VOLUME 2

TECHNICAL SPECIFICATIONS

FOR

WATER RECLAMATION FACILITY
PHOSPHORUS/TOTAL NITROGEN PROJECT
CONTRACT NO. 26

CITY OF CANTON, OHIO

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010CT - SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF PROJECT

A. The project is located in the City of Canton, Ohio at the Water Reclamation Facility (WRF) located at 3530 Central Avenue, SE.

1.2 RELATED DOCUMENTS

A. The Contract Documents include the Project Manual and the Drawings.

B. The Project Manual consists of three (3) volumes and an appendix to the Technical Specifications. Volume 1 includes the Legal Notice, Table of Contents, Instructions to Bidders, Forms to be Completed with Bid, Contract Forms, Modified General Conditions, Special Requirements, Project Labor Agreement and Wage Rates. Volume 2 consists of the technical specifications, Divisions 1 through Division 10 for material and material installation to be incorporated into the work. Volume 3 includes the technical specifications, Divisions 11 through Division 16 for the materials and the material installation to be incorporated into the work. The appendix includes non-contract reference documents. Included in the appendix are scope and price documentation from the suppliers of equipment that have been designated a Standard by Owner, reports, the procurement agreement between the City of Canton and OVIVO of Austin, Texas, along with approved shop drawings (pending availability prior to bidding).

C. Following is a general breakdown of the Drawings by a listing of Index headings. A detailed index of the drawings can be found on Sheet 0G-02.

General
Civil Site Work
Influent Pumping Building
Preliminary Treatment
Stage 1 Equalization
Secondary Treatment
Stage 2 Equalization
Tertiary Treatment
Post Treatment
Solids Handling
Solids Dewatering
Administration Building
Standard Details & Schedules
Instrumentation
Electrical
HVAC
Plumbing

1.3 PROJECT IDENTIFICATION

A. The project at the City of Canton Water Reclamation Facility (WRF) consists of construction to improve the plant process to a biological nutrient removal (BNR) membrane biological reactor (MBR) activated sludge process, increase the plant peak flow capacity after preliminary treatment and remove and/or upgrade existing infrastructure. The activated sludge process has been designed to biologically remove phosphorus and total nitrogen.

1.4 WORK IDENTIFICATION

A. Contract Documents indicate the work of the Contractor and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to, the following:

1. All labor, materials, tools, equipment and transportation necessary for the proper execution of the work in accordance with the Contract Documents.

2. All assistance required by the Owner or Engineer to verify compliance with the Contract Documents.

3. Reimbursement to the Owner for costs of re-inspection or retesting of any work not installed in compliance with the Contract Documents.

4. Existing site conditions and restrictions on the use of the work sites.

5. Construction sequencing to maintain continuous operation of existing facilities during the construction.

6. Scheduling of the work to accomplish the sequencing and improvement completion within the specified calendar days including intermediate milestones.

7. Allowances for Materials.

8. Testing of materials installed during construction.

9. Requirements for Owner acceptance including testing, start-up, training, and operational demonstration.

10. Special conditions associated with the project, including any Specific Project Requirements.

11. Other work to be performed concurrently by Subcontractors.

1.5 ABBREVIATED SUMMARY OF WORK

A. GENERAL

The Contract Documents, Project Specifications and Drawings together describe the work of this project. The specifications in their entirety apply to the work of the Contractor.

B. EXTENT OF WORK

It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work; the conformation of the ground/structure/buildings; the character, quality and quantity of the materials to be incorporated; the character of equipment and facilities needed preliminary to and during the execution of the work; the general and local conditions; and all other matters which can, in any way, affect the work under this Contract. The Contractor shall provide all labor, materials, tools, equipment, permit fees, and transportation necessary for the proper execution of the work in accordance with the Contract Documents.

The Base Bid Amount shall consist of Bid Items 1 through 10 as explained in the following sections.

C. Bid Item 1 – Phosphorus /Total Nitrogen Project Complete – Except Items 2 Through 10

Coordinated Efforts: The following is a listing of responsibilities of the Contractor:

1. The Contractor is responsible for the work as specified in Division 1 including submittals; temporary construction facilities; testing; start-up and commissioning; and project coordination.

2. All field staking necessary for construction from control points established by the Engineer.

3. All layout and survey for the work.

4. The Contractor is responsible for the Engineer's field office.

5. Assistance shall be provided as required by the Engineer to verify compliance with the Contract Documents, including measuring for quantities.

6. The Contractor shall verify interconnecting pipe diameters, material, etc. to substantiate interfacing of the equipment proposed to be furnished, and shall provide for any necessary equipment/materials and work changes to accommodate the equipment furnished at no change in Contract Price to the Owner.

7. The Contractor is responsible for providing water for their employees.

8. The Contractor is responsible for providing water for testing on new installations including but not limited to leakage testing of structures, tanks and piping. Refer to Specification 01066 – Temporary Water.

9. The Contractor is responsible for coordinating the communication systems (Phone, faxes, email, etc.) for himself and his Subcontractors. The Contractor will be responsible for the communication system and associated cost for the Engineer's field office.

10. The Contractor shall provide monthly updates regarding work progress and scheduling of work. The Contractor shall coordinate all work and provide updates to the Owner monthly at progress meetings. The Contractor is responsible for coordinating and scheduling the work of his subcontractors and equipment suppliers.

11. The Contractor is responsible for permits, permit fees, disposal permits, demolition permit, disposal fees and any other permit or fee required to perform the work. Refer to Specification Section 01020 – General Regulations and Permits.

12. The Contractor is responsible for Erosion Control and the preparation and implementation of site specific Stormwater Pollution Prevention Plans.

13. The Contractor is responsible for construction photographs and preconstruction videotape documentation.

14. Furnishing and installing the project sign.

15. The Contractor is responsible for preparing and maintaining a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP item shall include development, design, NPDES required inspection, modification, revision, updates, amendments and reporting related to the SWPPP. Refer to ODOT Supplemental Specification Section 832 – Temporary Sediment and Erosion Control.

16. The Contractor is responsible for maintaining one set of working, red-line record drawings as the work progresses. All original red-line drawing sets will be provided to the Owner at the completion of work. Refer to Specification Section 01098 – Project Record Drawings.

17. The Contractor is responsible for providing and maintaining temporary heat within the structures and areas of work. Refer to Specification Section 01070.

18. The Contractor is responsible for providing temporary parking areas for workers and visitors to the site.

19. The Contractor is responsible for providing and maintaining temporary sanitary facilities during the construction. Contractor's employees shall not use the Owner's facilities.

20. The Contractor is responsible for site safety.

21. The Contractor is responsible for furnishing and placing all anchorage systems for the installation of the equipment. The Contractor shall coordinate with the Manufacturer in identifying proper size and locations of all anchorage. The Contractor shall furnish and install Type 316 stainless steel anchor bolts unless indicated otherwise in the specifications and per Manufacturer's recommendation.

22. The Contractor shall protect adjacent equipment, materials, piping, structures and/or valves against damage from the installation procedure. Preparatory work in accordance with the manufacturer's instructions shall be completed prior to equipment installation.

23. All new process equipment and piping are to be coated per specification 09801- Special Coatings unless stated otherwise in the technical specifications or on the drawings. When existing piping and appurtenances are being reused for a new process it should also be coated per the referenced specification.

