: 1,215,000 BTU/hour at 7 to 14 inches.

L. All power and control wiring and conduit between the booth control panel and the associated equipment is provided and installed by the booth manufacturer, this includes lights, make-up air unit, exhaust fan, solenoid valve, safety switches, manometer pressure switches, etc.

M. Booth manufacturer to provide required ductwork to and from booth attached to make-up air unit and exhaust fan.

N. Finish: Prepare interior galvanized surfaces as required, prime and paint with a semi-gloss white enamel finish. Exterior galvanized surfaces shall be left unfinished

2.36 PERSONNEL FALL PROTECTION UNIT
Equipment Mark Number 6235

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Rigid Lifelines

B. Capacities and Dimensions:

1. Pre-engineered track system:

a. Minimum capacity: 2200 pounds, nominal certified for two user.

b. Minimum length: 45'

c. Three support hangers located in the middle and maximum of 6’ from each end

d. Fall protection track to have a minimum yield strength of 50,000 psi

e. Minimum yield strength of truss structure supporting the fall protection track shall be 42,000 psi

2. Self-retracting lifeline:

a. Capacity: 310 pounds, maximum.

b. Maximum arresting force: 900 pounds

c. Working length: 11 feet.

d. Webbing width: 1 inch.

e. Weight: 2.8 pounds, nominal.

3. Full body harness:

a. Capacity: 310 pounds, maximum.

b. D-ring capacity: 5000 pounds, nominal.

c. Weight: 1.71 pounds, nominal.

C. Features and Construction:

1. Operation: Personnel fall protection shall come complete with self-retracting lifeline, pre-engineered track system, and full body harness.

2. The fall protection system shall be manufactured in an ISO 9001 facility. All welders shall be AWS certified welders. Manufacturing facility must also be an AWS certified welding facility with an AWS certified Quality Management System

3. The manufacturer shall be an experienced manufacturer of fall protection equipment with at least five years of experience manufacturing full fall protection systems

4. All components used in the fall protection system shall be fully tested and documented to be in compliance with both OSHA 1910.66 App C and ANSI Z359 V2.0.

5. The manufacturer of the fall protection system shall be a member in good standing with the International Society of Fall Protection [ISFP] and American Society of Safety Engineers [ASSE].

6. Pre-engineered truss track system:

a. Construction: A500B tube steel

b. Hangers to be provided and engineered by the track system manufacturer. Hangers to be designed to accommodate suspended installation including installation of kickers to prevent swaying.

c. All trusses to be fully welded to the track and top cord. Hangers and stops to be bolted to/through the track such that no welding is required for installation.

d. Utilizes rotating eye trolley with friction brakes that engage during fall to prevent worker from drifting

e. Track profile design to ensure wheel protection, accurate alignment with minimum friction, and minimum maintenance "self" cleaning profile. All fall protection tracks shall have full contact flange loading surfaces [flat] to decrease flange and wheel loads during a fall event.

f. End stop bumpers through bolted to the track

g. All components to be painted with yellow paint

7. Self-retracting lifeline: Self-retracting lifeline shall be constructed of 1 inch nylon webbing with a sewn in load indicator and transparent plastic casing for visual inspection of internal components. Lifeline shall allow user freedom of movement in all directions through the utilization of a 360 degree swivel. Life shall arrest falls immediately through the use of a cable locking speed sensing brake system and comply with OSHA 1926 and ANSI Z359.1 standards.

a. Construction: lightweight aluminum housing with stainless steel working components.

b. Provide with steel snap hook

c. 3,600 pound rated gate

8. Full body harness: Full body harness shall be designed with three points of adjustment and include a sliding back drop forged proof tested D-ring to provide shock absorption during falls, a sub-pelvic strap to provide greater support while arresting a fall, and parachute buckles to ensure 100 percent closure. Harness shall be multicolored for ease of donning and constructed of 1-3/4 inch nylon straps and include sewn-in load indicators to provide immediate visual inspection points. Harness shall comply with OSHA 1926 and meet ANSI Z359.1-1998 Standard.

D. Delegated design: Contractor is responsible for coordinating all fall restraint capacities and dimensions with owner safety personnel prior to ordering. Provide written approval and verification that system complies with owner safety standards , OSHA, and ANSI regulations.

2.37 PAINT GUN WASHER
Equipment Mark Number: 6650

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Astro Tool

B. Capacities and Dimensions:

1. Minimum 2.5 gallons cleaning fluid tank

C. Features and Construction:

1. Designed for use with waterborne and solvent based paints spray guns

2. Pump-less, pneumatically operated

3. One gun and one cup capacity

4. Used cleaning fluid to be easily disposed of via drain valve

5. Pre-assembled and ready for use

6. Equipped with auto stop timer, safety shut-off valve, and air regulator

7. Provide steel stand

8. Stainless steel lid with auto shut-off switch

D. Utilities Available:

1. Air: 1/4 inch NPT

E. Finish: Durable enamel in manufacturer's standard color.

2.38 SHAKER, PAINT
Equipment Mark Number: 6670

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Midwest Mixing, Incorporated.

B. Capacities and Dimensions:

1. Paint can capacity: Single one, two, and five gallon cans or one case of four, one gallon cans.

C. Features and Construction:

1. Can clamp: Threaded top clamp mechanism for sealing and locking cans to be shaken shall incorporate recessed bottom clamp to minimize slippage.

2. Bearings: Unit shall have permanently lubricated ball bearings and eccentric mechanism.

3. Drive: Mechanism shall be completely enclosed in a bolted sheet steel housing.

4. Motor: Explosion proof motor and 0-30 minute timer.

5. Frame: Heavy steel channel frame shall be drilled for floor, bench, or pedestal mounting.

   Can holder will rotate through 360 degrees and lock in any position for shaking operation.

6. Power cord: Unit shall be provided with a minimum 10-foot power cord and plug compatible with facility's receptacles

D. Utilities Available:

1. Electrical: 120 VAC, 1 phase, 1/3 Hp.

E. Finish: Durable enamel in manufacturer's standard color.

2.39 DRAIN PAN, PORTABLE, USED OIL
Equipment Mark Number: 8165

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Graco inc.

B. Capacities and Dimensions:

1. Minimum tank capacity: 25 gallons.

2. Drain bowl height adjustment, nominal: 45 inches to 69 inches.

3. Operating temperature: 30 degrees to 105 degrees

C. Features and Construction:

1. Construction: Polyethylene tank with used filter tray, tool holders, and sight gauge..

2. Two large wheels shall be fixed and the other two shall be swivel casters.

3. Drain bowl assembly: A vertically adjustable drain bowl assembly with lock screw and removable filter screen..

4. Hose site gauge: Permanent clear hose site gauge shows you when to stop filling.

D. Finish: Durable enamel in manufacturer's standard color.

2.40 DRAIN PAN, PORTABLE, USED COOLANT
Equipment Mark Number: 8166

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Graco inc

B. Capacities and Dimensions:

1. Minimum tank capacity: 25 gallons.

2. Drain bowl height adjustment, nominal: 45 inches to 69 inches.

3. Operating temperature: 30 degrees to 105 degrees

C. Features and Construction:

1. Construction: Polyethylene tank with used filter tray, tool holders, and sight gauge.

2. Two large wheels shall be fixed and the other two shall be swivel casters.

3. Drain bowl assembly: A vertically adjustable drain bowl assembly with lock screw and removable filter screen..

4. Hose site gauge: Permanent clear hose site gauge shows you when to stop filling.

D. Finish: Durable enamel in manufacturer's standard color.

2.41 OIL FILTER PRESS
Equipment Mark Number: 8492

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Gray Automotive Products Company.

B. Capacities and Dimensions:

1. Minimum crushing force: up to 22,000 pounds.

2. Cycle time: 20 seconds.

3. Filter crush: 80 percent.

4. Minimum chamber size:

a. Width: 8 inches.

b. Depth: 10 inches.

c. Height: 16-1/4 inches.

C. Features and Construction:

1. Filter Capacity: Unit must be capable of crushing one 8-inch diameter heavy-duty filter or 4 automobile filters.

2. Crusher: Crusher shall use air bag crushing technology for even pressure distribution in crushing chamber.

3. Safety interlock: Press shall be equipped with dual safety interlock to prevent operation when the door is open.

4. Air inlet regulator/filter: Unit must have factory supplied air regulator/filter with 3/8 inch NPT air inlet fitting.

5. Method for waste oil storage: Unit shall be able to accommodate a waste oil accumulation tank or reservoir and connect to it by means of 3/4 inch NPT drain outlet fitting.

6. Shut off: Unit shall automatically shut off after each cycle.

D. Accessories:

1. Round steel drum, 55 gallon, ribbed, with removable top cover, to be placed under the oil filter crusher for the purposes of capturing drained oil, one each.

2. Flexible clear hose, 24 inches long, securely attached to oil drain fitting at base of the oil filter crusher, allowing oil to drain directly from the crusher to the drum beneath, one each.

3. Steel mesh or grate, cut to fit securely over the 55 gallon drum opening and capable of supporting the weight of up to six large oil filters, completely full, with out bending or bowing.

4. Round steel drum, 55 gallon, ribbed, with removable top cover, to be placed next to the oil filter crusher for the purposes of depositing crushed oil filters, one each.

5. Drum dolly with 600 pound capacity and maximum height of 3-1/2 inches to be attached to steel drums, Hamilton product DM232 or equal, two each.

E. Utilities Available:

1. Air: 1/4 inch, 130 PSI, 44 CFM.

F. Finish: Durable powder coat in manufacturer's standard color. All completed components shall be acid dipped prior to power coating.

2.42 FILTER, ELECTROSTATIC
Equipment Mark Number: 9350

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Plymovent Corporation.

B. Capacities and Dimensions:

1. Airflow: 883 CFM, nominal.

2. Motor: 1 HP.

3. Maximum noise level: 70 dBa, maximum.

4. Coverage: Arc of 360 degrees with 10-foot radius.

C. Features and Construction:

1. Filter unit: Unit shall be constructed of steel and house filters, impeller, and a TEFC model 110 volt single phase fan motor with spark resistant fan. Unit shall be equipped with a top hinged access door for service and filter replacement with a filter protection shield below the air inlet to eliminate damage to the filter elements. Unit shall be equipped with four 4 inch swivel type lockable casters and a three-prong plug 16-foot power cord.

2. Filtration: Unit shall utilize a multi stage filtration system with the first stage being a washable 3/4 inch deep aluminum mesh pre filter, the second being an electrostatic ionizer with spring loaded stainless steel wires charged to 12,000 volts, and the third being a 176 square foot collection cell charged to 6000 volts with a filtering efficiency of 98 to 99 percent for particulates down to .000005 mm. The unit shall have the capability to house an active carbon filter to absorb unpleasant odors.

3. Extraction arm assembly: Extraction arm, Model# KUA-3-S shall be 6-1/4 inches in diameter, ball bearing collar mounted, and capable of tilting 110 degrees and rotating 360 degrees with a vertical reach of 10 feet and a horizontal circular reach of approximately 19 feet 6 inches in diameter. The arm shall have manual ratcheting and locking airflow damper included in the ring handle, five adjustable friction joints, three friction links, and constructed of black polyemide flex hose covering internal plated steel supports.

4. Filter monitoring system: Unit shall have a monitoring system to alert operator of inadequate filtration system performance. When this occurs, a yellow warning light and an audible alarm shall activate for 20 seconds. After this period, a red light shall activate and the filter fan shall be automatically disabled. The operator must then clean the collection and ionization cells before restarting the filter system.

D. Controls: ON/OFF power switch shall be located on the side panel below steering handle.

E. Accessories:

1. Hood mounted, 24 volt, 20 watt halogen lamp: Model No. HL-20/24-160 with cord and 115/24 volt transformer, one each.

2. Activated Carbon Filter: Model No. CF-002.

3. Replacement pre-filter: Model No. FF-3000, one each

4. Replacement Collection Cell: Model No. EC-3000

5. Replacement Ionizing Cell: Model No. IM-3000

F. Utilities Available: 120 VAC, 1 HP.

G. Finish: Powder coated in manufacturers standard color.

2.43 BAYNET
Equipment Mark Number: 9951

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by BayNet Safety Systems

B. General Description

1. Sliding net system to protect personnel from injury caused by accidental tripping, slipping, or walking into an open work pit

C. Capacity and Dimensions.

1. Baynet dimensions to accommodate the full length of the inspection pit.

2. Tensile Strength over 3 tons

D. Features and Construction

1. Polypropylene netting installed with aircraft cable and forged hardware.

2. Non- sag, easily retracted netting glides open and closed from either end of the bay.

3. Petroleum resistant

4. Provide all required hard ware, cable, netting, etc to completely cover the inspection pit and comply with OSHA regulations.

E. Construction

1. Polypropylene

2.44 SPILL KIT
Equipment Mark Number: 9985

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by New Pig.

B. General Description

1. Spill kit contains an assortment of products for absorbing only oil

C. Capacity and Dimensions

1. Absorbency: up to 39 gallons

D. Features and Construction:

1. Chemical and water resistant polyethylene 65-gallon overpack- treated with UV inhibitors

2. Easy-open, threaded lid

3. Absorbents are packed in protective baskets with a lid for long-term protection against UV degradation; lift out baskets provide easy, organized access to contents for quick spill response

4. Empty overpack can be used as a low-cost shipping container for used-absorbents

5. Booms/socks and pads to meet NFPA 99standards for static decay

6. Provide UV-resistant overpack spill kit cover to accommodate outdoor use

7. UN certified

8. Construction

a. Overpack: Polyethylene

b. Booms: Co-Poly outer skin and Polypropylene inner skin and filler

c. Polypropylene inner skin and filler

d. Mats: Polypropylene

9. Contents included:

a. x2- 5” x 10’ oil only booms

b. x9- 3” x 10’ oil only booms

c. x40 mat absorbents

d. x10- temporary disposal bags and ties

e. x6- tamperproof labels

f. x1- instruction manual

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to start-up inspect, test, and adjust components, assemblies, and equipment installations, including connections, check operation of the equipment and components for operation and performance as specified and examine the finish for damage. Provide report in writing that the installation meets the requirements and shall include information concerning minor adjustments and minor repairs, which may be required before final acceptance by the Owner.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment

B. Prepare test and inspection reports

C. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.4 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.5 TRAINING

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

B. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. BUFFER/GRINDER, 8 INCH, WITH DUST COLLECTOR
Equipment Mark Number: 2080
Hours Required: 1

2. ABRASIVE BLASTING CABINET
Equipment Mark Number: 2270
Hours Required: 1

3. BUS TIRE MOUNTER/DEMOUNTER
Equipment Mark Number: 2450
Hours Required: 1

4. PARATRANSIT TIRE MOUNTER/DEMOUNTER
Equipment Mark Number: 2451
Hours Required: 1

5. PRESS ELECTRIC/HYDRAULIC
Equipment Mark Number: 2535
Hours Required: 1

6. PORTABLE BRAKE LATHE
Equipment Mark Number: 2674
Hours Required: 1

7. LATHE
Equipment Mark Number: 2680
Hours Required: 1

8. SCRUBBER, FLOOR BATTERY, WALK BEHIND
   Equipment Mark Number: 3357
   Hours Required: 1

9. TANK, PARTS CLEANER
   Equipment Mark Number: 3560
   Hours Required: 1

10. WASHER, PARTS, SMALL
    Equipment Mark Number: 3785
    Hours Required: 1

11. WHEEL BALANCER, ELECTRONIC, BUS
    Equipment Mark Number: 4912
    Hours Required: 1

12. WHEEL BALANCER, ELECTRONIC, PARATRANSIT
    Equipment Mark Number: 4913
    Hours Required: 1

13. ALIGNMENT MACHINE
    Equipment Mark Number: 5705
    Hours Required: 1

14. OPEN FACED PAINT BOOTH
    Equipment Mark Number: 6108
    Hours Required: 4

15. PERSONNEL FALL PROTECTION UNIT
    Equipment Mark Number 6235
    Hours Required: 2

16. PRESS, OIL FILTER, PNEUMATIC
    Equipment Mark Number: 8492
    Hours Required: 1

17. FILTER, ELCTROSTATIC, PORTABLE
    Equipment Mark Number: 9350
    Hours required: 1

C. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

D. Provide a Windows compatible movie file format recording on DVD disk of the training session. The DVD training movie can be of a live session or a produced training video.

END OF SECTION 115100

SECTION 115213 - PROJECTION SCREENS

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. Wall Mounted Projection Screen/Markerboard.

1.3 DEFINITIONS

A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

B. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product.

C. Samples for Initial Selection: For finishes of surface-mounted screen frames.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Projection Screens to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 PROJECTION SCREENS

A. General: Manufacturer's standard components necessary for a complete installation.

B. Wall Mounted Projection Screen and Markerboard: Units designed and fabricated for surface mounting on wall . Screen frame fabricated from aluminum, 1 ½ inch wide x 7/8 inch deep. Screen surface to consist of write/ erase projection film permanently adhered to tempered hardboard to allow use of dry erase markers and interactive stylus. Projection surface to have a gain of 2.5 and a viewing half angle of 25 degrees. Provide aluminum tray at bottom of frame and manufacturers standard wall mounting bracket.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Da-Lite Screen Company; Idea Screen.

a. Size: 46 inches high x 73.5 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install projection screens with screen frames in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a screen with vertical edges plumb and viewing surface flat.

END OF SECTION 115213

SECTION 115400- FARE COLLECTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED SECTIONS

The General Provisions of the Contract, including General and Special Conditions, apply to the Work in this Section.

1.2 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. VAULT/RECEIVER, FAREBOX, MOBILE BIN
   Equipment Mark Number: 7800
   PD, OM, T

2. DATA COLLECTION AND REPORTING SYSTEM, FAREBOX
   Equipment Mark Number: 7820
   PD, SD, OM, T

B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Piping, wiring, and switching between equipment and utilities.

1.3 QUALITY ASSURANCE

A. Farebox Data collection Manufacturer shall provide the engineering, installation, calibration, wiring, conduit, hardware, software programming, and check-out necessary to for a complete and fully operational system..

B. All components shall be factory tested and documented to operate as a complete system

C. Manufacturer's Representative: The manufacturer authorized representative shall be factory trained and certified personnel providing service, startup, and quality control field labor for the project from their local office.

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

F. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS

B. Refer to above submittal requirements. The following abbreviations are used to indentify submittals required:

1. PD- Product Data

2. SD- Shop drawings

3. OM- Operation and Maintenance manual

4. T- Training of owners personnel on specific equipment items

C. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical requirements, wiring diagrams, and provided accessories.

1. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

D. Shop drawings and schematics detailing fabrication, installation, piping layout, materials and finishes, system interconnections, and utility connections of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection

1.5 INFORMATION SUBMITTALS

A. Factory tests and inspection reports prior to shipping.

B. Field test and start-up reports, indicating and interpreting test results relative to compliance with specified requirements, for information

C. Certificates: For certification required in "Quality Assurance" Article

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For the equipment identified to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.7 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. All parts shall be readily available locally in the United States.

E. Any units or parts which prove defective during the warranty period will be replaced with OEM parts and transportation prepaid.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.9 LABELING

A. Nameplate: Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate with stamped figures showing manufacturer's name, address, model number, serial number and pertinent utility or operating data.

B. Lifting capacity shall be painted with letters and numbers 3 inches high Minimum on both sides of lifting mast assembly.

C. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 – PRODUCTS

2.1 VAULT/RECEIVER, FAREBOX, MOBILE BIN
Equipment Mark Number: 7800

A. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by GFI Genfare.

B. General Description: The mobile vault shall be designed to be placed in the bus service area and consist of a cashbox receiver on top of a mobile bin housing and a separate mobile bin on wheels that fits inside the housing. Coins and bills will be transferred from cashboxes in a rapid, secure manner to a mobile vault where bills and coins are kept segregated. The vault shall feature an interlock system that protects collected revenues

from theft by requiring a secure sequence of events and conditions. In this sequence, the receiver accepts the locked cashbox and, if secure conditions are met, opens the cashbox while inside the receiver, empties the contents into a separate coin and bill compartments in the vault below and then closes and locks the cashbox.

C. Capacities and Dimensions:

1. Maximum overall dimensions:

a. Width: 38 inches.

b. Depth: 41 inches.

c. Height: 66 inches.

2. Maximum mobile bin dimensions:

a. Width: 30 inches.

b. Depth: 37 inches.

c. Height: 31 inches.

3. Storage capacity:

a. Coins: $ 12500.

b. Bills: $12500.

D. Features and Construction:

1. Environmental:

a. Ambient temperature: 0 degrees F to 120 degrees F

b. Surface heated by direct sunlight: +150 degrees F

c. Humidity range 5% to 90% RH

d. Precipitation: driving rain, exterior condensate and icing effects, wind gusts up to 50 mph.

e. Weather, oil, and diesel fuel resistant

2. Stand-alone structure, no additional supports or overhead enclosure required.

3. Vault: Vault shall be constructed of welded and ground 1/8 inch non-corroding plate steel. The front surface shall have been cleaned, prepared, and painted with weather resistant enamel, door and interior shall be made of stainless steel to deter corrosion and wear. Doors on vault shall be rigid with heavy-duty hinges and security locks.

4. Cashbox receiver: Cashbox receiver shall be located at the top of the vault for gravity assisted revenue transfer. Unit shall be of stainless steel and mechanically operated for positive control. The internal mechanism shall be operated by a crank and allow the contents to transfer securely into dual compartments in the vault below. Elements of receiver shall be integral and all engagements an/or alignments shall be positive and automatic. Receiver shall be equipped with a locking device to restrain movement of operating crank when the receiver is not in use.5-digit mechanical counter in receiver shows number of revenue transfer cycle.

5. Mobile bin: Mobile bin shall be configured with two separate compartments, one for coins and one for bills. The mobile unit must have two large revenue discharge doors with security locks, one for coins and one for bills. Coins shall be discharged from the bin by gravity using sloped stainless steel bottoms surfaces. Discharge door and openings shall be securely designed to prevent unwanted exposure of revenue. Bin shall be equipped with heavy-duty two fixed and two swivel casters. The bottom of the bin must be reinforced to inhabit deformation while being moved with forklift. Mobile bin unit must not exceed 32 inches in width to allow unit to pass through 36 inch doors. Mechanical interlocks sense

6. Receiver indicators: Indicators shall be provided adjacent to the receiver door to signify a ready condition and a process condition. Indicators shall be patches of color that appear in a small window and shall not require electricity.

7. Discharge: Unit shall have built-in time delay assist to allow for gravity discharge of bills and coins and must have secure interlocks to allow for sequence and event controlled operation.

8. Coin access door: Unit access door shall be in captive track and secured by security lock.

9. Bill access door: Bill access door shall have a continuous hinge and be secured with security lock.

E. Accessories: Vault/Cashbox Electronic Monitoring System.

F. Utilities: Vaults do not require AC power.

G. Finish: Polyurethane high visibility orange.

2.2 DATA COLLECTION AND REPORTING SYSTEM, FAREBOX

Equipment Mark Number: 7820

A. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by GFI Genfare

B. General Description:

1. Data collection and reporting system (DCRS) shall communicate with the fareboxes to extract transaction and event data and download operating parameters and related information. The DCRS shall communicate with the vault to extract cashbox identification from cashboxes inserted in the receiver. The DCRS shall provide two data probes linked to an IBM PC-compatible computer capable of extracting and storing data from the bus fareboxes during routine servicing. The data system shall be capable of generating comprehensive management reports for use by the Owner.

2. System equipment: Equipment shall include but not be limited to the following:

   a. Two data probes, each with junction box, probe holder, lock boxes to secure the probe when not in use, interconnecting cabling, and an isolation box for transient voltage protection.

   b. Computer system consisting of an IBM PC-compatible computer with display and keyboard, laser printer, and other hardware and software.

   c. Uninterruptible power supply (UPS) for computer system, isolation box, and cashbox I.D. computer.

   d. Data collection software and single site use license.

   e. Cashbox ID computer.

   f. Miscellaneous hardware as required for a complete and operable installation.

C. Features and Construction:

1. Data probe: A data probe shall be provided to permit bi-directional communications between the farebox and the data system by means of infrared technology. The probe shall be a handheld device positioned and touched to a mating data port on the farebox, requiring no plugs or physical electrical contact. The case of the data probe shall be a hardened aluminum extrusion or casting, containing the necessary hardware for communication between the probe and the farebox. The probe shall be configured with a window of infrared-transparent plastic behind which is a communications link composed of an LED and photosensor. A slot shall be provided within the extrusion to support the probe printed circuit board. A strain relief shall be provided to support the data cable.

   The data probe and cabling shall be capable of withstanding extended operations under extreme temperature and humidity variations and shall be impervious to degradation due to diesel fuel, gasoline, oil, transmission fluid, road salts, and sunlight. The data probe shall be capable of withstanding being dropped from a height of three (3) feet onto a concrete surface with no resulting loss of operation. An LED lamp shall be provided in an easy-to-see location on the probe to aid in proper orientation and operation of the data probe. The LED shall pulse at a rate of

once per second to indicate that the data computer is operational and the data probe is ready for use. Once the probe is interfaced with the farebox data port, the LED shall flicker while data is being exchanged and then glow steadily for five seconds to indicate that transmission has been completed.

2. Data probe cable: The data cable shall be custom made with three (3) twisted wire pairs, a shield, and a heavy polyurethane jacket flexible at low temperatures and resistant to salt, moisture, abrasion and fuel. Cable length shall be twenty-five (25) feet. The cable shall be supported in the center by a retractor mechanism designed to hold the cable out of the way when not in use. The retractor may be attached to a supporting pole or wall. A probe holder shall be provided to hold the data probe between uses and a lockable box shall be provided to hold the data probe when not in use.

3. Junction box: Each data probe cable shall terminate in a junction box containing one or more connectors for the data probe cable(s) and a terminal strip for a cable connecting the junction box to the central isolation box. Junction boxes may be mounted on the supporting pole or to an existing structure, as appropriate.

4. Supporting poles: Data probe supporting poles and all other equipment shall be properly grounded for lightning protection through existing electrical outlets. The data probe printed circuit board and isolation boxes shall have transient protection circuits.

5. Interconnection cable: Each data probe junction box shall be connected to a central isolation box. Both ends of the cable shall attach to screw terminals. Maximum cable length is not to exceed 1,500 feet.

6. Central isolation box: The data probe subsystem shall include an isolation box designed to protect the data computer and its operator from a near-hit by lightning. The isolation box shall contain a separate opto-isolating printed circuit board for each data probe powered from a common power supply. Terminal strips shall be provided for connection to each of the data probes. The isolation box shall typically be mounted on a wall within 10 feet of the data computer, where its case can be properly grounded. Cables shall connect the isolation box to the data computer. The isolation box shall have its own 110 VAC grounded power cord.

7. Computer equipment: Computer equipment to be provided by Owner. Coordinate CPU specifications with owner and provide final software installation, programming, and connection to CPU for a complete and operable system.

D. Utilities: 110 VAC, 20 A.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to start-up inspect, test, and adjust components, assemblies, and equipment installations, including connections, check operation of the equipment and components for operation and performance as specified and examine the finish for damage. Provide report in writing that the installation meets the requirements and shall include information concerning minor adjustments and minor repairs, which may be required before final acceptance by the Owner.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment

B. Prepare test and inspection reports

C. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.4 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.5 TRAINING

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

B. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. VAULT/RECEIVER, FAREBOX, MOBILE BIN
   Equipment Mark Number: 7800
   Hours Required: 1

2. DATA COLLECTION AND REPORTING SYSTEM, FAREBOX
   Equipment Mark Number: 7820
   Hours Required: 1

C. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

D. Provide a Windows compatible movie file format recording on DVD disk of the training session. The DVD training movie can be of a live session or a produced training video.

END OF SECTION 115400

SECTION 115800 - FLUID LUBRICATION SYSTEMS

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 fluid lubrication system equipment.

B. Related Sections include the following:

1. Division 11 Section "Fluid Lubrication Piping" for distribution piping.

1.3 REFERENCE

A. The publications listed below form a part of this specification to the extent referenced.

B. The publications are referenced in the text by basic designation only.

1. Underwriters Laboratories
2. NFPA 30/30A
3. Connecticut Fire Code

1.4 QUALITY ASSURANCE

A. American Society for Testing and Materials (ASTM)

1. A53-81a Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. A120-81 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.

B. Underwriters Laboratories, Inc. (UL)

1. Requirements applicable to product listing and labeling.

C. All work shall be installed in compliance with NFPA Standards 17, 30, 30A, and 31.

D. Comply with Connecticut Department of Transportation and local state codes.

E. Comply with EPA Regulations 40 CFR Part 280.

F. Installing contractor shall be fully qualified for fluid tank installations by the tank manufacturer and shall have attended the manufacturer's training seminar within the past two years.

G. 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.

H. All components shall be fully tested and documented to operate as a complete system

I. Manufacturer's Representative: The manufacturer authorized representative shall be factory trained and certified personnel providing service, startup, and quality control field labor for the project from their local office
   1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.
   2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment

1.5 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS

B. Product Data: For pipe, tube, fittings, pumps, tanks, monitoring systems, specialties, and couplings.

C. Shop drawings and schematics detailing fabrication, installation, piping layout, materials and finishes, system interconnections, and utility connections of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection

D. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring

1.6 INFORMATION SUBMITTALS

A. Factory tests and inspection reports prior to shipping.

B. Field test and start-up reports, indicating and interpreting test results relative to compliance with specified requirements, for information.

C. Certificates: For certification required in "Quality Assurance" Article

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For the equipment identified to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.8 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. Provide five extra pump mufflers.

2. Provide five extra inlet compressed air hose kits.

1.9 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. All parts shall be readily available locally in the United States.

E. Any units or parts which prove defective during the warranty period will be replaced with OEM parts and transportation prepaid.

1.10 COORDINATION

A. Coordinate size and location of all foundations, supports, piping, electrical connections, and controls.

1.11 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid or dusty conditions.

B. Label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.12 LABELING

A. Nameplate: Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate with stamped figures showing manufacturer's name, address, model number, serial number and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 - PRODUCTS

2.1 GENERAL

A. Work Included: Provide materials and equipment necessary to install, test and make ready for operation a fluid dispensing system that is comprised of fluid reel banks, dispense consoles fluid dispensing pumps, and various components as specified here in,

B. Above Tanks and Drums, except waste storage, shall each be fully filled with designated fluid. Obtain owner approval for fluid manufacturer prior to installation.

C. Provide 10” x 14” signs (wall mounted) over each pump.

D. Provide labels at each hose reel designating fluid.

2.2 ABOVEGROUND FLUID STORAGE TANKS

A. Manufacturer
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Containment Solutions.

B. Comply with the following standards:
1. UL 142- Underwriters Laboratories, Inc., Steel Aboveground Tanks for Flammable and Combustible Liquids.
2. U.L. 2085, Underwriters Laboratories 2 Hour Fire Rating's Standard for Insulated.
3. NFPA 30, National Fire Protection Association Flammable and Combustible Code.
4. NFPA 30A, National Fire Protection Association Automotive and Marine Service Station
5. Uniform Fire Code International Fire Code Institute
6. B.O.C.A. National Fire Prevention Code

C. General Tank Description:
1. Tanks are designed and UL listed as atmospheric tanks with a maximum working pressure of 1 PSI.
2. The primary tank and the secondary containment tank shall have passed a proof of design hydrostatic pressure test of 25 PSI.
3. Tanks shall be equipped with (9) total openings- four (4) NPT openings, plus one for primary tank working vent, one for primary tank emergency vent, one for monitoring the interstitial space, one for secondary tank emergency vent, and one for secondary tank emergency vent. The emergency vents shall be sized per NFPA & UL 142 requirements. Coordinate tank opening quantity and
4. The tank shall be equipped with a minimum two (2) lifting lugs.
5. Tanks include a 1 year warranty.
6. Tank shall be provided with threaded PVC plugs in fittings (water tight).

7. The primary and secondary containment tank shall be pressure tested in the factory to UL 142 specification (3 PSI).
8. Tank is to be air tested at the factory but MUST be retested at the jobsite by the installer prior to installation and meet UL142 specifications

D. Primary Tank
1. The standard primary storage tank shall be rectangular in design. The tank will be constructed of UL 142 specified thickness, with continuous welds.
2. The primary storage tank shall be constructed of ASTM A-569 or A-36 carbon steel or 304 stainless steel, as required for compatibility of products being stored.

E. Secondary Containment Tank:
1. The secondary containment tank shall be rectangular in design and constructed of UL 142 specified steel thickness, with continuous welds.
2. The secondary containment tank shall be listed by Underwriters Laboratories as secondary containment under UL 142 standard.

F. Finish
1. The exterior surface of the secondary tank shall be cleansed of foreign material and coated with a corrosion resistant industrial paint (3 to 5 mils dry film thickness)
2. The standard color shall be desert sand.

2.3 ABOVEGROUND STEEL CLOSED HEAD STORAGE DRUM

A. Materials

1. Only new material shall be used in the manufacturing process and the manufacturer shall ensure that the material used meets all appropriate specifications and quality assurance requirements.
2. Material Requirements
   a. Nominal capacity of the tank(s) shall be: See drawings
   b. Minimal material thickness of the tank(s) shall be 18 gauge steel.
   c. Provide polyethylene tanks for storing windshield washer fluid and engine coolant.
3. Loading Conditions: Tank shall meet the following design criteria.
   a. Internal Load: Tank(s) shall withstand an air pressure test of 1.5-2.5 psi.
4. Product Storage Requirements
   a. Tank(s) shall be capable of storing liquids with a specific gravity up to 1.1.
   b. Tank(s) is designed for operation at atmospheric pressure only. Tank(s) shall have openings of sufficient size to meet normal venting requirements as stated in U.L. 142, UFC, and NFPA 30.
   c. Tank(s) shall be capable of storing motor oil, gear oil, windshield washer fluid, grease, engine coolant, and automatic transmission fluid at ambient temperature.

B. Accessories

1. Certification Plate: Underwriters Laboratories label shall be affixed to each tank.
2. Fittings: Threaded/NPT

a. All threaded fittings shall be of a material of construction consistent with the requirements of the Underwriters Laboratories label. All fittings shall be protected using threaded plugs or suitable closure caps.
b. Location: Refer to drawings.
c. Primary vent to be 3/4" vent with Sch 40 galvanized nipple
d. 2" bung hole for connection to pump suction kit

C. Installation

1. Tank shall be installed in strict accordance with the most recent installation instructions provided by the tank manufacturer, PEI/RP200, UFC, NFPA 30, local ordinance, recognized engineering procedure, and other applicable codes.

D. Factory Painting

1. Prepare tank surface with SSPC-SP-3 sandblast. Finish tank suface with factory applied epoxy finish.

2.4 MANUFACTURER

A. Manufacturer
1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Graco Inc

2.5 USED OIL AND COLLANT EVACUATION SYSTEMS

A. The system to be a wall mount 1" double diaphragm pump. The diaphragm pump to be of aluminum construction and have TPE diaphragms, balls & seats. Pump to include the following components:
1. Air and fluid connecting hose kit
2. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
3. Air guard runaway valve for pump protection
4. Wall bracket
5. Adapters
6. 2000 PSI Stainless steel ball type fluid shut-off valve for pump outlet
7. 10 FT evacuation hose kit
8. Air solenoid valve
a. Power open, spring closed
b. 24 V DC
c. Leads: 18 AWG x 12 in

B. Supply the following portable used oil receivers:

1. 25 gallon, portable used oil receiver with top connect coupler. Refer to specification 115100 "Shop Equipment" for further requirements.

C. Provide high level alarm/ pump shut-off system for used oil and used coolant. Refer to overfill alarm and acknowledgement specifications below. Locate alarm on wall near fluid evacuation

systems and install above floor per the local electrical code. Overfill alarm to be controlled by web based inventory and leak detection control panel.

2.6 WINDSHIELD WASHER FLUID (WWF) PUMP FOR 55 GALLON DRUM WALL MOUNT INSTALLATION

A. The system to be a wall mount 1" double diaphragm pump. The diaphragm pump to be of aluminum construction and have TPE diaphragms, balls & seats. The unit to be complete with all necessary components to draw washer fluid from a 55 gallon drum. The pump to have a 1½" NPT (F)aluminum drop tube. Pump to include the following components:
   1. Pressure relief kit
   2. Air and fluid connecting hose kit
   3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
   4. Air guard runaway valve for pump protection
   5. Wall bracket
   6. Adapters
   7. Suction hose kit with low level cut off
   8. 2000 PSI Stainless steel ball type fluid shut-off valve for pump outlet.

2.7 ENGINE COOLANT PUMP FOR 55 GALLON DRUM WALL MOUNT INSTALLATION

A. The system to be a wall mount 1" double diaphragm pump. The diaphragm pump to be of aluminum construction and have TPE diaphragms, balls & seats. The unit to be complete with all necessary components to draw engine coolant from a 55 gallon drum. The pump to have a 1½" NPT (F)aluminum drop tube. Pump to include the following components:
   1. Pressure relief kit
   2. Air and fluid connecting hose kit
   3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
   4. Air guard runaway valve for pump protection
   5. Wall bracket
   6. Adapters
   7. Suction hose kit with low level cut off
   8. 2000 PSI Stainless steel fluid ball type shut-off valve for pump outlet

2.8 ENGINE COOLANT (EC) PUMP FOR TANK MOUNT INSTALLATION

A. The system to be a wall mount 1" double diaphragm pump. The diaphragm pump to be of aluminum construction and have TPE diaphragms, balls & seats. The unit to be complete with all necessary components to draw engine coolant from a tank.. Pump to include the following components:
   1. Pressure relief kit
   2. Air and fluid connecting hose kit
   3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
   4. Air guard runaway valve for pump protection
   5. Wall bracket
   6. Adapters

7. Suction hose kit with low level cut off

2.9 GEAR OIL (GO) PUMP FOR 55 GALLON DRUM WALL MOUNT INSTALLATION

A. The positive displacement oil pump shall have a pneumatically operated 4 ¼" diameter air motor, a 4 ¼" pumping stroke length and cycle on demand only. The air motor is to have an external muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design which increases the pump's durability, longevity and gives uniform delivery on both the up and down strokes. The air motor cylinder material is to be hard coated aluminum and corrosive resistant steel. The air motor to feature a non-metallic poppet valve. The air motor and lower pump section shall be of the divorced design. The pump to have a 1½" NPT (F)aluminum drop tube. Pump to include the following components:
1. Pressure relief kit
2. Air and fluid connecting hose kit
3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
4. Air guard runaway valve for pump protection
5. Wall bracket
6. Adapters
7. Suction hose kit with low level cut off
8. 2,000 psi ball type shut-off valve for pump outlet

2.10 AUTOMATIC TRANSMISSION FLUID (ATF) PUMP FOR 55 GALLON DRUM WALL MOUNT INSTALLATION

A. The positive displacement oil pump shall have a pneumatically operated 3" diameter air motor, a 3" pumping stroke length and cycle on demand only. The air motor is to have an external muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design which increases the pump's durability, longevity and gives uniform delivery on both the up and down strokes. The air motor cylinder material is to be hard coated aluminum and corrosive resistant steel. The air motor to feature a non-metallic poppet valve. The air motor and lower pump section shall be of the divorced design. The pump to have a 1½" NPT (F)aluminum drop tube. Pump to include the following components:
1. Pressure relief kit
2. Air and fluid connecting hose kit
3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
4. Air guard runaway valve for pump protection
5. Wall bracket
6. Adapters
7. Suction hose kit with low level cut off
8. 2,000 psi ball type shut-off valve for pump outlet

2.11 AUTOMATIC TRANSMISSION FLUID (ATF) PUMP FOR TANK MOUNT INSTALLATION

A. The positive displacement oil pump shall have a pneumatically operated 4 ¼" diameter air motor, a 4 ¼" pumping stroke length and cycle on demand only. The air motor is to have an external muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design which increases the pump's durability, longevity and gives uniform delivery on both the up and down strokes. The air motor cylinder material is to be hard coated aluminum and corrosive resistant steel. The air motor to feature a non-metallic poppet valve. The air motor and lower pump section shall be of the divorced design. The pump to have a 1½" NPT (F) stainless steel drop tube. Pump to include the following components:

1. Pressure relief kit
2. Air and fluid connecting hose kit
3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
4. Air guard runaway valve for pump protection
5. 2,000 psi ball type shut-off valve for pump outlet

2.12 ENGINE OIL (EO) PUMP FOR TANK MOUNT INSTALLATION

A. The positive displacement oil pump shall have a pneumatically operated 4 ¼" diameter air motor, a 4 ¼" pumping stroke length and cycle on demand only. The air motor is to have an external muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design which increases the pump's durability, longevity and gives uniform delivery on both the up and down strokes. The air motor cylinder material is to be hard coated aluminum and corrosive resistant steel. The air motor to feature a non-metallic poppet valve. The air motor and lower pump section shall be of the divorced design. The pump to have a 1½" NPT (F) stainless steel drop tube. Pump to include the following components:

1. Pressure relief kit
2. Air and fluid connecting hose kit
3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
4. Air guard runaway valve for pump protection
5. 2,000 psi ball type shut-off valve for pump outlet

2.13 CHASSIS GREASE (CG) 400 LB DRUM PUMP SYSTEM:

A. The positive displacement oil pump shall have a pneumatically operated 4 1/4" diameter air motor, a 4" pumping stroke length and cycle on demand only. The air motor is to have an integral muffler that operates below OSHA noise standards, and be equipped with a grounding lug. The design of the air motor shall incorporate a valve in piston design which increases the pump's durability, longevity and gives uniform delivery on both the up and down strokes. The air motor cylinder material is to be hard coated aluminum and corrosive resistant steel. The pump system to include pump elevator, inductor plate, carriage, and connecting hoses.