24. General guidelines for demolition work are as follows.

    a. The Contractor is responsible for coordinating all disconnections of utilities at the existing site for facilities being demolished including electrical, gas, telephone, water, sewer and any other utilities.

    b. The Contractor is responsible for the demolition and disposal of electrical gear, equipment, wire, conduit, cable trays, etc. in structures, building and facilities remaining and/or being modified by the improvement. The Contractor shall disconnect primary power and signal wires whereas the WRF remaining will continue to function and operate as intended.

    c. The Contractor is responsible for mobilization, staging, temporary roads, temporary excavations, scaffolding, temporary structure, etc., required or used to perform the demolition work.

    d. The Contractor is responsible for complete demolition of the structures, buildings, equipment, piping and/or facilities as shown on the drawings and as specified. The Contractor is responsible for the removal and disposal of all equipment, piping, materials, wiring, conduits etc. being demolished.

e. Contractor debris shall be hauled to an approved disposal facility. Equipment and scrap material shall be disposed of in accordance with the laws and regulations so dictating disposal. The Contractor shall advise the Owner/Engineer of the disposal site for each item prior to the start of demolition work.

f. When structures, buildings and/or facilities are being demolished after being taken out of operation and abandoned for demolition, the Contractor is responsible to ensure that all utilities are disconnected and shall disconnect the primary power service from the abandoned structure, building, equipment and/or facility.

g. Demolition required for modifications of existing structures, buildings, equipment and/or facilities that will remain after the improvements shall be coordinated closely by the Contractor.

h. The Contractor shall restore the site surrounding the structure, building or facilities to the same condition as prior to demolition mobilization.

i. Structures below grade remaining after demolition shall be clean of all materials, equipment, piping, wire, conduit, materials, etc. with The Contractor will be responsible for backfilling the structures below grade in accordance with the drawings and specification to the final grades, topsoil, fine grading, fertilizing and seeding.

j. Demolition work specifically listed for demolition in structures, buildings and/or facilities remaining shall be performed in a timely manner and shall be listed in the development of the project schedule.

k. The Contractor shall provide selective demolition for piping that is currently in use or abandoned located throughout the tunnels as explained on the drawings. All remaining exposed piping abandoned in place shall be blind flanged or otherwise plugged as determined during construction and approved by the Engineer.

l. The Contractor shall refer to the Appendix for a Report of Findings by HZW dated October 10, 2013 for an Asbestos Survey identifying potential asbestos containing building materials for proposed removal prior to building demolition. ACBM consists of non friable roofing membrane, transite ductwork, transite building panel, sealant, tile mastic, etc. Contractor shall follow all rules and regulations pertaining to proper handling and disposal.

25. General guidelines for electrical work are as follows.

a. The Contractor is responsible for all work shown under Division 16 of the Technical Specifications and all work on the E Drawings.

b. The Contractor is to maintain existing electrical service at the WRF essential for the proper operation of the WRF and is responsible for supplying temporary electrical utilities at the plant during the construction.

c. Electrical controls, wiring, cables, and conduit will be furnished and installed based on the ratings, horsepower, wire, cable and conduit shown on the drawings. The Contractor is responsible for verifying the work after installation and prior to making the final interconnections and powering of the equipment.

d. The Contractor is responsible for providing temporary power for the construction. The Contractor shall provide multiple 100A to 200A 480/277 VAC services at various locations throughout the project site for the purpose of temporary construction power; necessary transformation to provide 120/208 VAC power at the site; and disconnects, breakers, power runs as necessary to distribute the power across the site. The temporary power may be taken from the existing MCC panels throughout the project site. The MCC panel buckets to be used shall be coordinated with the Owner prior to installing the temporary power service. Any upgrades to existing buckets, breakers, etc. to accomplish the temporary power system shall be at the cost and responsibility of the Contractor.

   (Refer to specification Section 01070 and electrical drawings for MCC panels and locations).

   The Owner will not require the temporary power system to be metered. The cost of the power used by the Contractors during the work will be at the City of Canton's expense.

e. The Contractor is responsible for all costs with the Electric Utility Company.

f. The Contractor is responsible for the coordinating the new permanent power distribution system to the WRF from the utility with the Electric Utility Company and internal to the WRF power distribution system.

g. The Contractor is responsible for the installation of conduit/trays and wire/cable for the Instrumentation and Control equipment as specified in Division 13. The Contractor is responsible for furnishing, installing, testing and startup of all instruments and equipment furnished. The Contractor is responsible for providing all wire, conduit and cable to the equipment and for landing the wire and cables.

26. General guidelines for HVAC work are as follows.

a. The Contractor is responsible for all work shown under Division 15 of the Technical Specifications and on the M Drawings. HVAC work areas include, but are not necessarily limited to, Preliminary Treatment Solids Building, Fine Screens Building, BNR/MBR and associated Access

Buildings, Sludge Thickener Building, Sludge Loading Building and Administrative Building.

b. The Contractor is responsible for furnishing and installing the mechanical systems and shall include temperature control systems for the purpose of heating and ventilating buildings.

c. The Contractor is responsible for testing, adjusting, and balancing; start-up and commissioning; temporary heating, ventilation, and humidity control.

d. Cast-in-place concrete and grouting for HVAC work includes the equipment pads, reinforcing steel, and anchor bolts.

e. The Contractor is responsible for control wiring between HVAC equipment and controls.

27. General guidelines for Plumbing work are as follows.

a. The Contractor is responsible for all work shown under Division 15 of the Technical Specifications and on the PL Drawings.

b. The Contractor is responsible for the new plumbing work including demolition, cutting, and patching of existing structures.

c. For the plumbing work, the Contractor shall furnish and install all materials to complete the pipe installation. The Contractor shall backfill the pipe, manhole or sump structures. The Contractor shall be responsible for complete installation of plumbing work including excavation and backfill at all other locations.

d. Cast-in-place concrete and grouting for plumbing work includes the equipment pads, reinforcing steel, and anchor bolts.

e. All piping and plumbing under Division 15; supports and anchors; mechanical identification; mechanical insulation; interior water potable plumbing system; drainage and vent system; natural gas system; plumbing fixtures; fire protection; and plumbing pumps and as shown on the PL drawings.

28. A more detailed breakdown of the improvements by each area is provided as a general summary; however, it shall not be considered to be all inclusive.

Civil Site Work

This work is generally described as the work associated with the reconfiguring and restoration of the existing site surface features. The existing concrete pavement removal, concrete pavement and sub-base replacement is included in other pay items. The Contractor shall include all materials, labor and cost associated with backfilling, fine grading, fertilizing and seeding to restore the existing site in areas that existing concrete pavement is removed and new concrete pavement will not be installed. This includes fill material, a minimum of six (6) inches of top soil, grading, seeding and fertilizing. Also, the earthwork necessary to reconfigure and restore the site to the proposed grades and elevations is part of the civil site work in Bid Item 1.

The civil site work includes miscellaneous demolition including the removal and disposal of the bulk chemical tanks, demolition of the at grade railroad crossings, restoration of railroad spur, earthwork, erosion control, excavation, backfill, engineered fill, rough grading, finish grading, subbase grading and preparation, drainage, sidewalks, bollards, fertilizing and seeding, photographs and videotaping, guard posts, parking blocks, miscellaneous painting, fencing and gates, and all other work indicated on the Drawings and specified herein.

Clean fill can be used to level out the previously removed railroad spurs. Clean fill may be available from Yard Chamber excavation and Retaining Wall.

The Contractor may use the concrete pavement removed for backfill of structures and basins to within 2 feet of final grade provided the removed pavement has been crushed and meets the acceptable gradation for fill material as specified in Section 02300 - Earthwork.

No additional payment will be made to the Contractor for use of concrete pavement as acceptable backfill.

Included in this item is backfill of structures to be abandoned in place after demolition. The Contractor shall backfill these below grade structures in accordance with the plans and specification. After backfilling the structure below grade, the Contractor shall provide a minimum 4-inches of topsoil, fine grading, fertilizing and seeding to the grades show on the site drawings. Refer to the Demolition drawings for structures being demolished and structures abandoned in place.

Underground Piping and Structures

This work is generally described as all underground piping and associated structures to be constructed on the site; however, outside of the existing structures and the proposed Preliminary Treatment Solids Building and the proposed Sludge Load-Out Facility. This work includes excavation, backfill and construction of all temporary and new process and utility pipes including permeate pipes, plant effluent pipes, bypass pipe(s), auxiliary storage and equalization pipes, structures, vaults, storm sewer system, roof drain systems, sanitary sewer system, adjustments to existing inlet basins, new inlet basins, water line system, hydrant lines, natural gas system, and all appurtenances as necessary for complete operating systems.

The Contractor shall excavate under proposed buildings for the plumbing pipe work complete with the extension to manholes or sumps. The Contractor shall furnish and install all materials to complete the pipe installation. The Contractor shall backfill the pipe, manhole or sump structures.

Influent Pumping Station

Besides the electrical work explained in the Project Manual, work in this building will be limited to the influent pumps discharge piping. The Contractor shall replace the horizontal elbows between each pump discharge and the cone valve, and the top vertical elbow between the existing cone valves and plug valves. The Contractor shall weld a steel plate curved to the pipe radius to the underside of the discharge header under each pump discharge connection. The Contractor shall remove and replace associated pipe supports to perform the work.