1. Air and fluid connecting hose kit
2. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
3. Air guard runaway valve for pump protection

4. Provide stationary supply stand
5. 5,000 psi needle shut-off valve for pump outlet

2.14 DIESEL EXHAUST FLUID (DEF) PUMP

A. The system to be a wall mount, double diaphragm pump. The diaphragm pump to be of polypropylene construction and have PTFE ball, flouroelastomer seat and stainless steel diaphragm materials. The unit to be complete with all necessary components to draw DEF from storage tank. The pump to have a 1½" NPT (F) stainless steel drop tube. Pump to include the following components:
   1. Pressure relief kit
   2. Air and fluid connecting hose kit
   3. Air filter/regulator/lubricator kit with gauge and automatic tank drain valve on the air filter
   4. Air guard runaway valve for pump protection
   5. Wall bracket
   6. Adapters
   7. Suction hose kit with low level cut off
   8. 2000 PSI ball type stainless steel fluid shut-off valve for pump outlet

2.15 FLUID DISPENSING REELS

A. General:
   1. Provide steel reel mounting channels to mount the number of reels as per each overhead reel station. The channel to accept specified reels. Channel to be painted black.

B. Reel Specification (EO, GO, ATF, EC, CG, CA, WWF):

   1. The hose reel shall have a minimum capacity of 50 feet of 1/2" ID hose for, EO, GO, ATF, EC, CG, and CA. The hose reel shall have a minimum capacity of 65 feet of 3/8" ID hose for WWF. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs for strength and durability.
   2. The ratchet assembly will be constructed of ZA-12 non-sparking alloy for use in fueling and other type environments. The ratchet will be designed to prevent damage in the event of being spun backwards and fits to an over-sized, two-point, mounted pivot support, that is removable as an assembly for service.
   3. The spring is a sealed unit and must be adjustable from the reel exterior with or without pressure and without removing the hose. The rewind motor spring will provide uniform tension through the usable range. It has high demand steel spring and external tension adjustment. The latch spring engineered to eliminate reel lock out condition.
   4. The reel spool to be all metal and have sealed roller bearings
   5. The fluid swivel will be full-ported, 1/2" NPT, with Viton seals and Teflon back up washers. The swivel will be completely accessible and serviceable without disassembly of other reel components. The swivel will be rated for a minimum of 1500-psi (103 bar) working pressure, and vacuum up to 24" Hg. (610mm Hg).
   6. The hose guide roller assembly will be the full width of the spool, with 1-1/8" (29mm) diameter steel rollers, a one-piece roller support and Delrin bearings and seals.
   7. The reel to be designed to mount on ceilings, wall or floors.
   8. The bar stop assemblies will be constructed of high impact, molded Hytrel.

9. Accessories
   a. EO, ATF, GO- 2,000 psi ball type shut-off valve for reel inlet
   b. WWF & EC- 2,000 psi ball type stainless steel fluid shut-off valve for reel inlet
   c. CG- 5,000 psi needle shut-off valve for reel inlet

C. Reel Specification (DEF):

1. The hose reel shall have a minimum capacity of 50 feet of 3/4" ID, DEF compatible hose. The hose reel base will be a 10 gauge, heavy-duty double pedestal frame with welded joints and formed ribs for strength and durability.
2. The ratchet assembly will be constructed of ZA-12 non-sparking alloy for use in fueling and other type environments. The ratchet will be designed to prevent damage in the event of being spun backwards and fits to an over-sized, two-point, mounted pivot support that is removable as an assembly for service.
3. The two, (one on each side) sealed, self-aligning ball bearings, support the hose spool on the reel base. The spool will be a welded assembly with formed flange support ribs and rolled edges for strength and durability. The rewind motor spring will provide uniform tension through the usable range. It has high demand steel spring and external tension adjustment. The latch spring engineered to eliminate reel lock out condition.
4. Provide with double-riveted connections and contained in its own lubricated, sealed safety canister. The canister assembly will be mounted externally to the reel base and have an external spring tension adjustment
5. The fluid swivel will be full-ported, 3/4" BSPP thread, with stainless steel seals and back up washers. The swivel will be completely accessible and serviceable without disassembly of other reel components. The swivel will be rated for a maximum of 50 psi working pressure.
6. The hose guide roller assembly will be the full width of the spool, with 1-1/8" (29mm) diameter steel rollers, a one-piece roller support and Delrin bearings and seals.
7. The reel to be designed to mount on ceilings, wall or floors.
8. The bar stop assemblies will be constructed of high impact, molded Hytrel.
9. Accessories:
   a. 3/4" 2,000 psi stainless steel ball type shut-off valve

D. Reel Specifications (Elec)

1. The hose reel shall have a minimum capacity of 95 feet of 12 gauge insulated electrical cord. The hose reel base will be a 10 gauge, heavy-duty single pedestal frame with welded joints and formed ribs for strength and durability.
2. The ratchet assembly will be constructed of ZA-12 non-sparking alloy for use in fueling and other type environments. The ratchet will be designed to prevent damage in the event of being spun backwards and fits to an over-sized, two-point, mounted pivot support, that is removable as an assembly for service
3. Provide with single industrial receptacle.
4. Reel to be provided with an adjustable arm
5. The spring is a sealed unit and must be adjustable from the reel exterior with or without pressure and without removing the hose. The rewind motor spring will provide uniform tension through the usable range. It has high demand steel spring and external tension adjustment. The latch spring engineered to eliminate reel lock out condition
6. The reel to be designed to mount on ceilings, wall or floors.
7. Electrical:
   a. 120V/1
   b. 18 amp

2.16 DISPENSING HANDLES

A. General
1. The dispensing handles to be designed and manufactured by same manufacturer of the fluid pumps and reels.
2. The compressed air reel to be provided with air coupler to match the ones to be utilized by owner.
3. Provide for each reel hose an identification label that has the product ID and snaps around the hose at the bottom near dispense valve connection.
4. Label to be plastic, available in 9 standard colors and have clearly visible lettering.
5. Reference: Seton, custom Setmark snap around pipe markers.

B. Dispensing handles specifications (EO, EC, ATF, GO)
1. The handle is to be heavy duty cast construction with trigger guard, trigger lock and inlet swivel.
2. The meter to have large LCD display with set up menu to program display resolution/lighting, calibration and units of measurement. There are to be simple control buttons on the meter head for ease of operation.
3. The meter head to have protective high density housing and the inlet swivel to have protection boot.
4. The meter has the ability to be pre-set for desired units and has an automatic shut-off.
5. The max flow to be 5 GPM.
6. The meter head to have protective housing and inlet swivel protection boot.
7. The unit to operate on replaceable AA alkaline battery.
8. Nozzle end:
   a. EO- rigid extension with standard automatic non-drip quick-close nozzle for oil.
   b. EC- rigid extension with standard quick close nozzle for engine coolant
   c. ATF- flexible extension with standard automatic non-drip quick-close nozzle for oil.
   d. GO- extension with standard quick-close nozzle for gear oil.

C. Dispensing handles specifications (WWF)
1. The dispense valve to be a bib type valve with rubber tip.
2. Valve to have bottom trigger and ¼” NPT inlet with screen.
3. Full volume dispense nozzle.

D. Dispensing handles specifications (CG)
1. The dispense valve to be of machined steel construction.
2. The valve to have rugged heavy duty handle with trigger guard.
3. The trigger to have a top adjustment nut, lockable.
4. The valve to be able to dispense grease up to NLGI #2.
5. The valve to include Z-swivel and 30” whip hose with coupler

E. Dispensing handles specifications (DEF)
1. The handle is to be heavy duty cast construction with trigger guard, trigger lock and stainless steel inlet swivel.
2. Provide stainless steel nozzle.
3. The meter head to have protective high density housing and the inlet swivel to have protection boot.

2.17 MANAGEMENT/MONITORING SYSTEM

A. Manufacturer
   1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Veeder Root

B. Tank level probes: Magnetostrictive Inventory only probe
   1. Stainless steel guide tube
   2. Temperature rating: -40 deg F to 140 deg F
   3. Adjustable spacers
   4. Length to be verified prior to ordering
   5. Provide installation kit
   6. Provide float kit, to be verified prior to ordering.
   7. Provide with water detection for all fluids except waste oil and waste coolant inventory probes. Waste oil and waste coolant inventory probes to be provided without water detection.

C. Interstitial sensors for steel tanks: detects the presence of liquid in the interstitial space of a double walled steel tank. When liquid is detected the sensor sends an alarm signal to the monitor.
   1. Cable length: to be verified prior to ordering
   2. Temperature rating: -20 deg C to 70 deg C
   3. Provide with watertight cord grips
   4. Two wires are required to connect to the monitor

D. Overfill alarms and acknowledgement: Wired to an alarm relay in the monitor, the alarm relay activates the overfill alarm horn and light when a potential overfill is detected. Limits can be set at each tank location.
   1. Alarm horn: adjustable noise level from 78 to 103 dB (at 10 feet)
   2. Alarm light: 25 watt, red polycarbonate lens, 75 per minute flashing rate
   3. Alarm acknowledgement switch: when the acknowledgement button is pressed the overfill alarm shuts off and the alarm acknowledgement light illuminated. 120 volt amber lens.
   4. Enclosure: Painted steel, NEMA 4. ½” conduit connector at the bottom
   5. Supply voltage: 120VAC

E. Inventory and leak detection monitor panel: Web based internet browser with Ethernet connection
   1. Up to three years of data history
   2. Inventory and delivery monitoring and reporting
   3. Support up to 32 probes
   4. Interstitial/sump monitoring
   5. Dispenser sump monitoring
   6. Groundwater monitoring
   7. Email notification and reporting
   8. Vapor well monitoring
   9. Continuous statistical leak detection software built programmed into controller.
   10. 3.0 gph, .1 gph, and .2 gph in tank leak detection
   11. 3.0 gph, .1 gph, and .2 gph in line leak detection
   12. Sensor status report
   13. Sensor status history report

14. 7.4” full VGA LCD tough screen display
15. High resolution, high speed printer
16. Universal compartments support universal sensor and probe module and output interface module
17. Built-in relay for overfill alarm
18. Supports multiple languages
19. Intuitive and user friendly interface
20. Single tough screen access to most functions
21. Customizable on-board help
22. Custom dashboard
23. Remote web access
24. XML web-enabled interface
25. Up to nine communication ports
26. Internal auto-dial fax modem communication
27. RS-232 and RS-485 data communication
28. USB ports for software upgrades and data backup.
29. Electrical: 120 VAC
30. Provide panel with relay to de-energize used oil and used coolant solenoid valve upon high level detection.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation of all equipment and systems and components shall be by experienced installers capable of installing each item in accordance with drawings and specifications and manufacturers requirements.

B. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

C. Install equipment with clearances for service and maintenance.

D. Support suspended hose reels from structure.

1. Install as per manufacturer’s instructions.

3.2 CLEANING AND ADJUSTING

A. After installation all items shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project. All movable parts shall be cleaned and adjusted to operate as designed without binding or deformation of the members and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

3.3 FIELD QUALITY CONTROL AND TESTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative to start-up inspect, test, and adjust components, assemblies, and equipment installations, including connections, check operation of the equipment and components for operation and performance as specified and examine the finish for damage. Provide report in writing that the installation meets the requirements and shall include information concerning minor adjustments and minor repairs, which may be required before final acceptance by the Owner.

B. General:

1. Installer must test in demonstrate the integrity of tanks, piping, and secondary containment as well as the satisfactory operation of gauging an monitoring systems, before the storage tank system is placed into service. Additionally, the installer is responsible for inspecting and testing the overfill-prevention equipment, line leak detectors and all valves installed to control product flow to verify the safety of the system.

2. Test all system components, piping, tanks, dispensers, etc for complete and correct system operation and demonstrate to owner prior to the system being placed in operation.
3. All testing shall be in compliance with NFPA 30 and 30a requirements

C. Tank:

1. Tanks are to be factory tested prior to shipment and field tested prior to system start-up.
2. Air pressure test both the primary and secondary tank in accordance with the tank manufacturer's recommendations. In addition to the pressure test, cover the entire tank surface, manways and all fittings with soap solution and inspect for leaks.
3. There shall be no drop in pressure.
4. Fill containment sump/turbine enclosure with water. There shall be no drop in the alter level after four hours.
5. Tank to be tested with air pressure not less than a gauge pressure of 3 psi and not more than a gauge pressure of 5 psi for two hours.
6. The interstitial space shall be air tested at a gauge pressure of 3 psi to 5 psi, by vacuum, or in accordance with the tank's listing of the manufacturer's instructions

D. Upon completion of the installation the Installer shall conduct operating test for approval of the Owner. These tests shall include but not be limited to the following:

1. All tests per manufacturer instructions.
2. Demonstration & training of all equipment to owner's personnel.

E. Tests shall be performed as outlined in the reference cited herein.

F. All test equipment and facilities shall be furnished at no additional expense to the Owner.

G. Final acceptance
1. All tanks to be completely filled with product for acceptance by the state

3.4 DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fluid lubrication system equipment.
2. Review data in maintenance manuals.
3. Schedule training with Owner and Architect with at least 14 days advance notice. Owner’s personnel training shall be for not less than 4 hours.
4. Provide training for up to ten (10) people.

END OF SECTION 115800

SECTION 143000-CRANES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The General Provisions of the Contract, including General and Special Conditions, apply to the Work in this Section.

1.2 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. CRANE, BRIDGE, FREE STANDING, 1 TON
   Equipment Mark Number: 5074
   Submittal requirements: PD, OM, SD, T

2. CRANE, JIB, BASE MOUNTED, 12’, 1 TON
   Equipment Mark Number: 5080
   Submittal requirements: PD, OM, SD, T

3. CRANE, PORTABLE, 2 TON
   Equipment Mark Number: 5280
   Submittal requirements: PD, OM

4. HOIST, CHAIN, ELECT., 1 TON
   Equipment Mark Number: 5362
   Submittal requirements: PD, OM

B. Provide roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

1. Coordinate and verify all electrical, foundation, and utility connections with all trades prior to equipment ordering and purchase.

C. Wiring and switching between equipment and utilities.

1.3 QUALITY ASSURANCE

A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

B. Each product shall be provided by a single manufacturer.

C. All components shall be fully tested and documented to operate as a complete system

D. Manufacturer's Representative: The manufacturer authorized representative shall be factory trained and certified personnel providing service, startup, and quality control field labor for the project from their local office.

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS

B. Refer to above submittal requirements. The following abbreviations are used to identify submittals required:

1. PD- Product Data

2. SD- Shop drawings

3. OM- Operation and Maintenance manual

4. T- Training of owners personnel on specific equipment items

C. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical requirements, wiring diagrams, and provided accessories.

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

D. Shop drawings and schematics detailing fabrication, installation, piping layout, materials and finishes, system interconnections, and utility connections of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection

1.5 INFORMATION SUBMITTALS

A. Delegated-design submittal: For equipment supports, foundations, structure, and capacities to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for their preparation

B. Factory tests and inspection reports prior to shipping.

C. Field test and start-up reports, indicating and interpreting test results relative to compliance with specified requirements, for information.

D. Certificates: For certification required in "Quality Assurance" Article

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For the equipment identified to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

B. Warranty: For bus wash systems specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR- CLOSEOUT DOCUMENTS.

1.7 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship unless otherwise noted below.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. All parts shall be readily available locally in the United States.

E. Any units or parts which prove defective during the warranty period will be replaced with OEM parts and transportation prepaid.

1.8 COORDINATION

A. Coordinate size and location of all foundations, supports, piping, electrical, and controls

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.10 LABELING

A. Nameplate: Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. Crane capacity shall be painted with letters and numbers 3 inches high minimum on both sides of the boom web.

C. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 – PRODUCTS

2.1 CRANE, BRIDGE, FREESTANDING, 1 TON
Equipment Mark Number: 5074

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Columbus McKinnon Lode Rail

B. Warranty: The crane must have a 10 year parts and 1 year labor warranty

C. Capacities and Dimensions:

1. Bridge:

a. Minimum bridge capacity: 1 ton.

b. Bridge length: 17 feet 8 inches.

c. Bridge depth: 14 7/8”

d. Bridge overhang: 1 foot 0 inches on each end of the runway

e. Minimum bridge trolley travel: 14feet 11 3/16 inches.

2. Runway

a. Capacity: 1 ton

b. Length: 53 feet 0 inches

c. Cantilever: 4 feet on each end

d. Overall length: 54 feet 7 inches

e. Runway depth: 15 3/8inches

f. Runway centers width: 15 feet 8 inches

g. Runway sections 28 feet & 25 feet

3. Supports

a. Number of supports: 6 (two assemblies per support center)

b. Support centers length: 25 feet-25 feet

c. Minimum overall height: 18 feet 8 1/2 inches

d. Support centers width: 18 feet 8 inches

e. Minimum overall width: 20 feet 3 1/2 inches

f. Anchor bolt load: 4191 pounds, 6 inch reinforced concrete minimum. Concrete compressive strength 3000 psi required.

4. Festooning

a. Runway carrier: 8 Gliders

b. Festoon clamps: Runway: 1, Bridge: 1

c. Conductor type: Flat cable (4-conductor #14 AWG) 1 pcs @ 80 ft each

d. Bridge carrier

1) Bridge: 1

2) 5-Trolleys

5. Trolley Pin height: 16 feet 0 inches to trolley pin

6. Speeds:

a. Bridge: Manual motion.

b. Trolley: Manual motion.

7. System capacity: 2,000 pounds, maximum.

D. Features and Construction:

1. Bridge: A single girder bridge shall be provided with the system.

a. Materials: The bridge shall consist of cold-rolled steel members welded together with two inch by two inch square tubing welded on top for reinforcement and strength as required. A stack section at one end of a runway shal serve as an extension that allows festoon carriers to be stored on the end of the runway without reducing crane coverage.

2. Runways:

   a. Materials: Track sections shall consist of cold-rolled steel members welded together.

3. Provide 14”x14” base plate welded to each support with 1 inch diameter bolt holes in each corner 11 inches on center.

4. Hoist trolley: Wheel to match the taper of the track to reduce rolling resistance. Wheels to contain ball bearings that are sealed and lubricated for life. Trolleys to be designed to operate in temperatures from +5 degrees F to + 200 degrees F.

5. End trucks: Provide connection between the bridge and runways. Wheels to match the taper of the track to reduce roiling resistance. Two horizontal wheels will center the truck within the runway to prevent binding of the bridge. Any slight runway misalignment is taken up by having the bridge float in one end truck and firmly clamped in the other.

6. Festoon trolleys: Trolleys to have four wheels and a pivoting festoon saddle support.

7. Festoon system: Provide flat cable and festoon system with enough cable for 3 foot loops on the runway and 1 foot 6 inch loops on the bridge.

   a. Trolleys: used to support the flat cable along the runway and bridge

   b. Clamps: used to anchor the festooning at the start of the runway and bridge. Also provided to prevent the festooning trolleys from exiting the track, and provide a redundant stop for the end trucks and trolleys.

8. End stops and Universal bumpers: Provide high impact molded end stop bumpers on the bridge and runways to prevent the end truck and trolley from exiting the track. The bumpers are to be bolted to the track to physically limit the travel of the end truck and trolley.

9. Hoist: Refer to item 5362. Provide one for each bridge crane.

10. Power supply: Power supply shall be provided by power feed end cap consisting of a rubber end pad and an aluminum terminal box with a twist type cable entry gland. Power feed cap shall be pre-assembled with attached plug connectors and jumper wires.

11. Capacity plate: Adhesive PVC foil plates indicating capacity of system shall be attached to both sides of bridge and equally spaced along runway length. Capacity stated on hoist shall be same as capacity indicated on plates.

E. Controls: All protective circuits and components shall meet National Electrical Code requirements.

1. Provide required contactors , relays, and switches to disable power to associated vehicle lift when crane is not in “home” position. Provide a roller type limit switch in the runway to enable/disable the lift. Lift to be enabled when crane is positioned approximately 2 feet from end of runway at the entrance into the maintenance bay. Similarly crane to be disabled when lift is enabled.

F. Finish: Durable, corrosion inhibiting enamel paint with color coded components and zinc-galvanized components where required.

2.2 CRANE, JIB
Equipment Mark Number: 5080

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Abell-Howe Company.

B. Capacities and Dimensions:

1. Capacity: 2000 pounds.

2. Dimensions:

a. Span : 12 feet.

b. Height under beam: 10 feet

c. Footing: 6 feet x 6 feet x 4 feet

3. Swing: 180 degrees, maximum.

C. Features and Construction:

1. Mast: Fabricated from heavy wall structural steel pipe with wall thickness sized to minimize deflection.

2. Base plate: Large diameter base plate reinforced with heavy steel gussets for continuous alignment.

3. Head section: Rigid steel plate box type with welded construction for minimum deflection between boom and mast

4. Boom: rolled steel I-beam section with long wearing tapered flange for smooth trolley travel.

5. 360 degree rotation on a tapered roller bearing providing full capacity vertical and radial thrust loading

6. Lower section of the head to revolve around the pillar on a pair of steel rollers equipped with self-aligning roller bearings

7. Stops: Crane shall be equipped with stops to prevent any portion of the boom, hoist, or tagline system from coming in contact with building walls or structure. Verify placement of stops in the field.

D. Finish: Durable enamel in manufacturer's standard color.

2.3 CRANE, PORTABLE
Equipment Mark Number: 5280

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Star Machine and Tool Company

B. Capacities and Dimensions:

1. Boom capacity:

a. Retracted: 4200 pounds.

b. Extended: 3300 pounds.

2. Maximum boom height:

a. Retracted: 111inches.

b. Extended: 122inches.

3. Effective boom reach:

a. Retracted: 35-1/2 inches.

b. Extended: 50-1/2 inches.

c. .

4. Leg throat: 57-1/2 inches.

5. Wheel diameters:

a. Fixed: 8 inches.

b. Casters: 6 inches.

6. .

C. Features and Construction:

1. Construction: Frame and boom shall be continuously welded seam box construction of heavy steel. Legs shall be flanged, I-beam construction.

2. Adjustment: Crane boom height and length shall be adjustable without use of tools.

3. Portability: Crane assembly shall be mobile frame mounted for portability. A steerable caster shall be at mast end with handle for towing and positioning. Heavy non-steel support wheels shall be for load bearing and quiet operation.

4. Hydraulics: Manual, double acting pump shall be included for rapid boom positioning and high force multiplication lifting.

5. Lift chain: Length shall be adjustable at boom attachment. Chain shall be provided with slip hook and grab hook.

6. Operating controls: Control valve for precise lowering control with automatic valving shall limit descent speed under load.

D. Finish: Durable enamel in manufacturer's standard color.

2.4 HOIST, CHAIN, ELECTRIC
Equipment Mark Number: 5362

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide equipment by Coffing Hoists

B. Capacities and Dimensions:

1. Hoist:

a. Capacity: 2000 pounds.

b. Lifting range: 20 feet.

c. Number of Chains: 2

d. Lifting speed: 8 FPM.

e. Motor: 1/2 HP.

C. Features and Construction:

1. Frame and wheels: Cast aluminum alloy with cast iron wheels and sealed, lifetime lubricated ball bearings. Motorized trolley wheels to be heat treated for added durability.

2. Five-pocket load sheave.

3. Multiple disk motor brake- heavy duty, direct acting designed for positive load spotting and holding

4. Mechanical load brake- Weston type, controls load lowering and prevents load drift. Holds independent of multiple disc motor brake

5. Load hook and chain: Forged steel hook with safety clip attached to heat treated chain by bearing type swivels.

6. Limit switches- adjustable to regulate upper and lower load travel. Provide stainless steel limit switch shaft.

7. Provide solid state starting switch

8. Gearing and transmission- helical gearing precision machined of alloy steel in oil bath.

9. Provide with overload clutch to protect hoist, clutch, and supporting structures from damaging overloads, chain jamming, and reverse phasing.

10. Wrap-around side plates to act as safety lugs and bumpers to protect wheels.

11. Hoist mounting: Lug mounted to trolley for minimum headroom.

12. Pendant: Designed to accommodate thumb or two handed operation constructed of glass- filled nylon, NEMA 3R. Control pendant shall be mounted 36 inches above finished floor.

13. Built in compliance with ASME/ANSI B30.16 and CSSA standards.

D. Controls: Pushbutton pendant, 24 volt, with cord strain relief bushings for hoist UP/DOWN.

E. Utilities Available: 208 VAC, 3 phase, 1/2 HP.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. Perform tests and inspections.

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to start-up inspect, test, and adjust components, assemblies, and equipment installations, including connections, check operation of the equipment and components for operation and performance as specified and examine the finish for damage. Provide report in writing that the installation meets the requirements and shall include information concerning minor adjustments and minor repairs, which may be required before final acceptance by the Owner.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment

B. Prepare test and inspection reports

B. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.4 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.5 TRAINING

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

B. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. CRANE, BRIDGE, FREE STANDING, 1 TON
   Equipment Mark Number: 5074
   Hours Required: 2

2. CRANE, JIB, BASE MOUNTED, 12’, 1 TON
   Equipment Mark Number: 5080
   Hours Required: 1

3. CRANE, PORTABLE, 2 TON
   Equipment Mark Number: 5280
   Hours Required: 1

4. HOIST, CHAIN, ELECT., 1 TON
   Equipment Mark Number: 5362
   Hours Required: 1

C. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

D. Provide a Windows compatible movie file format recording on DVD disk of the training session. The DVD training movie can be of a live session or a produced training video.

END OF SECTION 143000

SECTION 238200 TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Division 01, High Performance Buildings Requirements Section 018113.13 for credits 16a-38k-4(b)4, 16a-38k-4(b)5, 16a-38k-3(k).

a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.2 DESCRIPTION OF WORK

A. Extent of terminal unit work is indicated by drawings and schedules, and by requirements of this section.

B. Types of terminal units required for project include the following:

1. Finned Tube Radiation.
2. Unit Heaters.
3. Cabinet Unit Heaters.
4. Fan Coil Units.
5. Unit Ventilators.
6. Electric Heaters

C. Refer to other Sections for piping; ductwork; and testing, adjusting and balancing of terminal units; not work of this section.

D. Refer to other Sections for the following work; not work of this section.

1. Power supply wiring from power source to power connection on terminal unit. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

2. Interlock wiring between electrically-operated terminal units; and between terminal units and field-installed control devices.

a. Interlock wiring specified as factory-installed is work of this section.

E. Provide the following electrical work as work of this section. Complying with requirements of other Sections:

1. Control wiring, specified in other Sections, between field-installed controls, indicating devices, and terminal unit control panels.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. I-B-R Compliance: Test and rate baseboard and finned tube radiation in accordance with I-B-R, provide published ratings bearing emblem of I-B-R.
2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils."
3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils."
4. ARI Compliance: Test and rate fan-coil units in accordance with ARI Standard 440 "Room Fan-Coil Air Conditioners."
5. UL Compliance: Construct and install fan-coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units."
6. ARI Compliance: Test and rate unit ventilators in accordance with ARI Standard 330 "Unit Ventilators."
7. UL Compliance: Provide electrical components for terminal units which have been listed and labeled by UL.

1.4 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product.

1. Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instruction.

C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.5 INFORMATION SUBMITTALS

A. Product certificates signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and products' compliance with specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of terminal unit to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

B. Warranty: For each type of terminal unit specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.

B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

2.1 FINNED TUBE RADIATION

A. General: Provide finned tube radiation of lengths and in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Cabinets: Minimum 18-ga cold-rolled steel full backplate, minimum 16-ga front. Brace and reinforce front minimum of 4'-0" o.c. without visible fasteners. Pedestal units provided with bar grilles.

C. Elements: Copper tube and aluminum fins, with tube mechanically expanded into fin collars to eliminate noise and ensure durability and performance at scheduled ratings.

D. Finish: Flat black heat resisting paint for backplate; factory-finished baked enamel, standard colors, on fronts and accessories.

E. Accessories:

1. End panels, inside and outside corners, and enclosure extensions.

2. Removable panels in front of valve assemblies.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering finned tube radiation which may be incorporated in the work included, but are not limited to, the following:

1. Sterling Radiator; Mestek Inc.
2. Vulcan Radiator Co.
3. Rittling Radiator Co.

2.2 UNIT HEATERS

A. General: Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Horizontal Unit Heaters:

1. Casings: Construct of steel, phosphatized inside and out, and finished with baked enamel. Design casing to enclose fan, motor, and coil, design fan orifice formed into discharge panel. Provide air diffusers as scheduled.

2. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.

C. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in steam or hot water applications.

D. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering unit heaters which may be incorporated in the work include, but are not limited to, the following:

F. Manufacturer: Subject to compliance with requirements, provide unit heaters of one of the following:

1. Sterline; Mestek Inc.
2. Modine Mfg. Co.
3. Trane (The) Co.

2.3 CABINET UNIT HEATERS

A. General: Provide cabinet unit heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.

B. Chassis: Galvanized steel wrap-around structural frame with edges flanged.

C. Insulation: Faced, heavy density glass fiber.

D. Cabinet: 16-ga removable front panel, 18-ga top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer.

E. Water Coils: Construct of 5/8" seamless copper tubes mechanically bonded to configurated aluminum fins. Design for 300 psi and leak test at 300 psi under water. Provide same end connections for supply and return.

F. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded fiberglass reinforced thermo-plastic material. Construct fan scrolls of galvanized steel.

G. Motors: Provide shaded pole motors with integral thermal overload protection, and motor cords for plug-in to junction box in unit.

H. Filters: Provide 1" thick throwaway type filters in fiberboard frames.

I. Accessories: Provide the following accessories as indicated and/or scheduled:

1. Recessing Flanges: Provide 18-ga steel flanges for recessing cabinet heaters into wall or ceiling.

2. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cabinet heaters which may be incorporated in the work include, but are not limited to, the following:

K. Manufacturers: Subject to compliance with requirements, provide cabinet unit heaters of one of the following:

1. Sterling
2. Trane (The) Co.
3. Modine Mfg. Co.

2.4 FAN COIL UNITS

A. General: Provide fan coil units having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coils, drain pan assembly, fans, housing, motor, filter, and insulation.

B. Chassis: Construct chassis of galvanized steel with flanged edges.

C. Insulation: Faced, heavy density glass fiber.

D. Cabinet: Construct of 18-ga steel removable panels, 16-ga front. Provide insulation over entire coil section. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer.

E. Coils: Construct of 5/8" seamless copper tubes mechanically bonded to configurated aluminum fins. Design for 300 psi working pressure, and leak test at 300 psi under water.

F. Drain Pans: Construct of galvanized steel. Insulate with polystyrene or polyurethane insulation. Provide drain connection.

G. Fans: Provide centrifugal forward curved double width wheels of reinforced fiberglass, in galvanized steel fan scrolls.

H. Motors: Provide motors with integral thermal overload protection. Run test motors at factory in assembled unit prior to shipping. Provide quickly detachable motor cords.

I. Filters: Provide 1" thick throwaway type filters in fiberboard frames.

J. Dampers: Provide 18-ga steel damper blades with polyurethane stop across entire blade length. Provide factory-mounted electric operators for 25% open cycle.

K. Accessories: Provide the following accessories as indicated and/or scheduled:

1. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.
2. Recessing Flanges: Provide 18-ga steel flanges for recessing fan-coil units into wall or ceiling.

L. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fan-coil units which may be incorporated in the work include, but are not limited to, the following:

M. Manufacturer: Subject to compliance with requirements, provide fan coil units of one of the following:

1. Carrier Corp.
2. International Environmental Corp.
3. McQuay Inc.

2.5 UNIT VENTILATORS

A. General: Provide unit ventilators having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit cabinets, dampers, fan board assembly, motors, and coils.

B. Cabinets: Construct of 14-ga furniture steel with exposed edges rounded. Provide removable front. Clean, phosphatize, and flow coat with baked primer paint steel surface. Finish with baked enamel, standard color as selected by Architect. Provide 12-ga demountable fan board assembly. Provide continuous heavy steel bars welded in place for discharge grilles, integral with unit structure. Provide completely removable end panels for access to piping and valves. Provide leveling legs. Provide pipe access openings in bottom of each end pocket, and pipe chase across back of unit for crossover piping and wiring.

C. Dampers: Provide dual-blade mixing dampers for modulation of return and outside air. Provide sealing device on damper edges and ends.

D. Fan Board Assembly: Provide assembly including fans, fan housings, bearings, and fan shaft. Mount fan assembly on rubber isolators.

E. Motors: Provide split-phase-start, capacitor-run constant speed motors.

F. Coils: Construct hydronic and steam coils of 5/8" copper tubes with plate-type aluminum fins.

G. Accessories: Provide the following accessories as indicated and/or specified:

1. Filters: Provide 1" thick throwaway filters in both outside and return air streams.
2. Wall Louvers: Provide wall louvers for outside air intake, vertical blade design, constructed of heavy gage aluminum.
3. Unit Shelving: Construct unit shelving of materials and finish to match cabinets. Provide adjustable channel reinforced shelves. For closed shelving units, provide roller hung doors with lock.
4. Crossover Piping: Provide in cabinet pipe chase, crossover piping of size and configuration as indicated on drawings.
5. Auxiliary Radiation: Provide finned tube radiation with enclosures to match unit ventilator cabinets.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering unit ventilators which may be incorporated in the work include, but are not limited to, the following:

I. Manufacturer: Subject to compliance with requirements, provide unit ventilators of one of the following:

1. American Air Filter Co.
2. Daikin
3. Trane (The) Co.

2.6 ELECTRIC HEATERS

A. Casing shall be constructed of die-formed, heavy gage steel and finished in high gloss, baked enamel. The heater shall be designed to draw return air in through a stamped louver periphery

and discharge through an outward drawn venturi. Provide adjustable discharge louvers to control direction of airflow, and a large hinged access door extending the width of the heater and locked in position by quarter turn fasteners. Provide wall/ceiling mounting hardware as available from the unit manufacturer.

2.7 OVERHEAD DOOR HEATERS

Self-contained, factory assembled, pre-wired unit with horizontal delivery supply fan, totally enclosed motor, coil, air deflection louvers, fan guard and hanging brackets. Aluminum fin and continuous copper tube coil with schedule 40 steel pipe supply and return headers sandwiched between 18 gage cold rolled die-formed steel covers with die-formed fan venturi, adjustable horizontal air deflection louvers and polyester powder coat paint.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF FINNED TUBE RADIATION

A. General: Install finned tube radiation as indicated, and in accordance with manufacturer's installation instructions.

B. Locate finned tube radiation on outside walls as indicated, run cover wall-to-wall unless otherwise indicated.

C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.

D. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing valve, air temperature control valve.

3.3 INSTALLATION OF UNIT HEATERS

A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.

D. Support units with rod-type hangers anchored to building substrate.

E. Install piping as indicated.

F. Protect units with protective covers during balance of construction.

3.4 INSTALLATION OF CABINET UNIT HEATERS

A. General: Install cabinet unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.5 INSTALLATION OF FAN COIL UNITS

A. General: Install fan-coil units as indicated, and in accordance with manufacturer's installation instructions.

B. Locate fan coil units as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.6 INSTALLATION OF UNIT VENTILATORS

A. General: Install unit ventilators as indicated, and in accordance with manufacturer's installation instructions.

B. Locate unit ventilators as indicated, level and shim units, anchor to substrate. Coordinate with other trades for exact location of wall louvers.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.7 INSTALLATION OF ELECTRIC HEATERS

A. General: Install terminal units as indicated, to comply with manufacturer's written instructions, NFPA 90A and National Electrical Code. Coordinate installation of terminal units with building structure and architect. Provide all mounting accessories and access panels as required for unit maintenance.

3.8 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of other Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.9 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filter units for terminals requiring same.

END OF SECTION 238200

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements, as well as Division 1 High Performance Buildings Requirements, Section 018113.13. for credits 16a-38k-4(b)4, 16a-38k-4(b)5, 16a-38k-3(h)

1. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Grounding and Bonding to be included in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

B. Warranty: For Grounding and Bonding as specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.

2. ERICO International Corporation.
3. Harger Lightning and Grounding.

2.2 SYSTEM DESCRIPTION

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch by 10 feet (19 mm by 3 m).

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.

2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

9. Garage Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying garage equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

G. Raceways and Enclosures for Grounding Electrode Conductors: Provide bonding jumpers to insure the electrical continuity of ferrous metal enclosures sized in accordance with NEC 250.102(c). See NEC 250.64.E.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260533 " Raceways and Boxes for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building as indicated.

1. Install copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 275116 - PUBLIC ADDRESS NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements, as well as Division 1 High Performance Buildings Requirements, Section 018113.13. for credits 16a-38k-4(b)4, 16a-38k-4(b)5, 16a-38k-3(h)

1. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed

1.2 SUMMARY

A. Section Includes:

1. Preamplifiers.
2. Power amplifiers.
3. Transfer to standby amplifier.
4. Microphones.
5. Volume limiter/compressors.
6. Control console.
7. Equipment cabinet.
8. Telephone paging adapters.
9. Monitor panel.
10. Loudspeakers.
11. Noise-operated gain controllers.
12. Battery backup power unit.
13. Conductors and cables.
14. Raceways.

1.3 DEFINITIONS

A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

B. VU: Volume unit.

C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and Notice to Contractor – Submittals.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.