Preliminary Treatment

In general, the improvements include discontinuation of existing detritus tanks and process, equipment removal, and portions of the facility being demolished and a portion modified for the new parshall flume. Existing pre-aeration tanks and process are to be discontinued, equipment removed and structures modified for the new preliminary treatment process.

A new preliminary treatment facility is to be constructed to replace the detritus and pre-aeration systems. The new improvements will include a new parshall flume, a longitudinal grit and grease removal system and one stage or two stage fine screening system enclosed in a new building and the construction of a new preliminary treatment solids building.

Existing Detritus Facilities: A new parshall flume will be constructed in the existing detritus bypass channel and influent channels of the northern two detritus tanks. Construction of a new parshall flume within the existing bypass channel includes concrete structure demolition, new concrete work, furnishing and installing the new fiberglass parshall flume, miscellaneous metals, piping, gates and valves, coating systems and all necessary appurtenances to complete the facility.

The Contractor is responsible for the equipment removal/demolition of the four (4) existing detritus system equipment, the west grit building demolition, the east grit building demolition and the southern two detritus concrete structures demolition complete. The Contractor shall restore the site at the two southern detritus tanks and east and west grit buildings to the proposed grades. The Contractor shall modify the northern two detritus tanks per the plans and specifications including low strength mortar, miscellaneous metals and placement of concrete slab.

Existing Pre-aeration Tanks: The Contractor is responsible for the removal/demolition of the mixer on the west end of the pre-aeration tanks, the existing (4) four influent gates to the pre-aeration basins, the existing air piping that is not to be reused, air drop pipes and diffuser arms, the miscellaneous metal removal including grating, handrail, all piping shown to be removed and structural concrete removal. Structural concrete removal includes the raised box and slab on the southwest corner, the concrete slab at the existing influent gates, the concrete walls and walkways as shown on the drawings and cutting of the openings for the four new influent gates.

New Preliminary Treatment Facilities: The new preliminary treatment facilities consist of the new longitudinal grit and grease removal system, the fine screens and associated building/structure, the preliminary treatment solids building and all appurtenances. The construction work includes excavation, backfill, mud mats, low strength mortar, foundation work, reinforced concrete work, concrete structure, masonry work, miscellaneous metals, the Longitudinal Grit and Grease System specified in Section 11328, the fine screens specified in Section 11325, precast concrete roof panels, metal decking, skylights, architectural finishes, coiling doors, doors and windows, roofing systems, process piping, aluminum stairs, aluminum grating, hoist equipment, protective coatings, valves, slide gates, and all appurtenances necessary to complete the preliminary treatment facility as shown on the drawings and specified in the contract documents.

The Contractor shall also be responsible for the removal of the existing preaeration tanks grit accumulation and grit/sludge from channels. The grit (solids) removed from the tank bottom shall be disposed by the Contractor at a landfill licensed to accept such waste.

Equipment manufactured by Schreiber LLC of Trussville, Alabama has been identified by the Owner to as the Standard for the aerated grit and grease removal system based on technical capability and compatibility with the existing treatment plant layout, existing treatment plant processes, and proposed treatment plant improvements Schreiber LLC has provided a proposal to provide equipment, services, warranties and appurtenances. Schreiber LLC's proposal is titled Schreiber Proposal No.: 10-13-1984 and is dated November 1, 2013. A copy of the Schreiber LLC proposal is included in the Appendix to the Technical Specifications. Refer to Section 11328 for complete specifications.

Equipment manufactured by Hydro-Dyne Engineering, Inc. has been identified by the Owner as the Standard for the base bid screening system based on technical capability and compatibility with the existing treatment plant layout, existing treatment plant processes, and proposed treatment plant improvements. Hydro-Dyne Engineering, Inc. has provided a proposal to provide base bid equipment, services, warrantees and appurtenances, titled *Canton WRF Nutrient Removal and Miscellaneous Improvements Fine Screening Facility Scope of Work #11272-13-14 for (Dual Stage) Hydro-Flo Screens and Washing Compactors"*, prepared by Steve D. Frank, Regional Sales Manager, dated August 30, 2013, consisting of 8 pages.

A copy of Hydro-Dyne Engineering's base bid proposal is included in the Appendix to the Technical Specifications. Refer to Section 11325 for complete specifications.

Equipment manufactured by Hydro-Dyne Engineering, Inc. has been identified by the Owner as the Standard for the alternate bid for the screening system (Bid Alternate A-1) based on technical capability and compatibility with the existing treatment plant layout, existing treatment plant processes, and proposed treatment plant improvements. Hydro-Dyne Engineering, Inc. has provided a proposal to provide alternate bid equipment, services, warrantees and appurtenances, titled *Canton WRF Nutrient Removal and Miscellaneous Improvements Fine Screening Facility Scope of Work #11272-12 for (Single Stage) Hydro-Flo Screens and Washing Compactors"*, prepared by Steve D. Frank, Regional Sales Manager, dated August 30, 2013, consisting of 7 pages.

A copy of Hydro-Dyne Engineering's Bid Alternate A-1 proposal is included in the Appendix to the Technical Specifications.

Refer to Section 11325 for complete specifications.

Stage 1 Equalization

The Stage 1 Equalization Control Chamber (formerly called Primary Splitter Chamber) is to be rehabilitated and its associated gates automated. The rehabilitation of the chamber includes concrete repair work, removal of existing slide gates and air piping, installation of new air piping and diffusers, modifications to the existing gates, and modification of two weir gate openings.

Primary Settling Tank equipment is to be removed complete and the existing process tanks are to be converted to Stage 1 Equalization (EQ).

The removal of existing piping associated with the existing grease pumps, existing sludge pumps, the thickener overflow piping, grease piping in Tunnel E and thickener building, primary tank effluent pipes, the grease pumps, the primary sludge pumps and the primary effluent pump and all associated concrete equipment pads shall be by the Contractor.

The Contractor shall install the new Stage 1 EQ dewatering pump systems including the dewatering pumps, all proposed piping, fittings, valves, concrete equipment pads and appurtenances. Also included is the plant effluent pipe extension from the existing pipe in the primary gallery and in Tunnel E.

The Contractor shall remove the existing three (3) 100 horsepower blowers in the primary building including concrete pads and related piping in preparation of the new blower system installation.

The Contractor shall furnish and install three (3) new 25 horsepower Grit and Grease Process blowers complete with piping, fitting, valves, concrete pads and appurtenances.

Secondary Treatment – BNR/MBR Activated Sludge

The new improvements will convert the six (6) existing activated sludge basins to new activated sludge process with biological phosphorus and total nitrogen removal using membrane filters. The improvement will modify the six (6) tanks with one (1) anaerobic basin, two (2) parallel flow anoxic basins with an aeration swing zone, two (2) parallel flow preaeration basins and two (2) parallel flow membrane basins. Influent flow will be through the existing influent pipes, which have meters and rate of flow control valves to control the influent flow to each process train. Influent flow will enter the anaerobic basin. Fiberglass baffles will be provided between the anaerobic and anoxic basins, and the anoxic and pre-aeration basins. Reinforced concrete walls will be constructed between the preaeration and MBR basins. The Contractor shall make the necessary modifications to the six (6) existing activated sludge tanks and shall furnish and/or install all associated equipment for the BNR/MBR System and shall complete all modifications to the RAS System.

OVIVO MBR System Procurement Agreement: OVIVO is providing goods and services associated with the membrane bioreactor (MBR) system which includes equipment, piping, valves, supports, fasteners and system control process under a direct contract with the Owner ("OVIVO Contract"). The Appendix to the Technical Specifications includes the terms and conditions, general requirements, scope of supply, and drawings generally showing the equipment being supplied by OVIVO, which together serve as the OVIVO Contract. The membranes are flat plate membranes manufactured by Kubota. OVIVO shall be paid directly by the Owner.

The Contractor is an express third party beneficiary to the OVIVO Contract and shall have responsibility for all coordination, receipt of deliveries, verifying materials delivered, storage of materials delivered, installation, start up and commissioning of the system complete in accordance with the specifications, drawings and Contract Documents. The Contractor's price for this Bid Item shall include all coordination between the Owner, OVIVO, and Engineer to facilitate construction, as well as all costs for unloading, handling on site, labor, installation costs, start up and commissioning, overhead, profit and all other things not expressly reserved to OVIVO in the OVIVO Contract.

All MBR System equipment not specifically included in OVIVO's scope of supply but included in the process shall be purchased, furnished, installed, started and commissioned by the Contractor as part of the lump sum bid price for Item 1. The Contractor is responsible for furnishing and installing all other equipment associated with the project not included in the OVIVO Contract including piping and supports, concrete work, masonry work, doors, precast panels, aluminum railings, miscellaneous metals, hatches, grating, hoist systems, gates, weirs, valves, demolition work, fiberglass work, heating and ventilation systems, electrical systems, plumbing systems, architectural finishes and structural steel.

Contractor shall refer to specification 11361.

Demolition: The Contractor is responsible for the demolition work depicted on the 5D drawings. This work includes the demolition of the structural concrete (walls and walkways), diffuser system, and piping in the existing activated sludge trains, removal of the concrete as required for the installation of the two (2) access building in the MBR gallery, the concrete removal for the two (2) access stairs from the tunnel and passage ways to the MBR gallery, removing the air piping in the existing activated sludge effluent channel, removing the existing chemical piping throughout the RAS gallery and Tunnel D. The removal of the recycle line to the RAS well as shown on the drawings, removal of the RAS pumps complete with motors and all demolition work in the RAS pump wells, demolition of the pump pads and pipe supports of the demolished equipment. Also, the Contractor shall be responsible for the cutting and/or or demolition of concrete and wall restoration for all new pipes passing through the existing or proposed walls.

MBR/BNR Activated Sludge Tank: All six (6) anaerobic basins will be equipped with a bridge mounted mixer to keep the solids in suspension and level probe to monitor level. The six (6) anoxic basins will have two (2) bridge mounted mixers and a level probe. At the center of each anoxic basin there shall be an internal recycle pump with piping and appurtenances to the anaerobic basin. The existing Return Activate Sludge (RAS) system is to be abandoned/demolished and a new RAS System installed in each MBR activated sludge train. The Contractor may reuse the existing 36" RAS pipe when applicable.

New fine bubble diffusers will be installed in the pre-aeration basins and in the swing zone portion of the anoxic basins. Dissolved oxygen (DO) probes will be installed to measure the DO level and control the air to the basin. New process air blowers will be installed to provide air to the pre-aeration basins and swing zones. The Contractor shall provide the process air blowers and all associated piping and appurtenances. Temporary facilities required during the construction include pipe from the new process air piping to the existing process air drops at each process train. Contractor shall be responsible for all temporary provisions required to sequentially place the new MBR/BNR process trains in service as described in Section 1.9 Sequence of Construction.

Kubota SP submerged membrane units (SMU) will be installed in each membrane basin. Each SMU will consist of a stainless steel frame, medium bubble diffusers, 3 inch pipe flange connection for air, 3 inch pipe flange connection for each the upper and lower permeate and isolation valves. Two (2) level controls will be installed to monitor level.

MBR Crane System: A rail system and structural support beams shall be supplied by the Contractor for a new MBR gantry crane system. A MBR gantry crane shall be provided with trolly and hoist to lift and transport the membranes in and out of the basins. It is intended that the system be installed within the first year of construction so the Contractor can use the crane for installation of the components within the MBR basins.

The Contractor shall extend the basin walls to accommodate the gantry crane system ability to deliver the SMUs to an area designated for future cleaning with water. It is intended that OVIVO will furnish a cleaning system known as a Rapid Recovery Unit (RRU) for future use by the Owner. The Contractor shall coordinate with OVIVO to furnish all utilities, drains and appurtenances required for the RRU.

After the membrane installation is complete, the Owner shall have the gantry crane system inspected at the Cost of the Contractor. The Contractor is responsible to recondition the gantry crane based on manufacturer's recommendations.

MBR Process Control: The existing Activated Sludge Process control system is to be modified by the addition of the MBR Process Control System in a new control room to create a new MBR control and electrical gear will be installed in an existing unused room.

Scour Air: The existing blower system in the Compressor Building is to be modified for the membrane basin scour air system. The existing blowers in the Compressor Building are being rehabilitated for the membrane basin scour air system in accordance with Specification Section 11124CT – Factory Modifications to Centrifugal Blowers. Contractor shall remove one blower at a time and ship to the Manufacturer for rehabilitation. Upon receipt of each blower, the Contractor shall re-install the blower and provide start up and commissioning prior to removing the next blower. The existing air piping will be reused when possible as indicated on the Drawings. The Contractor shall provide air piping and work necessary to supply scour air to the membrane basins.

Equipment manufactured by Gardner Denver, Inc. (formerly Hoffman) has been identified by the Owner as the Standard for the base bid for the equipment and incidental labor to perform motor replacements, inlet valve rebuilding, and check valve replacement, and to supply and install the control panels for the scour air system, based on technical capability and compatibility with the existing treatment plant layout, existing treatment plant processes, and proposed treatment plant improvements.

A copy of the quotation from Gardner Denver Nash Hoffman & Lamson Products, titled *"Proposal No. 23201R3 Canton Ohio WWTP Equipment Repair…Centrifugal Products"*, prepared by Todd Lilly, Product Specialist, dated October 15, 2013, consisting of 8 pages is included in the Appendix to the Technical Specifications. Refer to Section 11124CT for complete specifications.

Equipment manufactured by Gardner Denver, Inc. (formerly Hoffman) has been identified by the Owner as the Standard for the alternate bid (Bid Alternate A-2) consisting of replacing the shafts and impellers on all five blowers.

A copy of the quotation from Gardner Denver Nash Hoffman & Lamson Products, which includes information pertaining to Bid Alternate A-2, and titled *"Proposal No. 23201R3 Canton Ohio WWTP Equipment Repair…Centrifugal Products"*, prepared by Todd Lilly, Product Specialist, dated October 15, 2013, consisting of 8 pages is included in the Appendix to the Technical Specifications. Refer to Section 11124CT for complete specifications.

Refer to Section 11124CT for complete specifications.

Permeate System: New permeate (effluent) piping from the Membrane System is to be added within the MBR basins, pipe galleries and in the yard as shown on the drawings. The Contractor shall furnish all permeate piping, valves, supports and appurtenances not included in the OVIVO contract. The permeate system is to operate as a gravity system with the use of throttling control valves. During periods of high transmembrane pressures (TMP), possible air locking and during peak flows, the Gravity Flow Pump Assisted Permeate System will be used.

Waste Activated Sludge System: The Waste Activated Sludge (WAS) pump system is to be abandoned/demolished and a new WAS pump system installed. The WAS shall be rotary lobe or progressive cavity type. The space is a concern in this area, so the Contractor must provide a pump configuration that will fit on the equipment pads shown on the drawings. The Contractor shall provide all necessary piping and appurtenances as shown on the Drawings to tie into the existing WAS piping.

Alum System: A new alum system is to be added for trimming the chemical removal of phosphorus.

Nitrogen Reduction System: A new nitrogen reduction system shall be added for the addition of a carbon source supplement to the BNR process for Total Nitrogen removal. The additional carbon source that will be used is refined glycerin.

Clean In Place System: A new Clean-in-Place (CIP) chemical system shall be added for use in cleaning the membranes. Contractor shall coordinate with the OVIVO Contract regarding specific components within their scope of supply.

Emergency Disinfection System: A new Emergency Disinfection System shall be added for the addition of sodium hypochlorite to the north and south permeate pipe before exiting the building.

Stage 2 - Equalization

The Secondary Settling Tanks equipment is to be removed complete and the existing process units to be converted to Stage 2 Equalization. The existing drain valves will be used to dewater Stage 2 Equalization.

The Contractor shall demolish the existing secondary settling tank equipment, weirs, flumes, etc. The Contractor shall also demolish the recycle water pump pads and associated piping in the secondary gallery and Tunnel D, secondary tank effluent pipes, the scum piping, air piping in Tunnel D and secondary pipe gallery, the recycle pipe in Tunnel D and all equipment pads and pipe supports.