2. Console layouts.

3. Control panels.

4. Rack arrangements.

5. Calculations: For sizing backup battery.

6. Wiring Diagrams: For power, signal, and control wiring.

a. Identify terminals to facilitate installation, operation, and maintenance.
b. Single-line diagram showing interconnection of components.
c. Cabling diagram showing cable routing.

1.6 INFORMATIONAL SUBMITTALS

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and Notice to Contractor – Submittals.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

C. Provide the following for control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

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

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For public address system to be included in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

B. Warranty: For public address system as specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Personnel certified by NICET as Audio Systems Level II Technician.

B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

1. Testing Agency's Field Supervisor: Currently certified by NICET at Level III to supervise on-site testing.

C. Source Limitations: Obtain public address and mass notification systems from single source from single manufacturer.

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. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Altec Lansing Technologies, Inc.
2. Atlas Sound LP.
3. Bogen Communications, Inc.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.

2. Selectively control sound from microphone outlets and other inputs.

3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.

4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.

5. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with TIA/EIA-310-D.

D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.4 PREAMPLIFIERS

A. Preamplifier: Separately mounted.

B. Preamplifier: Integral to power amplifier.

C. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

D. Total Harmonic Distortion: Less than 1 percent.

E. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

F. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

G. Minimum Noise Level: Minus 55 dB below rated output.

H. Controls: On-off, input levels, and master gain.

2.5 POWER AMPLIFIERS

A. Mounting: Rack.

B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.

C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

D. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

E. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.6 MICROPHONES

A. Paging Microphone:

1. Type: Dynamic, with omni polar characteristic.
2. Impedance: 150 ohms.
3. Frequency Response: Uniform, 50 to 14,000 Hz.
4. Output Level: Minus 58 dB, minimum.
5. Finish: Satin chrome.
6. Cable: C25J.
7. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.7 VOLUME LIMITER/COMPRESSOR

A. Minimum Performance Requirements:

1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.

2. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.

3. Distortion: 1 percent, maximum.

4. Rated Output: Minimum of plus 14 dB.

5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.

6. Rack mounting.

2.8 CONTROL CONSOLE

A. Panel for Equipment and Controls: Rack mounted.

B. Controls:

1. Switching devices to select signal sources for distribution channels.
2. Program selector switch to select source for each program channel.
3. Switching devices to select zones for paging.
4. All-call selector switch.

C. Indicators: A visual annunciation for each distribution channel to indicate source being used.

D. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.

E. Spare Positions: 20 percent spare zone control and annunciation positions on console.

F. Microphone jack.

2.9 EQUIPMENT CABINET

A. Comply with TIA/EIA-310-D.

B. House amplifiers and auxiliary equipment at each location.

1. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- locking doors and standard TIA/EIA-310-D-compliant, 19-inch (483-mm) racks.

2. Arranged for floor or wall mounting as indicated.

3. Sized to house all equipment indicated, plus spare capacity.

4. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.

C. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.

D. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.10 EQUIPMENT RACK

A. Racks: 19 inches (483 mm) standard, complying with TIA/EIA-310-D.

B. Power-Supply Connections: Compatible plugs and receptacles.

C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.

D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.

E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.

F. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack.

G. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.

H. Spare Capacity: 20 percent in rack for future equipment.

2.11 TELEPHONE PAGING ADAPTER

A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.

1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
2. Impedance Matching: Adapter matches telephone line to public address equipment input.
3. Rack mounting.

2.12 MONITOR PANEL

A. Monitor power amplifiers.

B. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.

C. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.

D. Mounting: Rack.

2.13 LOUDSPEAKERS

A. Cone-Type Loudspeakers:

1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.

3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.

4. Minimum Dispersion Angle: 100 degrees.

5. Rated Output Level: 10 W.

6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.

7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.

8. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.

B. Horn-Type Loudspeakers:

1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.

2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.

3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.

4. Dispersion Angle: 130 by 110 degrees.

5. Mounting: Integral bracket.

2.14 NOISE-OPERATED GAIN CONTROLLER

A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.

B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.

C. Level Adjustment Range: 20 dB minimum.

D. Maximum Distortion: 1 percent.

E. Control: Permits adjustment of sensing level of device.

2.15 OUTLETS

A. Volume Attenuator Station: Wall-plate-mounted autotransformer type with paging priority feature.

1. Wattage Rating: 10 W unless otherwise indicated.

2. Attenuation per Step: 3 dB, with positive off position.

3. Insertion Loss: 0.4 dB maximum.

4. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.

5. Label: "PA Volume."

2.16 BATTERY BACKUP POWER UNIT

A. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.

B. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.

C. Battery shall be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.

D. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

2.17 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multipair, untinned solid copper.

1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.

2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.

3. Plenum Cable: Listed and labeled for plenum installation.

2.18 RACEWAYS

A. Conduit and Boxes: Comply with Section 260533 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.

2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.

3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.

2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.

3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

D. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

E. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

F. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

G. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

H. Connect wiring according to Section 260519 "Building Wire and Cable."

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 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. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.

2. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.

3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

b. Repeat test for each separately controlled zone of loudspeakers.

c. Minimum acceptance ratio is 50 dB.

5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

8. Signal Ground Test: Measure and report ground resistance at pubic address equipment signal ground. Comply with testing requirements specified in Section 260526 "Grounding and Bonding for Electrical Systems."

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

D. Public address system will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.

2. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

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 two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment.

END OF SECTION 275116

Construction Contracts - Required Contract Provisions
(Contracts Funded by FHWA and FTA)

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1. Federal Highway Administration (FHWA) Form 1273 (Revised May 1, 2012)

2. Federal Transit Administration Required Contract Clauses

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Index of Exhibits

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EXHIBIT B - Federal Transit Administration Required Contract Clauses (Begins on page 34)
EXHIBIT C – Title VI Contractor Assurances (page 57)
EXHIBIT D – Contractor Work Force Utilization (Federal Executive Order 11246) / Equal Employment Opportunity (page 58)
EXHIBIT E – Health Insurance Portability and Accountability Act of 1996 (HIPAA) (page 65)
EXHIBIT F - Campaign Contribution Restriction (page 73)
EXHIBIT G – Federal Wage Rates (Attached at the end)
EXHIBIT H - State Wage Rates (Attached at the end)

1. Federal Highway Administration (FHWA) Form 1273

The Contractor shall comply with the Federal Highway Administration (FHWA), Form 1273 attached at Exhibit A, as revised, which is hereby made part of this contract. The Contractor shall also require its subcontractors to comply with the FHWA – Form 1273 and include the FHWA – Form 1273 as an attachment to all subcontracts and purchase orders.

2. Federal Transit Administration Required Contract Clauses

If applicable, the Contractor shall comply with the Federal Transit Administration (FTA) required contract clauses, attached at Exhibit B, as revised, of this section, all of which are hereby made part of this contract.

3. Title VI of the Civil Rights Act of 1964 / Nondiscrimination Requirements

The Contractor shall comply with Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000 et seq.), all requirements imposed by the regulations of the United States Department of Transportation (49 CFR Part 21) issued in implementation thereof, and the Title VI Contractor Assurances attached hereto at Exhibit C, all of which are hereby made a part of this Contract.

4. Contractor Work Force Utilization (Federal Executive Order 11246) / Equal Employment Opportunity

(a) The Contractor shall comply with the Contractor Work Force Utilization (Federal Executive Order 11246) / Equal Employment Opportunity requirements attached at Exhibit D and hereby made part of this Contract, whenever a contractor or subcontractor at any tier performs construction work in excess of $10,000. These goals shall be included in each contract and subcontract. Goal achievement is calculated for each trade using the hours worked under each trade.

(b) Companies with contracts, agreements or purchase orders valued at $10,000 or more will develop and implement an Affirmative Action Plan utilizing the ConnDOT Affirmative Action Plan Guideline. This Plan shall be designed to further the provision of equal employment opportunity to all persons without regard to their race, color, religion, sex or national origin, and to promote the full realization of equal employment opportunity through a positive continuation program. Plans shall be updated as required by ConnDOT.

5. Requirements of Title 49, Code of Federal Regulations (CFR), Part 26, Participation by DBEs

Pursuant to 49 CFR 26.13, the following paragraph is part of this Contract and shall be included in each subcontract the Contractor enters into with a subcontractor:

"The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26, Participation by DBEs, in the award and administration of U.S. DOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this contract or such other remedy as ConnDOT (recipient) deems appropriate."

6. Contract Wage Rates

The Contractor shall comply with:

The Federal and State wage rate requirements indicated in Exhibits G and H hereof are hereby made part of this Contract. If a conflict exists between the Federal and State wage rates, the higher rate shall govern.

Prevailing Wages for Work on State Highways; Annual Adjustments. With respect to contracts for work on state highways and bridges on state highways, the Contractor shall comply with the provisions of Section 31-54 and 31-55a of the Connecticut General Statutes, as revised.

As required by section 1.05.12 (Payrolls) of the State of Connecticut, Department of Transportation's Standard Specification for Roads, Bridges and Incidental Construction (FORM 816), as may be revised, every Contractor or subcontractor performing project work on a federal aid project is required to post the relevant prevailing wage rates as determined by the United States Secretary of Labor. The wage rate determinations shall be posted in prominent and easily accessible places at the work site.

7. Americans with Disabilities Act of 1990, as Amended

This provision applies to those Contractors who are or will be responsible for compliance with the terms of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. 12101 et seq.), (Act), during the term of the Contract. The Contractor represents that it is familiar with the terms of this Act and that it is in compliance with the Act. Failure of the Contractor to satisfy this standard as the same applies to performance under this Contract, either now or during the term of the Contract as it may be amended, will render the Contract voidable at the option of the State upon notice to the contractor. The Contractor warrants that it will hold the State harmless and indemnify the State from any liability which may be imposed upon the State as a result of any failure of the Contractor to be in compliance with this Act, as the same applies to performance under this Contract.

8. Connecticut Statutory Labor Requirements

(a) Construction, Alteration or Repair of Public Works Projects; Wage Rates. The Contractor shall comply with Section 31-53 of the Connecticut General Statutes, as revised. The wages paid on an hourly basis to any person performing the work of any mechanic, laborer or worker on the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such person to any employee welfare fund, as defined in subsection (i) of section 31-53 of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such public works project is being constructed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such persons to any such employee welfare fund shall pay to each mechanic, laborer or worker as part of such person's wages the amount of payment or contribution for such person's classification on each pay day.

(b) Debarment List. Limitation on Awarding Contracts. The Contractor shall comply with Section 3l-53a of the Connecticut General Statutes, as revised.

(c) Construction Safety and Health Course. The Contractor shall comply with section 31-53b of the Connecticut General Statutes, as revised. The contractor shall furnish proof to the Labor Commissioner with the weekly certified payroll form for the first week each employee begins work

on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 of the Connecticut General Statutes, as revised, on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

Any employee required to complete a construction safety and health course as required that has not completed the course, shall have a maximum of fourteen (14) days to complete the course. If the employee has not been brought into compliance, they shall be removed from the project until such time as they have completed the required training.

Any costs associated with this notice shall be included in the general cost of the contract. In addition, there shall be no time granted to the contractor for compliance with this notice. The contractor's compliance with this notice and any associated regulations shall not be grounds for claims as outlined in Section 1.11 – "Claims".

(d) Awarding of Contracts to Occupational Safety and Health Law Violators Prohibited. The Contract is subject to Section 31-57b of the Connecticut General Statutes, as revised.

(e) Residents Preference in Work on Other Public Facilities. NOT APPLICABLE TO FEDERAL AID CONTRACTS. Pursuant to Section 31-52a of the Connecticut General Statutes, as revised, in the employment of mechanics, laborers or workmen to perform the work specified herein, preference shall be given to residents of the state who are, and continuously for at least six months prior to the date hereof have been, residents of this state, and if no such person is available, then to residents of other states

9. Tax Liability - Contractor's Exempt Purchase Certificate (CERT – 141)

The Contractor shall comply with Chapter 219 of the Connecticut General Statutes pertaining to tangible personal property or services rendered that is/are subject to sales tax. The Contractor is responsible for determining its tax liability. If the Contractor purchases materials or supplies pursuant to the Connecticut Department of Revenue Services' "Contractor's Exempt Purchase Certificate (CERT-141)," as may be revised, the Contractor acknowledges and agrees that title to such materials and supplies installed or placed in the project will vest in the State simultaneously with passage of title from the retailers or vendors thereof, and the Contractor will have no property rights in the materials and supplies purchased.

Forms and instructions are available anytime by:

Internet: Visit the DRS website at www.ct.gov/DRS to download and print Connecticut tax forms; or Telephone: Call 1-800-382-9463 (Connecticut calls outside the Greater Hartford calling area only) and select Option 2 or call 860-297-4753 (from anywhere).

10. Executive Orders

This Contract is subject to the provisions of Executive Order No. Three of Governor Thomas J. Meskill, promulgated June 16, 1971, concerning labor employment practices, Executive Order No.

Seventeen of Governor Thomas J. Meskill, promulgated February 15, 1973, concerning the listing of employment openings and Executive Order No. Sixteen of Governor John G. Rowland promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into and are made a part of the Contract as if they had been fully set forth in it. The Contract may also be subject to the applicable parts of Executive Order No. 7C of Governor M. Jodi Rell, promulgated July 13, 2006, concerning contracting reforms and Executive Order No. 14 of Governor M. Jodi Rell, promulgated April 17, 2006, concerning procurement of cleaning products and services, in accordance with their respective terms and conditions. If Executive Orders 7C and 14 are applicable, they are deemed to be incorporated into and are made a part of the Contract as if they had been fully set forth in it. At the Contractor's request, the Department shall provide a copy of these orders to the Contractor.

11. Non Discrimination Requirement (pursuant to section 4a-60 and 4a-60a of the Connecticut General Statutes, as revised): References to "minority business enterprises" in this Section are not applicable to Federal-aid projects/contracts. Federal-aid projects/contracts are instead subject to the Federal Disadvantaged Business Enterprise Program.

(a) For purposes of this Section, the following terms are defined as follows:

i. "Commission" means the Commission on Human Rights and Opportunities;
ii. "Contract" and "contract" include any extension or modification of the Contract or contract;
iii. "Contractor" and "contractor" include any successors or assigns of the Contractor or contractor;
iv. "gender identity or expression" means a person's gender-related identity, appearance or behavior, whether or not that gender-related identity, appearance or behavior is different from that traditionally associated with the person's physiology or assigned sex at birth, which gender-related identity can be shown by providing evidence including, but not limited to, medical history, care or treatment of the gender-related identity, consistent and uniform assertion of the gender-related identity or any other evidence that the gender-related identity is sincerely held, part of a person's core identity or not being asserted for an improper purpose.
v. "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations;
vi. "good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements;
vii. "marital status" means being single, married as recognized by the State of Connecticut, widowed, separated or divorced;
viii. "mental disability" means one or more mental disorders, as defined in the most recent edition of the American Psychiatric Association's "Diagnostic and Statistical Manual of Mental Disorders", or a record of or regarding a person as having one or more such disorders;
ix. "minority business enterprise" means any small contractor or supplier of materials fifty-one percent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise, and (3) who are members of a minority, as such term is defined in subsection (a) of Connecticut General Statutes § 32-9n; and
x. "public works contract" means any agreement between any individual, firm or corporation and the State or any political subdivision of the State other than a

municipality for construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, or which is financed in whole or in part by the State, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

For purposes of this Section, the terms "Contract" and “contract” do not include a contract where each contractor is (1) a political subdivision of the State, including, but not limited to, a municipality, (2) a quasi-public agency, as defined in Conn. Gen. Stat. Section 1-120, (3) any other state, including but not limited to any federally recognized Indian tribal governments, as defined in Conn. Gen. Stat. Section 1-267, (4) the federal government, (5) a foreign government, or (6) an agency of a subdivision, agency, state or government described in the immediately preceding enumerated items (1), (2), (3), (4) or (5).

(b) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the State of Connecticut; and the Contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by the Contractor that such disability prevents performance of the work involved; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the Commission; (3) the Contractor agrees to provide each labor union or representative of workers with which the Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which the Contractor has a contract or understanding, a notice to be provided by the Commission, advising the labor union or workers’ representative of the Contractor's commitments under this section and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor agrees to comply with each provision of this Section and Connecticut General Statutes §§ 46a-68e and 46a-68f and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes §§ 46a-56, 46a-68e and 46a-68f; and (5) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor as relate to the provisions of this Section and Connecticut General Statutes § 46a-56. If the contract is a public works contract, the Contractor agrees and warrants that he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works projects.

(c) Determination of the Contractor's good faith efforts shall include, but shall not be limited to, the following factors: The Contractor's employment and subcontracting policies, patterns and practices; affirmative advertising, recruitment and training; technical assistance activities and such other reasonable activities or efforts as the Commission may prescribe that are designed to ensure the participation of minority business enterprises in public works projects.

(d) The Contractor shall develop and maintain adequate documentation, in a manner prescribed by the Commission, of its good faith efforts.

(e) The Contractor shall include the provisions of subsection (b) of this Section in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes §46a-56; provided if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter.

(f) The Contractor agrees to comply with the regulations referred to in this Section as they exist on the date of this Contract and as they may be adopted or amended from time to time during the term of this Contract and any amendments thereto.

(g) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of sexual orientation, in any manner prohibited by the laws of the United States or the State of Connecticut, and that employees are treated when employed without regard to their sexual orientation; (2) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the Commission on Human Rights and Opportunities advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (3) the Contractor agrees to comply with each provision of this section and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes § 46a-56; and (4) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor which relate to the provisions of this Section and Connecticut General Statutes § 46a-56.

(h) The Contractor shall include the provisions of the foregoing paragraph in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes § 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter."

The Nondiscrimination Certifications can be found at the Office of Policy and Management website.

http://www.ct.gov/opm/cwp/view.asp?a=2982&Q=390928

12. Whistleblower Provision

The following clause is applicable if the Contract has a value of Five Million Dollars ($5,000,000) or more.

Whistleblowing. This Contract may be subject to the provisions of Section 4-61dd of the Connecticut General Statutes. In accordance with this statute, if an officer, employee or appointing authority of the Contractor takes or threatens to take any personnel action against any employee of the Contractor in retaliation for such employee's disclosure of information to any employee of the contracting state or quasi-public agency or the Auditors of Public Accounts or the Attorney General under the provisions of subsection (a) of such statute, the Contractor shall be liable for a civil penalty of not more than five thousand dollars for each offense, up to a maximum of twenty per cent of the value of this Contract. Each violation shall be a separate and distinct offense and in the case of a continuing violation, each calendar day's continuance of the violation shall be deemed to be a separate and distinct offense. The State may request that the Attorney General bring a civil action in the Superior Court for the Judicial District of Hartford to seek imposition and recovery of such civil penalty. In accordance with subsection (f) of such statute, each large state contractor, as defined in the statute, shall post a notice of the provisions of the statute relating to large state contractors in a conspicuous place which is readily available for viewing by the employees of the Contractor.

13. Connecticut Freedom of Information Act

(a) Disclosure of Records. This Contract may be subject to the provisions of section 1-218 of the Connecticut General Statutes. In accordance with this statute, each contract in excess of two million five hundred thousand dollars between a public agency and a person for the performance of a governmental function shall (a) provide that the public agency is entitled to receive a copy of records and files related to the performance of the governmental function, and (b) indicate that such records and files are subject to FOIA and may be disclosed by the public agency pursuant to FOIA. No request to inspect or copy such records or files shall be valid unless the request is made to the public agency in accordance with FOIA. Any complaint by a person who is denied the right to inspect or copy such records or files shall be brought to the Freedom of Information Commission in accordance with the provisions of sections 1-205 and 1-206 of the Connecticut General Statutes.