Tertiary Treatment

The existing tertiary treatment facility as depicted on the 7D drawings is to be demolished. This work includes removal of existing process equipment, piping valves, fittings, instruments, windows, doors, architectural finishes, plumbing fixtures, piping, and incidental complete; electrical wire, conduits, receptacles and lighting, and mechanical systems complete.

The Contractor shall backfill the abandoned in ground basins and structures. The Contractor shall be responsible to ensure that all utilities or items to be removed or relocated prior to demolition have been disconnected or completed before proceeding with the facility demolition. The removal of the mud well solids and filer media shall be paid for under other bid item unit price items 5 and 6 herein.

Post Treatment

The work consists of demolishing the existing disinfection chemical systems equipment complete. Other demolition work includes the four (4) mixers in the existing chlorine contact tank, the filter backwash piping in the chlorine contact tanks and the drain pumps.

Proposed work includes the relocation and installation of the final effluent sampler unit complete with the pH analyzer including instrumentation and SCADA interface to the exising maintenance building. Other maintenance building work includes interior and exterior demolition of the drain system, new floor drains and new piping with necessary connections. Work in the existing chlorine contact tanks includes the recoating of the chlorine contact tank interior walls, installation of post aeration system complete and any other work specifically shown on the 7P Drawings. The complete installation of the post aeration system includes new blowers, piping, valves, supports and the diffuser system.

Solids Handling

The work consists of converting the existing sludge thickeners to aerated sludge holding and includes removal of the existing thickener system complete, demolition work to the existing masonry structure, a new diffuser system, aeration blowers, air piping, valves, fittings, instruments, and architectural modification to the building. The work includes the new aeration diffuser equipment, blower installation, masonry work, grating, LSM, concrete, doors, windows, piping systems and coating systems.

The existing sludge transfer pumps used to feed the belt filter presses feed well located in the basement of the thickener building will be removed. The pumps will be replaced with either rotary lobe or positive displacement type pumps and will be the new belt filter press feed pumps. The new pumps require piping modifications and valves and will tie directly into the existing belt presses. Existing pipe systems no longer needed are to be removed.

The existing nuclear density meter in the basement will be removed and the Contractor is responsible for the shipment of the meter to the appropriate Nuclear Regulatory agency along will all manifests and any associated costs for disposal.

Solids Dewatering

Generally, the improvement includes eliminating the existing belt presses sludge wells, feed pumps and piping and replacing the existing feed system with new pumps at the sludge holding tanks and new feed piping; modifying the belt filter press control system; removing the existing conveyor system; expanding the existing polymer systems; removal of the existing incinerator system and all support systems; and new conveyors from the presses to and the construction of a new sludge load-out facility.

The Contractor is responsible for removal of existing belt filter press feed pumps, piping and sludge well mixers; demolishing the existing belt press feed well, existing incinerators systems complete including all support systems; removal of the existing conveyor system complete including the support structure, removal of piping systems and any other item shown for removal on the 10D drawings.

The Contractor is responsible for the removal of the abandoned 6" grease line, 12" drain line to flange and blind flange in Tunnel A.

The Contractor is responsible for the installation of the new belt filter press feed pumps and associated piping, valves and appurtenances in the thickener building basement and associated piping system; the new polymer feed unit and associated piping that will be installed next to the existing two polymer feed units, the modifications to the belt filter press control system, the roof system removal and replacement, the building window and metal siding removal and replacement, modifications to the belt press control system, the installation of the new shaftless screw conveyor system complete, the construction of the new sludge load building complete and any other work required in the building.

The new sludge load-out building construction includes excavation, backfill, foundation system, a new retaining wall, concrete structure, structural steel frame building, miscellaneous metals, instruments, miscellaneous metals, masonry, doors, windows and architectural finishes, coiling doors, and all appurtenances necessary to complete the installation. The Contractor is responsible for the demolition necessary to install the new conveyor system.

Administration Building

Administrative Building improvements include replacement of HVAC systems, plumbing work, HVAC controls, refurbishment and or replacement of incubator-refrigerator equipment and modifications of instrumentation and controls systems.

Equipment manufactured by Farrar Scientific of Marietta, Ohio has been identified by the Owner as the Standard for the base bid rehabilitation of the incubator/refrigerator based on technical capability and compatibility with the existing laboratory equipment. Farrar Scientific has provide a proposal to provide base bid equipment, services, warranties and appurtenances titled "Quote: FS080512 Rev 1 for Refrigerator Environmental Chamber/Incubator Environmental Chamber System", prepared by Craig A. Wood, Director of Engineering, dated May 10, 2013, consisting of 2 pages.

Refer to Section 11602CT for complete specifications.

The Contractor is responsible for the removal of limited amounts of drywall, ceiling tile and ceiling grid to allow access to wall chases and ceiling. The Contractor is to replace the drywall, ceiling and other finishes after the mechanical work is completed. Limited masonry work is required to fill in where existing mechanical ductwork penetrates masonry.

Standard Details and Schedules

The drawings include standard details and schedules for the Contractor's general reference; they are not intended to be all inclusive. Schedules are included for the weir plates, stop plates, ladders, valves, gates, and piping materials by work area.

The blind flanges required for pipe demolition are not shown in the schedule. Blind flanges shall be ductile iron for pipes that will still be under pressure. In lieu of ductile iron where pipe is not pressurized, blind flanges may be fiberglass or otherwise plugged as determined during construction and approved by the Engineer.

Instrumentation Work Summary

The Plant System Integrator will work as a Subcontractor to the Contractor. The OVIVO System Integrator, a separate Instrumentation and Controls specialist, will work as a Subcontractor to OVIVO. The Contractor will have responsibility of coordinating all Instrumentation and Control work.

The OVIVO System Integrator work includes the furnishing of all controls for the instrumentation that is directly associated with the MBR process as identified on the Instrumentation and Control drawings. The P&ID Instrumentation Schedules identify the instrumentation and control that is

to be supplied by OVIVO and installed by the Contractor. This contract includes portions of the work specified in MBR System Procurement Agreement. The OVIVO System Integrator must coordinate with the Plant System Integrator and the Contractor to allow the Plant to have control over all MBR related functions from a centralized location.

The work to be by the Plant System Integrator includes all work explained in Section 13500 and shown on the "I" drawings and all work necessary for engineering, furnishing, adjusting, testing, documenting, and start-up the Process Instrumentation and Control (I and C) System, as a complete fully functioning computer-based supervisory control and data acquisition (SCADA) system.

The Contractor shall include the cost of all Plant Instrumentation and Controls Work, except for Work to be performed by the OVIVO System Integrator, in this Bid Item.

Bid Alternate A-3. Owner has identified Status, Control & Integration, Inc. of Kensington, Ohio ("SCI") as an especially qualified contractor to perform the Plant Instrumentation and Controls Work, based on SCI's significant prior history of working at the treatment plant. Under Bid Alternate A-3, Contractor shall provide a price for subcontracting all Plant Instrumentation and Controls Work, except for Work to be performed by the OVIVO System Integrator, to SCI, whether it be an add or subtract deduct.

Owner, in its sole discretion for determining which overall bid is lowest and best, will decide whether or not to accept Bid Alternate A-3, the same as any other bid alternate.

Miscellaneous

Also included under this Bid item is the construction trailer for the On-Site Project Representative; project photographic documentation, project plaque; overall project coordination among all Contractors, all mobilization, all demobilization, bond and insurance, project overhead and any other work item not included in any other bid item.

Coursework and the development of online training modules are included in this Bid Item. Refer to the Section 01821CT for complete specification.

Bid Alternate A-4. Owner has identified 360water, Inc. as an especially qualified contractor to perform the coursework and the development of online training modules scope of work, based on 360water's significant prior history of working at the treatment plant. Under Bid Alternate A-4, Contractor shall provide a price for subcontracting all coursework and the development of online training modules scope of work to 360water, Inc. whether it be an add or subtract deduct.

Owner, in its sole discretion for determining which overall bid is lowest and best, will decide whether or not to accept Bid Alternate A-4, the same as any other bid alternate.

Bid Alternate A-5. Under Bid Alternate A-5, Contractor shall provide a price for furnishing and installing a weathered steel structural support beam system for the gantry crane rail. The base bid structural support beam system is reinforced concrete. Contractor shall indicate whether it will be an add or subtract deduct.

Payment to the Contractor for Bid Item 1:

Payment for the WRF Improvement Work Complete will be made for the actual work performed based on the Schedule of Values prepared by Contractor and approved by Engineer as set forth in Paragraph 2.07 of the General Conditions. The Contractor shall provide a breakdown for the lump sum price to the Owner/Engineer for review and acceptance by the Owner/Engineer.

D. Bid Item 2 – Concrete Pavement Removal

This item shall include furnishing all labor, materials, tools and appurtenances necessary to accomplish the concrete pavement removal in accordance with the drawings, specifications, standard details and/or as summarized in Specification Section 01010CT – Summary of Work.

Payment will be made at the unit price bid per square yard of concrete pavement actually removed and measured in the field. The pay limits shall not exceed the pavement removal as dimensioned on the plans unless directed by the Owner/Engineer.

E. Bid Item 3 – Concrete Pavement

This item shall include furnishing all labor, materials, tools and appurtenances necessary to prepare the sub based and install the new pavement as shown on the plans or directed by the Engineer as per the detail type, in accordance with the drawings, specifications and standard details. Sub-base preparation is included in this item.

This item includes any subbase base material required over existing suitable subgrade to reestablish the grade and prepare the subbase for the placement of the new concrete pavement.

Any subbase material determined to be unacceptable for the new pavement will be removed and replaced under Item 4.

Payment will be made at the unit price bid per square yard of concrete pavement actually installed and measured in the field. The pay limits shall not exceed the pavement as dimensioned on the plans unless directed by the Owner/Engineer.

F. Bid Item 4 – Sub-base Replacement

As Directed by the Owner/Engineer. This item is for furnishing all labor, materials, tools and appurtenances necessary for the excavation of unsuitable existing subgrade, compaction and placement of new subbase material to accept the new concrete pavement system as directed by the Owner/Engineer.

Payment will be made at the unit price bid per cubic yard of sub-base replacement actually performed and measured in the field. Crushed removed concrete pavement is acceptable material provided it meets the gradation of the specification.

Contractor shall protect the existing sub-base once the existing pavement is removed. It is the expectation that most of the existing subbase is satisfactory for reuse without any subbase removal or modification.

The Contractor shall protect the existing sub-base from the elements and from degradation once exposed so it may be reused without the Owner incurring an addition cost to restore the existing subbase to a satisfactory condition.

There are areas on the site in which the subbase is expected to be unsatisfactory for reuse. This bid quantity has been estimated based on the possible modification needed in those areas.

G. Bid Item 5 - Mudwell Material Removal

This item is for furnishing all labor, materials, tools and appurtenances necessary for the removal, dewatering and disposal of all contents of the mud well.

Payment will be made at the unit price bid for actual in-place quantity of mudwell material removed, dewatered and disposed at a licensed landfill. Waste manifests shall be provided to Owner/Engineer prior to payment for disposal of same.

H. Bid Item 6 – Tertiary Filter Media Removal

This item is for furnishing all labor, materials, tools and appurtenances necessary for the removal, dewatering and disposal of the filter media.

Payment will be made at the unit price bid for actual filter media removed, dewatered and disposed at an approved landfill. Waste manifests shall be provided to Owner/Engineer prior to payment for disposal of same.

I. Bid Item 7 – Tunnel Leak Repairs Allowance

Include a $50,000.00 allowance for tunnel leak repair. Conditions unknown at the time of bidding and uncovered once construction has begun are to be included in this allowance. These factors causing the existing tunnels leaks will not be precisely known until excavation begins.

Refer to Specification Section 01210 – Allowances.

J. Bid Item 8 – Signage Allowance

Include a $35,000.00 allowance for signage. This includes the sign to be mounted on the site entrance sign structure, directional signs around the plant, signs for operator information, and signs for safety, etc.

Refer to Specification Section 01210 – Allowances.

K. Bid Item 9 –SCADA Equipment Allowance

Include a $150,000.00 allowance to cover changes in in the SCADA scope of work authorized by the Owner in response to actual conditions and/or changes in available technology.

Refer to Specification Section 01210 – Allowances.

L. Bid Item 10 – Erosion Control Allowance

Include a $25,000.00 allowance for Erosion Control. This includes locating, furnishing, installing and maintaining temporary sediment and erosion control best management practices for earth disturbing activity areas. Measurement and Payment shall be made in accordance with ODOT Supplemental Specification (SS) 832 – Temporary Sediment and Erosion Control. Payment will be made for BMP work items at unit prices specified in SS 832 Appendix F.

Refer to Specification Section 01210 – Allowances.

1.6 CONTRACTORS USE OF PREMISES

A. General: During the entire construction period, the Contractor shall have the use of the premises for construction operation, as shown on the Drawings and agreed upon with the Owner.

B. General: The Contractors shall limit their use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public.

1. Use of the Site: Confine activities at the site to the areas of work under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed.

a. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials.

b. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas approved by the Owner.

c. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

a. Construction and Equipment/Material Lay Down areas are available on site as indicated on the drawings.

2. Existing Buildings/Structures: Maintain the existing buildings/structures in a safe and watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect buildings/structures and their occupants during the construction period.

a. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris.

b. All plant personnel traffic corridors within the buildings or structures shall be maintained open and passable with the exception of localized work immediate to the traffic corridors. All traffic corridors blocked shall be barricaded during the work. All barricades shall be removed at the end of each work day.

c. The Contractor's employees are not to use the existing plant restrooms or utilities. Appropriate temporary facilities are to be provided by the Contractor.

c. Limits on Contractor's use of site are to its new construction area(s) and as directed by the Owner/Engineer. Space is available for the Contractor to store tools, lock boxes, scissor truck etc, being used in the buildings/structures. Locations for the storage of this equipment will be determined during the preconstruction meeting and dependent on the area in which work is commencing.

d. All parking and use of vehicles on site shall be controlled. Employee parking shall be restricted to areas designated by the Engineer.

b. Access to the existing buildings will be limited to building and structure in which work is occurring. Under no circumstances shall the Contractor access the Administration building through the front entrances into the lobby.

c. Access to the tunnels for mobilization, demobilization and removal of equipment being demolished shall be through the south garage bay in the Administration Building, through access hatches in the incinerator building (including the vehicle bay), the access hatch in

the garage bay of the return sludge building, and/or the solids holding building garage bays.

d. Existing hoist equipment may be used by the Contractors once the Contractors personnel have been trained in the operation of the hoist system by the plant maintenance superintendent. Only personnel of the Contractor trained by the Owner may operate the hoist equipment. Hoist equipment shall not be used to lift any load exceeding the listed load on the equipment. Any lift in excess of 70 percent of the listed load limit shall not be lifted without permission from the Owner for each lift. Hoist equipment is available in the influent pump station, return pump station, sludge holding building and incinerator building.

e. Prior to and after construction the Owner shall have the hoist system inspected. Any repairs to the hoist system after the start of construction and recommended by the final inspection after construction shall be split equally by the Contractors using the equipment and the Owner.

f. Secured storage for the Contractor is not available in the existing buildings and structures. The Contractor shall provide trailers on site for secured storage of equipment and supplies to be incorporated into the construction.

g. The existing buildings/structures are not to be used for equipment and construction material lay down or storage except for equipment or materials are to be incorporated into the work at the said location within the buildings or structures.

h. Items to be demolished within buildings/structures shall be removed from the building as they are demolished.

i. Electric and propane powered vehicle used solely for workers access to the work may be used in the buildings/structures. All Contractor vehicles used for this purpose shall be operated safely and parked in designated locations when not in use. The Contractor shall repair any damages caused by the operation of these vehicles.

A.7QUALITY ASSURANCE

A. The Contractor shall comply with all manufacturers' requirements and recommendations.

B. The Contractors will be responsible to coordinate and schedule the sequence of work.

C. To demonstrate the intent and methods of compliance with this specification, the Contractor shall submit an overall bar chart schedule of the sequence of construction. These documents must be submitted and reviewed by the Engineer and the Owner prior to the start of the work involved. Judgments of practicality of compliance will be made by the Engineer. The Contractor shall furnish all labor, equipment and materials, temporary or permanent, required for compliance at no additional cost to the Owner.