(b) Confidential Information. The State will afford due regard to the Contractor's request for the protection of proprietary or confidential information which the State receives from the Contractor. However, all materials associated with the Contract are subject to the terms of the FOIA and all corresponding rules, regulations and interpretations. In making such a request, the Contractor may not merely state generally that the materials are proprietary or confidential in nature and not, therefore, subject to release to third parties. Those particular sentences, paragraphs, pages or sections that the Contractor believes are exempt from disclosure under the FOIA must be specifically identified as such. Convincing explanation and rationale sufficient to justify each exemption consistent with the FOIA must accompany the request. The rationale and explanation must be stated in terms of the prospective harm to the competitive position of the Contractor that would result if the identified material were to be released and the reasons why the materials are legally exempt from release pursuant to the FOIA. To the extent that any other provision or part of the Contract conflicts or is in any way inconsistent with this section, this section controls and shall apply and the conflicting provision or part shall not be given effect. If the Contractor indicates that certain documentation is submitted in confidence, by specifically and clearly marking the documentation as "CONFIDENTIAL," DOT will first review the Contractor's claim for consistency with the FOIA (that is, review that the documentation is actually a trade secret or commercial or financial information and not required by statute), and if

determined to be consistent, will endeavor to keep such information confidential to the extent permitted by law. See, *e.g.*, Conn. Gen. Stat. §1-210(b)(5)(A-B). The State, however, has no obligation to initiate, prosecute or defend any legal proceeding or to seek a protective order or other similar relief to prevent disclosure of any information that is sought pursuant to a FOIA request. Should the State withhold such documentation from a Freedom of Information requester and a complaint be brought to the Freedom of Information Commission, the Contractor shall have the burden of cooperating with DOT in defense of that action and in terms of establishing the availability of any FOIA exemption in any proceeding where it is an issue. In no event shall the State have any liability for the disclosure of any documents or information in its possession which the State believes are required to be disclosed pursuant to the FOIA or other law.

14. Service of Process

The Contractor, if not a resident of the State of Connecticut, or, in the case of a partnership, the partners, if not residents, hereby appoints the Secretary of State of the State of Connecticut, and his successors in office, as agent for service of process for any action arising out of or as a result of this Contract; such appointment to be in effect throughout the life of this Contract and six (6) years thereafter.

15. Substitution of Securities for Retainages on State Contracts and Subcontracts

This Contract is subject to the provisions of Section 3-ll2a of the General Statutes of the State of Connecticut, as revised.

16. Health Insurance Portability and Accountability Act of 1996 (HIPAA)

The Contractor shall comply, if applicable, with the Health Insurance Portability and Accountability Act of 1996 and, pursuant thereto, the provisions attached at Exhibit E, and hereby made part of this Contract.

17. Forum and Choice of Law

Forum and Choice of Law. The parties deem the Contract to have been made in the City of Hartford, State of Connecticut. Both parties agree that it is fair and reasonable for the validity and construction of the Contract to be, and it shall be, governed by the laws and court decisions of the State of Connecticut, without giving effect to its principles of conflicts of laws. To the extent that any immunities provided by Federal law or the laws of the State of Connecticut do not bar an action against the State, and to the extent that these courts are courts of competent jurisdiction, for the purpose of venue, the complaint shall be made returnable to the Judicial District of Hartford only or shall be brought in the United States District Court for the District of Connecticut only, and shall not be transferred to any other court, provided, however, that nothing here constitutes a waiver or compromise of the sovereign immunity of the State of Connecticut. The Contractor waives any objection which it may now have or will have to the laying of venue of any Claims in any forum and further irrevocably submits to such jurisdiction in any suit, action or proceeding.

18. Summary of State Ethics Laws

Pursuant to the requirements of section 1-101qq of the Connecticut General Statutes, the summary of State ethics laws developed by the State Ethics Commission pursuant to section 1-81b of the Connecticut General Statutes is incorporated by reference into and made a part of the Contract as if the summary had been fully set forth in the Contract.

19. Audit and Inspection of Plants, Places of Business and Records

(a) The State and its agents, including, but not limited to, the Connecticut Auditors of Public Accounts, Attorney General and State's Attorney and their respective agents, may, at reasonable hours, inspect and examine all of the parts of the Contractor's and Contractor Parties' plants and places of business which, in any way, are related to, or involved in, the performance of this Contract. For the purposes of this Section, "Contractor Parties" means the Contractor's members, directors, officers, shareholders, partners, managers, principal officers, representatives, agents, servants, consultants, employees or any one of them or any other person or entity with whom the Contractor is in privity of oral or written contract and the Contractor intends for such other person or entity to Perform under the Contract in any capacity.

(b) The Contractor shall maintain, and shall require each of the Contractor Parties to maintain, accurate and complete Records. The Contractor shall make all of its and the Contractor Parties' Records available at all reasonable hours for audit and inspection by the State and its agents.

(c) The State shall make all requests for any audit or inspection in writing and shall provide the Contractor with at least twenty-four (24) hours' notice prior to the requested audit and inspection date. If the State suspects fraud or other abuse, or in the event of an emergency, the State is not obligated to provide any prior notice.

(d) The Contractor shall keep and preserve or cause to be kept and preserved all of its and Contractor Parties' Records until three (3) years after the latter of (i) final payment under this Agreement, or (ii) the expiration or earlier termination of this Agreement, as the same may be modified for any reason. The State may request an audit or inspection at any time during this period. If any Claim or audit is started before the expiration of this period, the Contractor shall retain or cause to be retained all Records until all Claims or audit findings have been resolved.

(e) The Contractor shall cooperate fully with the State and its agents in connection with an audit or inspection. Following any audit or inspection, the State may conduct and the Contractor shall cooperate with an exit conference.

(f) The Contractor shall incorporate this entire Section verbatim into any contract or other agreement that it enters into with any Contractor Party.

20.Campaign Contribution Restriction

For all State contracts, defined in Conn. Gen. Stat. §9-612(g)(1) as having a value in a calendar year of $50,000 or more, or a combination or series of such agreements or contracts having a value of $100,000 or more, the authorized signatory to this Agreement expressly acknowledges receipt of the State Elections Enforcement Commission's notice advising state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice, as set forth in "Notice to Executive Branch State Contractors and Prospective State Contractors of Campaign Contribution and Solicitation Limitations," attached as Exhibit F.

21. Tangible Personal Property

(a) The Contractor on its behalf and on behalf of its Affiliates, as defined below, shall comply with the provisions of Conn. Gen. Stat. §12-411b, as follows:

(1) For the term of the Contract, the Contractor and its Affiliates shall collect and remit to the State of Connecticut, Department of Revenue Services, any Connecticut use tax due under the provisions of Chapter 219 of the Connecticut General Statutes for items of tangible personal property sold by the Contractor or by any of its Affiliates in the same manner as if the Contractor and such Affiliates were engaged in the business of selling tangible personal property for use in Connecticut and had sufficient nexus under the provisions of Chapter 219 to be required to collect Connecticut use tax;

(2) A customer's payment of a use tax to the Contractor or its Affiliates relieves the customer of liability for the use tax;

(3) The Contractor and its Affiliates shall remit all use taxes they collect from customers on or before the due date specified in the Contract, which may not be later than the last day of the month next succeeding the end of a calendar quarter or other tax collection period during which the tax was collected;
(4) The Contractor and its Affiliates are not liable for use tax billed by them but not paid to them by a customer; and
(5) Any Contractor or Affiliate who fails to remit use taxes collected on behalf of its customers by the due date specified in the Contract shall be subject to the interest and penalties provided for persons required to collect sales tax under chapter 219 of the general statutes.

(b) For purposes of this section of the Contract, the word "Affiliate" means any person, as defined in section 12-1 of the general statutes, that controls, is controlled by, or is under common control with another person. A person controls another person if the person owns, directly or indirectly, more than ten per cent of the voting securities of the other person. The word "voting security" means a security that confers upon the holder the right to vote for the election of members of the board of directors or similar governing body of the business, or that is convertible into, or entitles the holder to receive, upon its exercise, a security that confers such a right to vote. "Voting security" includes a general partnership interest.

(c) The Contractor represents and warrants that each of its Affiliates has vested in the Contractor plenary authority to so bind the Affiliates in any agreement with the State of Connecticut. The Contractor on its own behalf and on behalf of its Affiliates shall also provide, no later than 30 days after receiving a request by the State's contracting authority, such information as the State may require to ensure, in the State's sole determination, compliance with the provisions of Chapter 219 of the Connecticut General Statutes, including, but not limited to, §12-411b.

22. Bid Rigging and/or Fraud – Notice to Contractor

The Connecticut Department of Transportation is cooperating with the U.S. Department of Transportation and the Justice Department in their investigation into highway construction contract bid rigging and/or fraud.

A toll-free "HOT LINE" telephone number 800-424-9071 has been established to receive information from contractors, subcontractors, manufacturers, suppliers or anyone with knowledge of bid rigging and/or fraud, either past or current. The "HOT LINE" telephone number will be available during normal working hours (8:00 am – 5:00 pm EST). Information will be treated confidentially and anonymity respected.

23. Consulting Agreement Affidavit

The Contractor shall comply with Connecticut General Statutes Section 4a-81(a) and 4a-81(b), as revised. Pursuant to Public Act 11-229, after the initial submission of the form, if there is a change in the information contained in the form, a contractor shall submit the updated form, as applicable, either (i) not later than thirty (30) days after the effective date of such change or (ii) prior to execution of any new contract, whichever is earlier.

The Affidavit/Form may be submitted in written format or electronic format through the Department of Administrative Services (DAS) website.

EXHIBIT A

FHWA-1273 -- Revised May 1, 2012

REQUIRED CONTRACT PROVISIONS

FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Nonsegregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Compliance with Governmentwide Suspension and Debarment Requirements
XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the

assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential

minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26, and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26, in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating

areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or

any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is

registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit

any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under

construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered

transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with

obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency,

a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

EXHIBIT B

FEDERAL TRANSIT ADMINISTRATION

Construction Contracts Required Clauses

1. Notification of Federal Participation
2. Fly America Requirements
3. Buy America Requirements (See Certification - Exhibit A, page 24)
4. Cargo Preference Requirements
5. Seismic Safety Requirements
6. Energy Conservation Requirements
7. Clean Water Requirements
8. Lobbying (See Certification - Exhibit B, page 25)
9. Access to Records and Reports
10. Federal Changes
11. Bonding Requirements
12. Clean Air
13. Recycled Products
14. Davis-Bacon and Copeland Anti-Kickback Acts
15. Contract Work Hours and Safety Standards Act
16. No Government Obligation to Third Parties
17. Program Fraud and False or Fraudulent Statements and Related Acts
18. Termination
19. Government-wide Debarment and Suspension (Nonprocurement)
20. Civil Rights Requirements
21. Breaches and Dispute Resolution
22. Transit Employee Protective Agreements
23. Disadvantaged Business Enterprises (DBE)
24. Incorporation of Federal Transit Administration (FTA) Terms
25. Access for Individuals with Disabilities
26. National Intelligent Transportation Systems Architecture and Standards
27. Assignability Clause

1. NOTIFICATION OF FEDERAL PARTICIPATION

To the extent required by law, the State agrees that any request for proposals, solicitation, award notice, press release, or other publication involving the distribution of FTA assistance for the Program or the Project having an aggregate value of $500,000 or more, shall indicate that FTA is the Federal agency that is providing the Federal assistance, the Catalog of Federal Domestic Assistance Number of the program from which the Federal assistance is authorized, as may be applicable, and the amount of Federal assistance FTA provided.

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2. FLY AMERICA REQUIREMENTS
49 U.S.C. § 40118
41 CFR Part 301-10

Applicability to Contracts

The Fly America requirements apply to the transportation of persons or property, by air, between a place in the U.S. and a place outside the U.S., or between places outside the U.S., when the FTA will participate in the costs of such air transportation. Transportation on a foreign air carrier is permissible when provided by a foreign air carrier under a code share agreement when the ticket identifies the U.S. air carrier's designator code and flight number. Transportation by a foreign air carrier is also permissible if there is a bilateral or multilateral air transportation agreement to which the U.S. Government and a foreign government are parties and which the Federal DOT has determined meets the requirements of the Fly America Act.

Flow Down Requirements

The Fly America requirements flow down from FTA recipients and subrecipients to first tier contractors, who are responsible for ensuring that lower tier contractors and subcontractors are in compliance.

Fly America Requirements

The Contractor agrees to comply with 49 U.S.C. 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and subrecipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

3. BUY AMERICA REQUIREMENTS
49 U.S.C. 5323(j)
49 CFR Part 661

Applicability to Contracts
The Buy America requirements apply to the following types of contracts: Construction Contracts and Acquisition of Goods or Rolling Stock (valued at more than $100,000).

Flow Down
The Buy America requirements flow down from FTA recipients and subrecipients to first tier contractors, who are responsible for ensuring that lower tier contractors and subcontractors are in compliance. The $100,000 threshold applies only to the grantee contract, subcontracts under that amount are subject to Buy America.

Buy America - The contractor agrees to comply with 49 U.S.C. 5323(j) and 49 C.F.R. Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 C.F.R. 661.7, and include final assembly in the United States for 15 passenger vans and 15 passenger wagons produced by Chrysler Corporation, and microcomputer equipment and software. Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C) and 49 C.F.R. 661.11. Rolling stock must be assembled in the United States and have a 60 percent domestic content.

A bidder or offeror must submit to the FTA recipient the appropriate Buy America certification (See Exhibit A of these FTA required clauses) with all bids or offers on FTA-funded contracts, except those subject to a general waiver. Bids or offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive. This requirement does not apply to lower tier subcontractors.

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4. CARGO PREFERENCE REQUIREMENTS
46 U.S.C. 1241
46 CFR Part 381

Applicability to Contracts
The Cargo Preference requirements apply to all contracts involving equipment, materials, or commodities which may be transported by ocean vessels.

Flow Down
The Cargo Preference requirements apply to all subcontracts when the subcontract may be involved with the transport of equipment, material, or commodities by ocean vessel.
Cargo Preference - Use of United States-Flag Vessels - The contractor agrees: a. to use privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels; b. to furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of leading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of -lading in English for

each shipment of cargo described in the preceding paragraph to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (through the contractor in the case of a subcontractor's bill-of-lading.) c. to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.

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5. SEISMIC SAFETY REQUIREMENTS
42 U.S.C. 7701 et seq. 49
CFR Part 41

Applicability to Contracts
The Seismic Safety requirements apply only to contracts for the construction of new buildings or additions to existing buildings.

Flow Down
The Seismic Safety requirements flow down from FTA recipients and subrecipients to first tier contractors to assure compliance, with the applicable building standards for Seismic Safety, including the work performed by all subcontractors.

Seismic Safety - The contractor agrees that any new building or addition to an existing building will be designed and constructed in accordance with the standards for Seismic Safety required in Department of Transportation Seismic Safety Regulations 49 CFR Part 41 and will certify to compliance to the extent required by the regulation. The contractor also agrees to ensure that all work performed under this contract including work performed by a subcontractor is in compliance with the standards required by the Seismic Safety Regulations and the certification of compliance issued on the project.

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6. ENERGY CONSERVATION REQUIREMENTS
42 U.S.C. 6321 et seq.
49 CFR Part 18

Applicability to Contracts
The Energy Conservation requirements are applicable to all contracts.

Flow Down
The Energy Conservation requirements extend to all third party contractors and their contracts at every tier and subrecipients and their subagreements at every tier.

Energy Conservation - The contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

7. CLEAN WATER REQUIREMENTS
33 U.S.C. 1251

Applicability to Contracts
The Clean Water requirements apply to each contract and subcontract which exceeds $100,000.

Flow Down
The Clean Water requirements flow down to FTA recipients and subrecipients at every tier.

Clean Water - (1) The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

(2) The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

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8. LOBBYING
31 U.S.C. 1352
49 CFR Part 19
49 CFR Part 20

Applicability to Contracts
The Lobbying requirements apply to Construction/Architectural and Engineering/Acquisition of Rolling Stock/Professional Service Contract/Operational Service Contract/Turnkey contracts.

Flow Down
The Lobbying requirements mandate the maximum flow down, pursuant to Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352(b)(5) and 49 C.F.R. Part 19, Appendix A, Section 7.

Byrd Anti-Lobbying Amendment, 31 U.S.C. 1352, as amended by the Lobbying Disclosure Act of 1995, P.L. 104-65 [to be codified at 2 U.S.C. § 1601, et seq.] - Contractors who apply or bid for an award of $100,000 or more **shall file the certification required (See Exhibit B of these FTA required clauses)** by 49 CFR part 20, "New Restrictions on Lobbying." Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-Federal funds with respect to that Federal contract, grant or award covered by 31 U.S.C. 1352. Such disclosures are forwarded from tier to tier up to the recipient.

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9. ACCESS TO RECORDS AND REPORTS
49 U.S.C. 5325
18 CFR 18.36 (i)
49 CFR 633.17

Applicability to Contracts
Reference Chart "Requirements for Access to Records and Reports by Type of Contracts"

Flow Down
FTA does not require the inclusion of these requirements in subcontracts.

Access to Records - The following access to records requirements apply to this Contract:

1. Where the Purchaser is not a State but a local government and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 C.F.R. 18.36(i), the Contractor agrees to provide the Purchaser, the FTA Administrator, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 C.F.R. 633.17 to provide the FTA Administrator or his authorized representatives including any PMO Contractor access to Contractor's records and construction sites pertaining to a major capital project, defined at 49 U.S.C. 5302(a)1, which is receiving federal financial assistance through the programs described at 49 U.S.C. 5307, 5309 or 5311.

2. Where the Purchaser is a State and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 C.F.R. 633.17, Contractor agrees to provide the Purchaser, the FTA Administrator or his authorized representatives, including any PMO Contractor, access to the Contractor's records and construction sites pertaining to a major capital project, defined at 49 U.S.C. 5302(a)1, which is receiving federal financial assistance through the programs described at 49 U.S.C. 5307, 5309 or 5311. By definition, a major capital project excludes contracts of less than the simplified acquisition threshold currently set at $100,000.

3. Where the Purchaser enters into a negotiated contract for other than a small purchase or under the simplified acquisition threshold and is an institution of higher education, a hospital or other non-profit organization and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 C.F.R. 19.48, Contractor agrees to provide the Purchaser, FTA Administrator, the Comptroller General of the United States or any of their duly authorized representatives with access to any books, documents, papers and record of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions.

4. Where any Purchaser which is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 U.S.C. 5325(a) enters into a contract for a capital project or improvement (defined at 49 U.S.C. 5302(a)1) through other than competitive bidding, the Contractor shall make available records related to the contract to the Purchaser, the Secretary of Transportation and the Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.

5. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

6. The Contractor agrees to maintain all books, records, accounts and reports required under this contract for a period of not less than three years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until the Purchaser, the FTA Administrator, the Comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18.39(i)(11).

7. FTA does not require the inclusion of these requirements in subcontracts.

Requirements for Access to Records and Reports by Types of Contract

Contract Characteristics		Operational Service Contract	Turnkey	Construction	Architectural Engineering	Acquisition of Rolling Stock	Professional Services
I State Grantees a. Contracts below SAT ($100,000) b. Contracts above $100,000/Capital Projects		None None unless[1] non-competitive award	Those imposed on state pass thru to Contractor	None Yes, if non-competitive award or if funded thru[2] 5307/5309/5311	None None unless non-competitive award	None None unless non-competitive award	None None unless non-competitive award
II Non State Grantees a. Contracts below SAT ($100,000) b. Contracts above $100,000/Capital Projects		Yes[3] Yes[3]	Those imposed on non-state Grantee pass thru to Contractor	Yes Yes	Yes Yes	Yes Yes	Yes Yes

Sources of Authority:
[1] 49 USC 5325 (a)
[2] 49 CFR 633.17
[3] 18 CFR 18.36 (i)

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10. FEDERAL CHANGES
49 CFR Part 18

Applicability to Contracts
The Federal Changes requirement applies to all contracts.