D. All work performed under this section shall be in accordance with approved trade practices and manufacturers recommendations.

1.8 SUBMITTALS

A. All submittals shall be in accordance with Division 1.

1.9 SEQUENCE OF CONSTRUCTION

A. Description: The Contractor is responsible for coordinating and scheduling the sequence of and interface of the work.

B. General Requirements: Since alterations, additions, and tie-ins are included in this work that potentially could interfere with the operations of the Canton Water Reclamation Facility (WRF), all Contractors shall take any and all steps necessary to avoid this interference, including, but not limited to, the following:

1. When existing paralleled components (mains, pumps, blowers, etc.) must be taken out of service, only one component in the system shall be out of service at any one time, unless otherwise indicated herein.

2. When existing non-paralleled components (piping, pumps, etc.) must be taken out of service, temporary parallel components shall be installed and maintained by the Contractor until service is restored, unless otherwise indicated herein.

3. When avoidance of interference is impractical by the above methods, the Contractor shall take the following additional steps:

   a. The Contractor shall schedule his work so as to minimize the time interval and/or frequency that the plant or any critical system is out of service.
   b. The Contractor shall coordinate all labor, materials, and equipment to be on the site at the start of a shutdown.
   c. The Contractor shall work continuously until service is restored.
   d. The Contractor shall coordinate with and notify the Owner/Engineer well in advance of a shutdown so that the necessary preparations can be made.

C. Specific Requirements: Due to the continuous plant operations, it is an absolute critical requirement that the existing water reclamation facility and sewers remain in service and accessible until each new facility is field tested and ready for continuous operation. Each work area shall be carefully scheduled with the Owner and Engineer and shall be approved only if everything is in readiness to accomplish the work.

Months 1 – 3

- Prepare Contractor lay down areas, mobilize
- Approve Shop Drawings for preliminary treatment equipment

Months 2 – 12

- Approve Shop Drawings for remaining Plant Equipment
- Influent Pump Building Improvements
    - Replacement of the horizontal elbow and tope vertical elbow between the pump and cone valve and cone valve and plug valve shall be replaced on the same pump, one pump at a time. The repairs to the header pipe in the trench shall be done separate from the work on each pump.
- Construct new Preliminary Treatment Facility (PTF)
  - Decommission (Isolate, drain, clean and remove equipment) Pre-aeration Tanks
  - Install New Longitudinal Grit and Grease System
  - Install New Fine Screen Building and Equipment
  - Install New Preliminary Solids Building and Equipment
  - Replacement of the three existing blowers in the primary building with new blowers and associated system piping in the tunnels must be completed before the grit/grease system is started for operation.
    - The Contractor will be permitted to work in the existing Pre-aeration Tanks 1, 2, 3, and 4 concurrently. The existing Pre-aeration tanks shall be bypassed via the existing pre-aeration system bypass channel. Existing detritus tanks 1, 2, 3 and 4 shall remain operational until the new grit/grease facilities and fine screen facilities construction is complete. This includes the Preliminary Treatment Solids Building.
    - The Contractor shall construct temporary bulkheads and coordinate work to the existing operating facilities with the Owner so the existing flumes, channels, etc. remain in service during the final interconnection work. As an alternative, the Contractor shall provide standby pumping to bypass the existing operating infrastructure during low flow periods at the plant. Low flow periods at the plant will require night work by the Contractor. Night work can be started at 7:00 pm and can continue until 7:00 am. The existing infrastructure shall be placed back into service each day.
    - The Contractor shall perform all tie-in connections during periods of low and dry weather flows. The Contractor shall provide

temporary pumping to bypass flows if the Contractor cannot isolate the active wastewater flows and operation form the interconnection work. Isolation can be performed by building temporary bulkheads, gates, plugs, etc. All temporary measures to isolate the interconnection work shall be removed when and as required by the Owner.

- Complete PTF Equipment and process commissioning to achieve substantial completion of the systems by Month 12.
- Install Process Air Blowers, Piping and Appurtenances
  - Complete Process Air System Equipment Start-up and Process Commissioning to achieve Substantial Completion by Month 12. System will serve new MBRs as they're installed along with conventional activated sludge.
- Begin receiving MBR System Equipment and Appurtenances (minimum all components for MBR 1) and properly store.
- Decommission existing Aeration Basin No. 1.
- The existing recycle line from the existing RAS well to and including the piping modified at the two valves adjacent to Aeration Basin 1 shall be removed by month 12.
- Solids Holding and Belt Filter Press Feed System
  - Install Sludge Feed Pump to Belt Filter Presses
  - The belt filter press feed pumps and the new feed pipes must be completed before the existing sludge wells and feed sludge pumps can be demolished.
  - The polymer system shall be added and completed by the end of month 12.
  - Two of the Sludge Thickener tanks shall be converted to aerated sludge holding tanks prior to the end of month 12. This includes removal of the existing sludge thickening equipment and installation of the new air system with diffusers and replacement of the transfer pumps which discharge to the existing sludge well. The new belt filter press discharge pumps and piping system will be available for work at the beginning of construction. The piping system includes the existing sludge pipe modifications and the new sludge pipe installation. These pipe systems shall be completed as well as the belt filter press modification. These pumps, pipe system modifications and belt filter press modifications must be completed prior to the abandonment of the sludge well and existing belt press feed sludge system. Once these pumps and piping system are installed, the Owner will utilize it to feed directly to the Belt Filter Presses.
  - Install Blowers and associated piping for Sludge Holding.
  - The Owner will utilize the existing two thickener tanks for sludge holding until the new preliminary treatment facility is made operational. Once the new preliminary treatment facility is made operational, the use of the Primary Tanks will be discontinued and the Owner will utilize the aerated sludge holding tanks.

- Sludge Load-Out Facility
    - The new sludge load-out building cannot be constructed until the existing sludge feed well can be abandoned and demolished. The new sludge load-out building must be operational before the incinerators can be demolished. The Owner is required to stop using the incinerators on December 31, 2013.
    - **Install Sludge Load-Out Facility, Complete Equipment Start-up and Process Commissioning to achieve Substantial Completion by <u>December 1, 2014</u> (<u>Mandatory</u>).**
    - Roofing and siding work shall not begin until the incinerators are demolished.
- Complete Administration Building Improvements.

Months 2 – 18

- Install OVIVO Instrumentation and Control Systems by Month 14.
- Install Upgraded plant I & C, SCADA Systems by Month 18

Months 13 – 16

- Existing Detritus Facilities Demolition and Install Parshall Flume
    - The new parshall flume shall be installed at the detritus tank system and/or detritus tank bypass channel. The initiation of construction through testing of the new parshall flume shall start after completion of and operation of the new grit/grease tanks and fine screen facility and before the installation of operation for the first MBR Train. The existing detritus tanks shall remain operational until the new grit/grease tanks and fine screen building are completed. Flow from the detritus system shall be bypassed past the existing pre-aeration tanks via the existing bypass channel during construction of the grit/grease and fine screens systems.
- Convert Primary Clarifiers to Stage 1 Equalization
    - The new grit/grease system and fine screen facility shall be started and operational before this work begins. The conversion of the primary settling tanks to equalization tanks shall be completed prior to placing MBR activated sludge Train 1 in service.
- Stage 1 Equalization Control Chamber Work
    - Work in the control chamber must be performed with the chamber in service. Work this chamber can being at the beginning of construction and must be completed by the end of month 15. After the new grit/grease facility and new fine screen facility is operational, it is possible for the plant staff to lower the water level in the chamber since the primary tanks will be out of service. The Contractor shall provide bypass pumping if the chamber needs to be completely dry for work. Bypass pumping the chamber can be from the preliminary treatment facility to Stage 1 EQ if operational. Otherwise bypassing flow would be pumped to the downstream of the Stage 1 Control Chamber.
- Install Process Air

- The new Process air piping system can begin at the initiation of construction and shall be completed prior to month 12. This system must be in place and operational prior to taking the scour air blowers out of service for rehabilitation.