Flow Down
The Federal Changes requirement flows down appropriately to each applicable changed requirement.

Federal Changes - Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

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11. BONDING REQUIREMENTS

Refer to the Standard Specifications for Roads, Bridges and Incidental Construction, FORM 816, Section 1.02.01 – "Contract Bidding and Award" - Bonding requirements are addressed in the Connecticut Department of Transportation's Construction Contract Bidding and Award Manual.

12. CLEAN AIR
42 U.S.C. 7401 et seq
40 CFR 15.61
49 CFR Part 18

Applicability to Contracts
The Clean Air requirements apply to all contracts exceeding $100,000, including indefinite quantities where the amount is expected to exceed $100,000 in any year.

Flow Down
The Clean Air requirements flow down to all subcontracts which exceed $100,000.

Clean Air - (1) The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq. The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

(2) The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

13. RECYCLED PRODUCTS
42 U.S.C. 6962
40 CFR Part 247
Executive Order 12873

Applicability to Contracts
The Recycled Products requirements apply to all contracts for items designated by the EPA, when the purchaser or contractor procures $10,000 or more of one of these items during the fiscal year, or has procured $10,000 or more of such items in the previous fiscal year, using Federal funds. New requirements for "recovered materials" will become effective May 1, 1996. These new regulations apply to all procurement actions involving items designated by the EPA, where the procuring agency purchases $10,000 or more of one of these items in a fiscal year, or when the cost of such items purchased during the previous fiscal year was $10,000.

Flow Down
These requirements flow down to all contractor and subcontractor tiers.

Recovered Materials - The contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

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14. DAVIS-BACON AND COPELAND ANTI-KICKBACK ACTS

Background and Application

The Davis-Bacon and Copeland Acts are codified at 40 USC 3141, *et seq.* and 18 USC 874. The Acts apply to grantee construction contracts and subcontracts that "at least partly are financed by a loan or grant from the Federal Government." 40 USC 3145(a), 29 CFR 5.2(h), 49 CFR 18.36(i)(5). The Acts apply to any construction contract over $2,000. 40 USC 3142(a), 29 CFR 5.5(a). 'Construction,' for purposes of the Acts, includes "actual construction, alteration and/or repair, including painting and decorating." 29 CFR 5.5(a). The requirements of both Acts are incorporated into a single clause (*see* 29 CFR 3.11) enumerated at 29 CFR 5.5(a) and reproduced below.

The clause language is drawn directly from 29 CFR 5.5(a) and any deviation from the model clause below should be coordinated with counsel to ensure the Acts' requirements are satisfied.

Davis-Bacon and Copeland Anti-Kickback Acts

(1) **Minimum wages -** (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) Except with respect to helpers as defined as 29 CFR 5.2(n)(4), the work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) With respect to helpers as defined in 29 CFR 5.2(n)(4), such a classification prevails in the area in which the work is performed.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(v)(A) The contracting officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination with 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(v) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(2) **Withholding** - The State shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) **Payrolls and basic records** - (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain

records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the State for transmission to the Federal Transit Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5 and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Transit Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) **Apprentices and trainees** - (i) Apprentices - Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division of the U.S. Department of Labor determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees - Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity - The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) **Compliance with Copeland Act requirements** - The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) **Subcontracts** - The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal Transit Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) **Contract termination: debarment** - A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) **Compliance with Davis-Bacon and Related Act requirements** - All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) **Disputes concerning labor standards** - Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) **Certification of eligibility** - (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

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15. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Background and Application

The Contract Work Hours and Safety Standards Act is codified at 40 USC 3701, *et seq.* The Act applies to grantee contracts and subcontracts "financed at least in part by loans or grants from … the

[Federal] Government." 40 USC 3701(b)(1)(B)(iii) and (b)(2), 29 CFR 5.2(h), 49 CFR 18.36(i)(6). Although the original Act required its application in any construction contract over $2,000 or non-construction contract to which the Act applied over $2,500 (and language to that effect is still found in 49 CFR 18.36(i)(6)), the Act no longer applies to any "contract in an amount that is not greater than $100,000." 40 USC 3701(b)(3) (A)(iii).

The Act applies to construction contracts and, in very limited circumstances, non-construction projects that employ "laborers or mechanics on a public work." These non-construction applications do not generally apply to transit procurements because transit procurements (to include rail cars and buses) are deemed "commercial items." 40 USC 3707, 41 USC 403 (12). A grantee that contemplates entering into a contract to procure a developmental or unique item should consult counsel to determine if the Act applies to that procurement and that additional language required by 29 CFR 5.5(c) must be added to the basic clause below.

Contract Work Hours and Safety Standards

(1) **Overtime requirements** - No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) **Violation; liability for unpaid wages; liquidated damages** - In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

(3) **Withholding for unpaid wages and liquidated damages** - The (***write in the name of the grantee***) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

(4) **Subcontracts** - The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section

16. NO GOVERNMENT OBLIGATION TO THIRD PARTIES

Applicability to Contracts
Applicable to all contracts.

Flow Down
Not required by statute or regulation for either primary contractors or subcontractors, this concept should flow down to all levels to clarify, to all parties to the contract, that the Federal Government does not have contractual liability to third parties, absent specific written consent.

No Obligation by the Federal Government.

(1) The Purchaser and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the Purchaser, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

(2) The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

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17. PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS AND RELATED ACTS

31 U.S.C. 3801 et seq.
49 CFR Part 31 18 U.S.C. 1001
49 U.S.C. 5307

Applicability to Contracts
These requirements are applicable to all contracts.

Flow Down
These requirements flow down to contractors and subcontractors who make, present, or submit covered claims and statements.

Program Fraud and False or Fraudulent Statements or Related Acts.

(1) The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil
Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

(2) The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.

(3) The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

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18. TERMINATION

Refer to the Standard Specifications for Roads, Bridges and Incidental Construction FORM 816 Section 1.05.14

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19. GOVERNMENT-WIDE DEBARMENT AND SUSPENSION (NONPROCUREMENT)

Background and Applicability

In conjunction with the Office of Management and Budget and other affected Federal agencies, DOT published an update to 49 CFR Part 29 on November 26, 2003. This government-wide regulation implements Executive Order 12549, *Debarment and Suspension*, Executive Order 12689, *Debarment and Suspension*, and 31 U.S.C. 6101 note (Section 2455, Public Law 103-355, 108 Stat. 3327).

The provisions of Part 29 apply to all grantee contracts and subcontracts at any level expected to equal or exceed $25,000 as well as any contract or subcontract (at any level) for Federally required auditing services. 49 CFR 29.220(b). This represents a change from prior practice in that the dollar threshold for application of these rules has been lowered from $100,000 to $25,000. These are contracts and subcontracts referred to in the regulation as "covered transactions."

Grantees, contractors, and subcontractors (at any level) that enter into covered transactions are required to verify that the entity (as well as its principals and affiliates) they propose to contract or subcontract with is not excluded or disqualified. They do this by (a) Checking the Excluded Parties List System, (b) Collecting a certification from that person, or (c) Adding a clause or condition to the contract or subcontract. This represents a change from prior practice in that certification is still acceptable but is no longer required. 49 CFR 29.300.

Grantees, contractors, and subcontractors who enter into covered transactions also must require the entities they contract with to comply with 49 CFR 29, subpart C and include this requirement in their own subsequent covered transactions (i.e., the requirement flows down to subcontracts at all levels).

Suspension and Debarment

This contract is a covered transaction for purposes of 49 CFR Part 29. As such, the contractor is required to verify that none of the contractor, its principals, as defined at 49 CFR 29.995, or affiliates, as defined at 49 CFR 29.905, are excluded or disqualified as defined at 49 CFR 29.940 and 29.945.

The contractor is required to comply with 49 CFR 29, Subpart C and must include the requirement to comply with 49 CFR 29, Subpart C in any lower tier covered transaction it enters into.
By signing and submitting its bid or proposal, the bidder or proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by Connecticut Department of Transportation. If it is later determined that the bidder or proposer knowingly rendered an erroneous certification, in addition to remedies available to Connecticut Department of Transportation., the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The bidder or proposer agrees to comply with the requirements of 49 CFR 29, Subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

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20. CIVIL RIGHTS REQUIREMENTS

29 U.S.C. § 623, 42 U.S.C. § 2000
42 U.S.C. § 6102, 42 U.S.C. § 12112
42 U.S.C. § 12132, 49 U.S.C. § 5332
29 CFR Part 1630, 41 CFR Parts 60 et seq.

Applicability to Contracts
The Civil Rights Requirements apply to all contracts.

Flow Down
The Civil Rights requirements flow down to all third party contractors and their contracts at every tier.
Model Clause/Language
The following clause was predicated on language contained at 49 CFR Part 19, Appendix A, but FTA has shortened the lengthy text.

Civil Rights - The following requirements apply to the underlying contract:

(1) Nondiscrimination - In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

(2) Equal Employment Opportunity - The following equal employment opportunity requirements apply to the underlying contract:
(a) Race, Color, Creed, National Origin, Sex - In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to

take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(b) Age - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(c) Disabilities - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(3) The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

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21. BREACHES AND DISPUTE RESOLUTION

Refer to the Standard Specifications for Roads, Bridges and Incidental Construction, FORM 816, Sections 1.05.01 and 1.08.01 and Connecticut General Statue 4-61(as amended)

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22. TRANSIT EMPLOYEE PROTECTIVE AGREEMENTS
49 U.S.C. § 5310, § 5311, and § 5333
29 CFR Part 215

Applicability to Contracts

The Transit Employee Protective Provisions apply to each contract for transit operations performed by employees of a Contractor recognized by FTA to be a transit operator. (Because transit operations involve many activities apart from directly driving or operating transit vehicles, FTA determines which activities constitute transit "operations" for purposes of this clause.)

Flow Down

These provisions are applicable to all contracts and subcontracts at every tier.

Transit Employee Protective Provisions. (1) The Contractor agrees to the comply with applicable transit employee protective requirements as follows:

(a) General Transit Employee Protective Requirements - To the extent that FTA determines that transit operations are involved, the Contractor agrees to carry out the transit operations work on the underlying contract in compliance with terms and conditions determined by the U.S. Secretary of Labor to be fair and equitable to protect the interests of employees employed under this contract and to meet the employee protective requirements of 49 U.S.C. A 5333(b), and U.S. DOL guidelines at 29

C.F.R. Part 215, and any amendments thereto. These terms and conditions are identified in the letter of certification from the U.S. DOL to FTA applicable to the FTA Recipient's project from which Federal assistance is provided to support work on the underlying contract. The Contractor agrees to carry out that work in compliance with the conditions stated in that U.S. DOL letter. The requirements of this subsection (1), however, do not apply to any contract financed with Federal assistance provided by FTA either for projects for elderly individuals and individuals with disabilities authorized by 49 U.S.C. § 5310(a)(2), or for projects for nonurbanized areas authorized by 49 U.S.C. § 5311. Alternate provisions for those projects are set forth in subsections (b) and (c) of this clause.

(b) Transit Employee Protective Requirements for Projects Authorized by 49 U.S.C. § 5310(a)(2) for Elderly Individuals and Individuals with Disabilities - If the contract involves transit operations financed in whole or in part with Federal assistance authorized by 49 U.S.C. § 5310(a)(2), and if the U.S. Secretary of Transportation has determined or determines in the future that the employee protective requirements of 49 U.S.C. § 5333(b) are necessary or appropriate for the state and the public body subrecipient for which work is performed on the underlying contract, the Contractor agrees to carry out the Project in compliance with the terms and conditions determined by the U.S. Secretary of Labor to meet the requirements of 49 U.S.C. § 5333(b), U.S. DOL guidelines at 29 C.F.R. Part 215, and any amendments thereto. These terms and conditions are identified in the U.S. DOL's letter of certification to FTA, the date of which is set forth Grant Agreement or Cooperative Agreement with the state. The Contractor agrees to perform transit operations in connection with the underlying contract in compliance with the conditions stated in that U.S. DOL letter.

(c) Transit Employee Protective Requirements for Projects Authorized by 49 U.S.C. § 5311 in Nonurbanized Areas - If the contract involves transit operations financed in whole or in part with Federal assistance authorized by 49 U.S.C. § 5311, the Contractor agrees to comply with the terms and conditions of the Special Warranty for the Nonurbanized Area Program agreed to by the U.S. Secretaries of Transportation and Labor, dated May 31, 1979, and the procedures implemented by U.S. DOL or any revision thereto.

(2) The Contractor also agrees to include the any applicable requirements in each subcontract involving transit operations financed in whole or in part with Federal assistance provided by FTA.

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23. DISADVANTAGED BUSINESS ENTERPRISE (DBE)

Refer to the Special Provision section titled D.B.E. Subcontractors and Material Suppliers or Manufacturers

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24. INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION (FTA) TERMS
FTA Circular 4220.1F

Applicability to Contracts
The incorporation of FTA terms applies to all contracts.

Flow Down
The incorporation of FTA terms has unlimited flow down.

Incorporation of Federal Transit Administration (FTA) Terms - The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in

the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1F, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any (name of grantee) requests which would cause (name of grantee) to be in violation of the FTA terms and conditions.

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25. ACCESS FOR INDIVIDUALS WITH DISABILITY

The Contactor agrees to comply with 49 U.S.C. § 5301(d), which states the Federal policy that elderly individuals and individuals with disabilities have the same right as other individuals to use public transportation services and facilities, and that special efforts shall be made in planning and designing those services and facilities to implement transportation accessibility rights for elderly individuals and individuals with disabilities. The Contractor also agrees to comply with all applicable provisions of section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of disability in the administration of programs or activities receiving.

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26. NATIONAL INTELLIGENT TRANSPORTATION SYSTEMS ARCHITECURE AND STANDARDS

To the extent applicable, the Contractor agrees to conform to the National Intelligent Transportation Systems (ITS) Architecture and Standards as required by SAFETEA-LU § 5307(c), 23 U.S.C. § 512 note, and follow the provisions of FTA Notice, "FTA National ITS Architecture Policy on Transit Projects," 66 *Fed. Reg.* 1455 *et seq*., January 8, 2001, and any other implementing directives FTA may issue at a later date, except to the extent FTA determines otherwise in writing.

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27. ASSIGNABILITY CLAUSE

The State agrees to comply with applicable third party procurement requirements of 49 U.S.C. chapter 53, and ensure that for piggybacking purchases made with FTA-assistance, that contract utilized contains assignability clause that authorizes such piggybacking purchases.

Exhibit A of FTA Requirements

Certification requirement for procurement of steel, iron, or manufactured products.

Certificate of Compliance with 49 U.S.C. 5323(j)(1)

The bidder or offeror hereby certifies that it will meet the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 C.F.R. Part 661.5.

Date _____

Signature _____

Company Name _____

Title _____

Certificate of Non-Compliance with 49 U.S.C. 5323(j)(1)

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1) and 49 C.F.R. 661.5, but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7.

Date _____

Signature _____

Company Name _____

Title _____

Exhibit B of FTA Requirements

(To be submitted with each bid or offer exceeding $100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form--LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, *et seq.*)]

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq.*, apply to this certification and disclosure, if any.

_____ Signature of Contractor's Authorized Official

_____ Name and Title of Contractor's Authorized Official

_____ Date

EXHIBIT C

TITLE VI CONTRACTOR ASSURANCES

During the performance of this Contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "Contractor") agrees as follows:

1. **Compliance with Regulations:** The Contractor shall comply with the regulations relative to nondiscrimination in federally assisted programs of the United States Department of Transportation (hereinafter, "USDOT"), Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the "Regulations"), which are herein incorporated by reference and made a part of this contract.

2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the Contract, shall not discriminate on the grounds of race, color, national origin, sex, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by Subsection 5 of the Regulations, including employment practices when the Contract covers a program set forth in Appendix B of the Regulations.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:**
In all solicitations either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the Contractor of the Contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, national origin, sex, age, or disability.

4. **Information and Reports:** The Contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Connecticut Department of Transportation (ConnDOT) or the Funding Agency (FHWA, FTA and FAA) to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to ConnDOT or the Funding Agency, as appropriate, and shall set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of the Contractor's noncompliance with the nondiscrimination provisions of this Contract, the ConnDOT shall impose such sanctions as it or the Funding Agency may determine to be appropriate, including, but not limited to:

A. Withholding contract payments until the Contractor is in-compliance; and/or
B. Cancellation, termination, or suspension of the Contract, in whole or in part.

6. **Incorporation of Provisions:** The Contractor shall include the provisions of paragraphs 1 through 5 in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations or directives issued pursuant thereto. The Contractor shall take such action with respect to any subcontract or procurement as the ConnDOT or the Funding Agency may -direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the Contractor may request the ConnDOT to enter into such litigation to protect the interests of the Funding Agency, and, in addition, the Contractor may request the United States to enter into such litigation to protect the interests of the United States

EXHIBIT D

CONTRACTOR WORKFORCE UTILIZATION (FEDERAL EXECUTIVE ORDER 11246) / EQUAL EMPLOYMENT OPPORTUNITY (Federal - FHWA)

1. **Project Workforce Utilization Goals:**
   These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted or funded) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where the work is actually performed.

   Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications which contain the applicable goals for minority and female participation.

   The goals for minority and female utilization are expressed in percentage terms for the contractor's aggregate work-force in each trade on all construction work in the covered area, are referenced in the attached Appendix A.

2. **Executive Order 11246**
   The Contractor's compliance with Executive Order 11246 and 41-CFR Part 60-4 shall be based on its implementation of the specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(A) and its efforts to meet the goals established for the geographical area where the contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hour performed.

   If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or subcontractors toward a goal in an approved Pan does not excuse any covered Contractor's of subcontractor's failure to take good faith efforts to achieve the plan goals and timetables.

   The Contractor shall implement the specific affirmative action standards provided in a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in

which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form and such notices may be obtained from any Office of Federal Contract Compliance Programs (OFCCP) Office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractors obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant hereto.

In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites; and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off the street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason thereafter; along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the Union or Unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or women sent by the Contractor, or when the Contractor has other

information that the Union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO Policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company EEO Policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment, decisions including specific Foreman, etc. prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO Policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work-force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and

employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review at least annually of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (a through p). The efforts of a contractor association, joint contractor union, contractor community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work-force participation, makes a good faith effort to meet with individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of Executive Order 11246 if a particular group is employed in a substantially disparate manner, (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized).

The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in these

specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4 8.

The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status, (e.g. mechanic, apprentice, trainee, helper, or laborer) dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

Nothing herein provided shall be construed as a limitation upon the application of their laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

The Director of the Office of Federal Contract Compliance Programs, from time to time, shall issue goals and timetables for minority and female utilization which shall be based on appropriate work-force, demographic or other relevant data and which shall cover construction projects or construction contracts performed in specific geographical areas. The goals, which shall be applicable to each construction trade in a covered contractor's or timetables, shall be published as notices in the Federal Register, and shall be inserted by the Contracting officers and applicants, as applicable, in the Notice required by 41 CFR 60-4.2.

FEDERALLY FUNDED OR ASSISTED PROJECTS
APPENDIX A
(Labor Market Goals)

Standard Metropolitan Statistical Area (SMSA)

Female **Minority**

Bridgeport – Stamford – Norwalk – Danbury			**10.2%**
6.9%			
Bethel	Bridgeport	Brookfield	Danbury
Darien	Derby	Easton	Fairfield
Greenwich	Milford	Monroe	New Canaan
New Fairfield	Newton	Norwalk	Redding
Shelton	Stamford	Stratford	Trumbull
Weston	Westport	Wilton	

Hartford – Bristol – New Britain			**6.9%**
6.9%			
Andover	Avon	Berlin	Bloomfield
Bolton	Bristol	Burlington	Canton
Colchester	Columbia	Coventry	Cromwell
East Granby	East Hampton	East Hartford	East Windsor
Ellington	Enfield	Farmington	Glastonbury
Granby	Hartford	Hebron	Manchester
Marlborough	New Britain	New Hartford	Newington
Plainville	Plymouth	Portland	Rocky Hill
Simsbury	South Windsor	Southington	Stafford
Suffield	Tolland	Vernon	West Hartford
Wethersfield	Willington	Windsor	Windsor Locks

New Haven – Waterbury – Meriden			**9.0%**
6.9%			
Beacon Falls	Bethany	Branford	Cheshire
Clinton	East Haven	Guilford	Hamden
Madison	Meriden	Middlebury	Naugatuck
New Haven	North Branford	North Haven	Orange
Prospect	Southbury	Thomaston	Wallingford
Waterbury	Watertown	West Haven	Wolcott
Woodbridge	Woodbury		

New London – Norwich			**4.5%**
6.9%			
Bozrah	East Lyme	Griswold	Groton
Ledyard	Lisbon	Montville	New London
Norwich	Old Lyme	Old Saybrook	Preston
Sprague	Stonington	Waterford	

Non SMSA

Female				**Minority**
Litchfield – Windham				**5.9%**
6.9%				
Abington	Ashford	Ballouville	Bantam	
Barkhamsted	Bethlehem	Bridgewater	Brooklyn	
Canaan	Canterbury	Central Village	Cahplin	
Colebrook	Cornwall	Cornwall Bridge	Danielson	
Dayville	East Canaan	East Killingly	East Woodstock	
Eastford	Falls Village	Gaylordsville	Goshen	
Grosvenor Dale	Hampton	Harwinton	Kent	
Killignly	Lakeside	Litchfield	Moosup	
Morris	New Milford	New Preston	New Preston Marble Dale	
Norfolk	North Canaan	No. Grosvenordale	North Windham	
Oneco	Pequabuck	Pine Meadow	Plainfield	
Pleasant Valley	Pomfret	Pomfret Center	Putnam	
Quinebaug	Riverton	Rogers	Roxbury	
Salisbury	Scotland	Sharon	South Kent	
South Woodstock	Sterling	Taconic	Terryville	
Thompson	Torrington	Warren	Warrenville	
Washington	Washington Depot	Wauregan	West Cornwall	
Willimantic	Winchester	Winchester Center	Windham	
Winsted	Woodstock	Woodstock Valley		

EXHIBIT E

Health Insurance Portability and Accountability Act of 1996 ("HIPAA").

(a) If the Contactor is a Business Associate under the requirements of the Health Insurance Portability and Accountability Act of 1996 ("HIPAA"), the Contractor must comply with all terms and conditions of this Section of the Contract. If the Contractor is not a Business Associate under HIPAA, this Section of the Contract does not apply to the Contractor for this Contract.

(b) The Contractor is required to safeguard the use, publication and disclosure of information on all applicants for, and all clients who receive, services under the Contract in accordance with all applicable federal and state law regarding confidentiality, which includes but is not limited to HIPAA, more specifically with the Privacy and Security Rules at 45 C.F.R. Part 160 and Part 164, subparts A, C, and E; and

(c) The State of Connecticut Agency named on page 1 of this Contract (hereinafter the "Department") is a "covered entity" as that term is defined in 45 C.F.R. § 160.103; and

(d) The Contractor, on behalf of the Department, performs functions that involve the use or disclosure of "individually identifiable health information," as that term is defined in 45 C.F.R. § 160.103; and

(e) The Contractor is a "business associate" of the Department, as that term is defined in 45 C.F.R. § 160.103; and

(f) The Contractor and the Department agree to the following in order to secure compliance with the HIPAA, the requirements of Subtitle D of the Health Information Technology for Economic and Clinical Health Act (hereinafter the HITECH Act), (Pub. L. 111-5, sections 13400 to 13423), and more specifically with the Privacy and Security Rules at 45 C.F.R. Part 160 and Part 164, subparts A, C, and E.

(g) Definitions

(1) "Breach shall have the same meaning as the term is defined in section 13400 of the HITECH Act (42 U.S.C. §17921(1))

(2) "Business Associate" shall mean the Contractor.

(3) "Covered Entity" shall mean the Department of the State of Connecticut named on page 1 of this Contract.

(4) "Designated Record Set" shall have the same meaning as the term "designated record set" in 45 C.F.R. § 164.501.

(5) "Electronic Health Record" shall have the same meaning as the term is defined in section 13400 of the HITECH Act (42 U.S.C. §17921(5))

(6) "Individual" shall have the same meaning as the term "individual"' in 45 C.F.R. § 160.103 and shall include a person who qualifies as a personal representative as defined in 45 C.F.R. § 164.502(g).

(7) "Privacy Rule" shall mean the Standards for Privacy of Individually Identifiable Health Information at 45 C.F.R. part 160 and parts 164, subparts A and E.

(8) "Protected Health Information" or "PHI" shall have the same meaning as the term "protected health information" in 45 C.F.R. § 160.103, limited to information created or received by the Business Associate from or on behalf of the Covered Entity.

(9) "Required by Law"' shall have the same meaning as the term "required by law" in 45 C.F.R. § 164.103.

(10) "Secretary" shall mean the Secretary of the Department of Health and Human Services or his designee.

(11) "More stringent" shall have the same meaning as the term "more stringent" in 45 C.F.R. § 160.202.

(12) "This Section of the Contract" refers to the HIPAA Provisions stated herein, in their entirety.

(13) "Security Incident" shall have the same meaning as the term "security incident" in 45 C.F.R.§ 164.304.

(14) "Security Rule" shall mean the Security Standards for the Protection of Electronic Protected Health Information at 45 C.F.R. part 160 and parts 164, subpart A and C.

(15) "Unsecured protected health information" shall have the same meaning as the term as defined in section 13402(h)(1)(A) of HITECH. Act. (42 U.S.C. §17932(h)(1)(A)).

(h) Obligations and Activities of Business Associates.

(1) Business Associate agrees not to use or disclose PHI other than as permitted or required by this Section of the Contract or as Required by Law.

(2) Business Associate agrees to use appropriate safeguards to prevent use or disclosure of PHI other than as provided for in this Section of the Contract.

(3) Business Associate agrees to use administrative, physical and technical safeguards that reasonably and appropriately protect the confidentiality, integrity, and availability of electronic protected health information that it creates, receives, maintains, or transmits on behalf of the Covered Entity.

(4) Business Associate agrees to mitigate, to the extent practicable, any harmful effect that is known to the Business Associate of a use or disclosure of PHI by Business Associate in violation of this Section of the Contract.

(5) Business Associate agrees to report to Covered Entity any use or disclosure of PHI not provided for by this Section of the Contract or any security incident of which it becomes aware.

(6) Business Associate agrees to insure that any agent, including a subcontractor, to whom it provides PHI received from, or created or received by Business Associate, on behalf of the Covered Entity, agrees to the same restrictions and conditions that apply through this Section of the Contract to Business Associate with respect to such information.

(7) Business Associate agrees to provide access, at the request of the Covered Entity, and in the time and manner agreed to by the parties, to PHI in a Designated Record Set, to Covered Entity or, as directed by Covered Entity, to an Individual in order to meet the requirements under 45 C.F.R. § 164.524.

(8) Business Associate agrees to make any amendments to PHI in a Designated Record Set that the Covered Entity directs or agrees to pursuant to 45 C.F.R. § 164.526 at the request of the Covered Entity, and in the time and manner agreed to by the parties.

(9) Business Associate agrees to make internal practices, books, and records, including policies and procedures and PHI, relating to the use and disclosure of PHI received from, or created or received by, Business Associate on behalf of Covered Entity, available to Covered Entity or to the Secretary in a time and manner agreed to by the parties or designated by the Secretary, for purposes of the Secretary determining Covered Entity's compliance with the Privacy Rule.

(10) Business Associate agrees to document such disclosures of PHI and information related to such disclosures as would be required for Covered Entity to respond to a request by an Individual for an accounting of disclosures of PHI in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder.

(11) Business Associate agrees to provide to Covered Entity, in a time and manner agreed to by the parties, information collected in accordance with clause h. (10) of this Section of the Contract, to permit Covered Entity to respond to a request by an Individual for an accounting of disclosures of PHI in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder. Business Associate agrees at the Covered Entity's direction to provide an accounting of disclosures of PHI directly to an individual in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder.

(12) Business Associate agrees to comply with any state or federal law that is more stringent than the Privacy Rule.

(13) Business Associate agrees to comply with the requirements of the HITECH Act relating to privacy and security that are applicable to the Covered Entity and with the requirements of 45 C.F.R. sections 164.504(e), 164.308, 164.310, 164.312, and 164.316.

(14) In the event that an individual requests that the Business Associate (a) restrict disclosures of PHI; (b) provide an accounting of disclosures of the individual's PHI; or (c) provide a copy of the individual's PHI in an electronic health record, the Business Associate agrees to notify the covered entity, in writing, within two business days of the request.

(15) Business Associate agrees that it shall not, directly or indirectly, receive any remuneration in exchange for PHI of an individual without (1) the written approval of the covered entity, unless receipt of remuneration in exchange for PHI is expressly authorized by this Contract and (2) the valid authorization of the individual, except for the purposes provided under section 13405(d)(2) of the HITECH Act,(42 U.S.C. § 17935(d)(2)) and in any accompanying regulations

(16) Obligations in the Event of a Breach

A. The Business Associate agrees that, following the discovery of a breach of unsecured protected health information, it shall notify the Covered Entity of such breach in accordance with the requirements of section 13402 of HITECH (42 U.S.C. 17932(b) and the provisions of this Section of the Contract.
B. Such notification shall be provided by the Business Associate to the Covered Entity without unreasonable delay, and in no case later than 30 days after the breach is discovered by the Business Associate, except as otherwise instructed in writing by a law enforcement official pursuant to section 13402 (g) of HITECH (42 U.S.C. 17932(g)) . A breach is considered discovered as of the first day on which it is, or reasonably should have been, known to the Business Associate. The notification shall include the identification and last known address, phone number and email address of each individual (or the next of kin of the individual if the individual is deceased) whose unsecured protected health information has been, or is reasonably believed by the Business Associate to have been, accessed, acquired, or disclosed during such breach.
C. The Business Associate agrees to include in the notification to the Covered Entity at least the following information:
    1. A brief description of what happened, including the date of the breach and the date of the discovery of the breach, if known.

    2. A description of the types of unsecured protected health information that were involved in the breach (such as full name, Social Security number, date of birth, home address, account number, or disability code).

    3. The steps the Business Associate recommends that individuals take to protect themselves from potential harm resulting from the breach.

    4. A detailed description of what the Business Associate is doing to investigate the breach, to mitigate losses, and to protect against any further breaches.

    5. Whether a law enforcement official has advised either verbally or in writing the Business Associate that he or she has determined that notification or notice to

individuals or the posting required under section 13402 of the HITECH Act would impede a criminal investigation or cause damage to national security and; if so, include contact information for said official.

D. Business Associate agrees to provide appropriate staffing and have established procedures to ensure that individuals informed by the Covered Entity of a breach by the Business Associate have the opportunity to ask questions and contact the Business Associate for additional information regarding the breach. Such procedures shall include a toll-free telephone number, an e-mail address, a posting on its Web site and a postal address. Business Associate agrees to include in the notification of a breach by the Business Associate to the Covered Entity, a written description of the procedures that have been established to meet these requirements. Costs of such contact procedures will be borne by the Contractor.

E. Business Associate agrees that, in the event of a breach, it has the burden to demonstrate that it has complied with all notifications requirements set forth above, including evidence demonstrating the necessity of a delay in notification to the Covered Entity.

(i) Permitted Uses and Disclosure by Business Associate.

(1) General Use and Disclosure Provisions Except as otherwise limited in this Section of the Contract, Business Associate may use or disclose PHI to perform functions, activities, or services for, or on behalf of, Covered Entity as specified in this Contract, provided that such use or disclosure would not violate the Privacy Rule if done by Covered Entity or the minimum necessary policies and procedures of the Covered Entity.

(2) Specific Use and Disclosure Provisions

(A) Except as otherwise limited in this Section of the Contract, Business Associate may use PHI for the proper management and administration of Business Associate or to carry out the legal responsibilities of Business Associate.

(B) Except as otherwise limited in this Section of the Contract, Business Associate may disclose PHI for the proper management and administration of Business Associate, provided that disclosures are Required by Law, or Business Associate obtains reasonable assurances from the person to whom the information is disclosed that it will remain confidential and used or further disclosed only as Required by Law or for the purpose for which it was disclosed to the person, and the person notifies Business Associate of any instances of which it is aware in which the confidentiality of the information has been breached.

(C) Except as otherwise limited in this Section of the Contract, Business Associate may use PHI to provide Data Aggregation services to Covered Entity as permitted by 45 C.F.R. § 164.504(e)(2)(i)(B).

(j) Obligations of Covered Entity.

(1) Covered Entity shall notify Business Associate of any limitations in its notice of privacy practices of Covered Entity, in accordance with 45 C.F.R. § 164.520, or to the extent that such limitation may affect Business Associate's use or disclosure of PHI.

(2) Covered Entity shall notify Business Associate of any changes in, or revocation of, permission by Individual to use or disclose PHI, to the extent that such changes may affect Business Associate's use or disclosure of PHI.

(3) Covered Entity shall notify Business Associate of any restriction to the use or disclosure of PHI that Covered Entity has agreed to in accordance with 45 C.F.R. § 164.522, to the extent that such restriction may affect Business Associate's use or disclosure of PHI.

(k) Permissible Requests by Covered Entity. Covered Entity shall not request Business Associate to use or disclose PHI in any manner that would not be permissible under the Privacy Rule if done by the Covered Entity, except that Business Associate may use and disclose PHI for data aggregation, and management and administrative activities of Business Associate, as permitted under this Section of the Contract.

(l) Term and Termination.

(1) Term. The Term of this Section of the Contract shall be effective as of the date the Contract is effective and shall terminate when the information collected in accordance with clause h. (10) of this Section of the Contract is provided to the Covered Entity and all of the PHI provided by Covered Entity to Business Associate, or created or received by Business Associate on behalf of Covered Entity, is destroyed or returned to Covered Entity, or, if it is infeasible to return or destroy PHI, protections are extended to such information, in accordance with the termination provisions in this Section.

(2) Termination for Cause Upon Covered Entity's knowledge of a material breach by Business Associate, Covered Entity shall either:

(A) Provide an opportunity for Business Associate to cure the breach or end the violation and terminate the Contract if Business Associate does not cure the breach or end the violation within the time specified by the Covered Entity; or

(B) Immediately terminate the Contract if Business Associate has breached a material term of this Section of the Contract and cure is not possible; or

(C) If neither termination nor cure is feasible, Covered Entity shall report the violation to the Secretary.

(3) Effect of Termination

(A) Except as provided in (l)(2) of this Section of the Contract, upon termination of this Contract, for any reason, Business Associate shall return or destroy all PHI received from Covered Entity, or created or received by Business Associate on behalf of Covered Entity. Business Associate shall also provide the information collected in accordance with clause h. (10) of this Section of the Contract to the Covered Entity

within ten business days of the notice of termination. This provision shall apply to PHI that is in the possession of subcontractors or agents of Business Associate. Business Associate shall retain no copies of the PHI.

(B) In the event that Business Associate determines that returning or destroying the PHI is infeasible, Business Associate shall provide to Covered Entity notification of the conditions that make return or destruction infeasible. Upon documentation by Business Associate that return or destruction of PHI is infeasible, Business Associate shall extend the protections of this Section of the Contract to such PHI and limit further uses and disclosures of PHI to those purposes that make return or destruction infeasible, for as long as Business Associate maintains such PHI. Infeasibility of the return or destruction of PHI includes, but is not limited to, requirements under state or federal law that the Business Associate maintains or preserves the PHI or copies thereof.

(m) Miscellaneous Provisions.

(1) Regulatory References. A reference in this Section of the Contract to a section in the Privacy Rule means the section as in effect or as amended.

(2) Amendment. The Parties agree to take such action as in necessary to amend this Section of the Contract from time to time as is necessary for Covered Entity to comply with requirements of the Privacy Rule and the Health Insurance Portability and Accountability Act of 1996, Pub. L. No. 104-191.

(3) Survival. The respective rights and obligations of Business Associate shall survive the termination of this Contract.

(4) Effect on Contract. Except as specifically required to implement the purposes of this Section of the Contract, all other terms of the Contract shall remain in force and effect.

(5) Construction. This Section of the Contract shall be construed as broadly as necessary to implement and comply with the Privacy Standard. Any ambiguity in this Section of the Contract shall be resolved in favor of a meaning that complies, and is consistent with, the Privacy Standard.

(6) Disclaimer. Covered Entity makes no warranty or representation that compliance with this Section of the Contract will be adequate or satisfactory for Business Associate's own purposes. Covered Entity shall not be liable to Business Associate for any claim, civil or criminal penalty, loss or damage related to or arising from the unauthorized use or disclosure of PHI by Business Associate or any of its officers, directors, employees, contractors or agents, or any third party to whom Business Associate has disclosed PHI contrary to the provisions of this Contract or applicable law. Business Associate is solely responsible for all decisions made, and actions taken, by Business Associate regarding the safeguarding, use and disclosure of PHI within its possession, custody or control.

(7) Indemnification. The Business Associate shall indemnify and hold the Covered Entity harmless from and against any and all claims, liabilities, judgments, fines, assessments, penalties, awards and any statutory damages that may be imposed or assessed pursuant to HIPAA, as amended or the

HITECH Act, including, without limitation, attorney's fees, expert witness fees, costs of investigation, litigation or dispute resolution, and costs awarded thereunder, relating to or arising out of any violation by the Business Associate and its agents, including subcontractors, of any obligation of Business Associate and its agents, including subcontractors, under this section of the contract, under HIPAA, the HITECH Act, the Privacy Rule and the Security Rule.

Notice to Executive Branch State Contractors and Prospective State Contractors of Campaign Contribution and Solicitation Limitations

This notice is provided under the authority of Connecticut General Statutes §9-612(g)(2), as amended by P.A. 10-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on the reverse side of this page).

CAMPAIGN CONTRIBUTION AND SOLICITATION LIMITATIONS

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract* or *state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee (which includes town committees).

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

On and after January 1, 2011, no state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor, with regard to a state contract or state contract solicitation with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall **knowingly** *solicit* contributions from the state contractor's or prospective state contractor's employees or from a *subcontractor* or *principals of the subcontractor* on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

DUTY TO INFORM

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

PENALTIES FOR VIOLATIONS

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties—Up to $2,000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of up to $2,000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or not more than $5,000 in fines, or both.

CONTRACT CONSEQUENCES

In the case of a state contractor, contributions made or solicited in violation of the above prohibitions may resulting the contract being voided.

In the case of a prospective state contractor, contributions made or solicited in violation of the above prohibitions shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State shall not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.
Additional information may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to “Lobbyist/Contractor Limitations.”

DEFINITIONS

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization**,** (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract,* (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan, a loan to an individual for other than commercial purposes or any agreement or contract between the state or any state agency and the United States Department of the Navy or the United States Department of Defense.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

"Managerial or discretionary responsibilities with respect to a state contract" means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

"Dependent child" means a child residing in an individual's household who may legally be claimed as a dependent on the federal income tax of such individual.

"Solicit" means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

"Subcontractor" means any person, business entity or nonprofit organization that contracts to perform part or all of the obligations of a state contractor's state contract. Such person, business entity or nonprofit organization shall be deemed to be a subcontractor until December thirty first of the year in which the subcontract terminates. "Subcontractor" does not include (i) a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or (ii) an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a subcontractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a subcontractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a subcontractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a subcontractor, which is not a business entity, or if a subcontractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any subcontractor who has managerial or discretionary responsibilities with respect to a subcontract with a state contractor, (v) the spouse or a dependent child who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the subcontractor.

EXHIBIT G

(federal wage rate package will be inserted here)

EXHIBIT H

(state wages will be inserted here)