- Install Permeate Pipe from North End of Aeration Tanks
- Install WAS for MBRs 1, 2, 3, and 4
  - The new waste activated sludge (WAS) system (pumps and piping) can begin at the beginning of construction and shall be completed 3 months prior to the work on the MBR Train for which the waste activated sludge pump is needed. The tie in to the existing waste activated sludge piping shall be completed prior to month 14.
- Install MBR CIP Systems (Hypochlorite and Acid) by Month 14
  - The CIP piping to each MBR system shall be completed with the completion of each MBR Train.
- Install Alum Feed System by Month 14
- Modify Scour Air Blower System
  - The new scour air blower rehabilitation work shall begin after the new process air system is installed. Once the process air blower system is operational, the existing scour air blower system can be removed from operation until the MBR Train 1 initiation of operation. At a minimum the 500 horsepower blower and two (2) 800 horsepower blower shall be completed by the end of month 15. These 3 blowers must be operational as a minimum prior to the initiation of MBR Train 1. The other remaining 800 horsepower blowers shall be rehabilitated prior to month 18. All blower work must be complete prior to the initiation of operation of MBR Train 2.
  - The replacement of the influent valve controllers for MBR Trains 1 through 6 shall be completed by month 14.
- Install and Start-up MBR No. 1 inclusive of respective: mixers; walls, bridges and baffles; air piping, valves and appurtenances: diffusers, permeate pumps, piping, valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbid meters, electrical work, structural work and internal recycle pump and piping.
  - MBR Train 1 shall begin at the end of month 12 provided the grit/grease systems and fine screen facility has initiated operation. The work on MBR Train 1 shall be during months 13, 14, 15 and initiation of operation shall be by the end of month 16.
  - General Requirement for all 6 MBR Trains: Membranes (SMU's) will not be installed at each process Train until the said process Train has been cleared for operation, all equipment has been started and the manufacturer has agreed that membrane installation may proceed. It is the intention of the project that the membrane SMU's are only installed when the process Train is ready to be started for continuous operation and that all equipment, facilities, and appurtenances are installed and ready to operate. Once the membranes are installed the clean water test may proceed to calibrate the system before sludge is transferred to the process train.

    - The operational demonstration period for the startup of each MBR Train is 14 days of uninterrupted operation.
    - Complete equipment Start-up, process commissioning and initial performance testing to achieve substantial completion by Month 16.
- Receive System Equipment and Appurtenances for MBR No. 2
- Decommission Aeration Basin No. 2.
- Aerated Sludge Holding
    - The second two Sludge Thickeners shall be converted to aerated sludge the work is the same as the first two tanks' conversion.

Months 17 – 20

- Install MBR No. 2 System inclusive of respective: mixers; walls, bridges and baffles; air piping, valves and appurtenances: diffusers, permeate pumps, piping, valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbid meters, electrical work, structural work and internal recycle pump and piping.
    - Start-up all equipment systems to achieve substantial completion by end of month 20.

Months 21 – 24

- Install and Start-up MBR 3 System inclusive of respective: mixers, walls and baffles, air piping, diffusers, permeate pumps, piping valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbid meters, electrical work, structural work and internal recycle pump.

Months 25 – 28

- Install and Start-up MBR 4 System inclusive of respective: mixers, walls and baffles, air piping, diffusers, permeate pumps, piping valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbid meters, electrical work, structural work and internal recycle pump.
- Install Permeate Pipe from South End of Aeration Tanks
- Stage 2 Equalization
    - The southern four (4) tanks will be provided to the Contractor after MBR Trains 1 through 4 are complete.

Months 29 – 32

- Install and Start-up MBR 6 System inclusive of respective: mixers, walls and baffles, air piping, diffusers, permeate pumps, piping valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbidimeters, electrical work, structural work and internal recycle pump.

Months 33 – 36

- Install and Start-up MBR 5 System inclusive of respective: mixers, walls and baffles, air piping, diffusers, permeate pumps, piping valves, RAS Pumps, piping and valves, WAS pumps, piping and valves, turbidimeters, electrical work, structural work and internal recycle pump.
- Stage 2 Equalization
    - The northern four (4) basins will be provided to the contractor after completion of MBR Trains 5 and 6

Months 36 - 42

- Complete Installation and Start-up of Ancillary System: Refined Glycerin.
- Install and test Submerged Membrane unit Removal Crane System.
- Complete MBR System Performance Tests to achieve final completion of all process improvements.
- Complete demolition of RAS Pumps, Tertiary Facility and Disinfection equipment removal.
    - The Tertiary Facility demolition cannot be performed until after all the MBR Trains are operational and accepted by the Owner. The 72-inch effluent pipe must be installed before this work is started.
- Complete Post Treatment
    - Repainting of the chlorine contact tank shall occur after the 72 inch effluent pipe has been installed.
    - Complete post aeration.
    - The relocation of the effluent sampler system and pH analyzer including instrumentation shall be completed prior to the demolition of the tertiary building and prior to completion of the new 72 inch effluent pipe.
    - The Contactor may perform this work after all the MBR Trains are operational and accepted by the Owner. This includes removal of the disinfection chemical systems, mixers and chlorine contact tank drain pump.
- Complete remaining site restoration, pavement replacement, membrane rapid recovery unit provisions.

Months 43 - 52

- Perform one year Certification inspections, prepare quarterly reports and implement corrective action as required.
- With final construction achieved, reassign the OVIVO Procurement Agreement back to the City for warranty follow-up.

<u>Miscellaneous Improvements</u>

- The bulk chemical system removal is independent of other work and can be performed at any time.

Administration Building

1. Work shall start July 14, 2014 and be completed before October 6, 2014. All equipment shall be on site prior to HVAC equipment shut-down. Should equipment not be available to be on site prior to July 14, 2014, work shall start June 1, 2015 and be completed before August 25, 2015.
2. The work periods above are anticipated to require temporary cooling only. Should the work be delayed beyond October 6, 2014, regardless of causes, Contractor will be required to furnish temporary heating units also. Space temperatures shall be maintained to 70-degF during the heating season.
3. Furnish and install portable cooling units in identified spaces, as indicated on the plans. Fifteen (15) units are required. See temporary heating/cooling requirements in Section 01070.
4. Furnish and install temporary power wiring from new sub-panel for portable heating/cooling units. See temporary power requirements in Section 01070.

    a. Temporary 16-circuit panel to be fed from chiller circuit.
    b. Suspend temporary power wiring conduit from ceiling tile and drop to units.

5. Contractor to perform and submit employee background check for any person entering this building.
6. The laboratory incubator work and refrigerator work shall be done first, and prior to the HVAC system's work. See specification Section 11602.
7. Employees will remain in the building during the renovation process. All exits must be maintained. Employees may need to enter work area during construction. Appropriate accommodations shall be provided.
8. Work to be performed in three separate phases in the order outlined below. Area must be completed before a new area may start.
9. Piping work is excluded from this phasing as long as all protection methods are followed. Due to excessive existing corrosion, the existing piping systems are prohibited from connection to any new HVAC equipment (AHU's, Chiller, Boilers, Pumps, etc), and any existing HVAC equipment is prohibited from connection to the new piping systems.

Phase 1: Lower Level & Upper Level Offices, Restrooms

1. Demolish multi-zone air handler, boiler, chiller, pumps, piping systems, etc.
2. Maintain upper level lab air handling units, located on the roof, to provide outside air.
3. Clean existing ducts/diffusers. Provide protection at all air inlets and outlets (diffusers, registers, grilles, etc.) to minimize dust infiltration.
4. Install new systems in Mechanical Room.
5. Set exterior chiller.
6. Install piping systems and temperature control systems.
7. Start-up lower level heat/air-conditioning systems.
8. Remove lower level and upper level portable heating/cooling units and temporary wiring, in areas conditioned by new MZ-1 multi-zone unit.

Phase 2: Upper Level Main and Instrument Laboratories (Rooms 222 and 220)

1. Construct dust partition and cover all furniture and equipment with 8 mil polyethylene sheets. Tape all edges to be air tight.
2. Remove ceilings in Rooms 222 Main Lab, 223 Corridor, and 215 Incubator, and remove chase partition in 215 Incubator.
3. Remove two rooftop AHU's above Room 222 Main Lab.
4. Temporarily support light fixtures.
5. Modify roof curb and roof membrane.
6. Clean existing ducts/diffusers. Provide protection at all air inlets and outlets (diffusers, registers, grilles, etc.) to minimize dust infiltration.
7. Extend ducts to new AHU-2 unit height. Install new Instrument Lab ducts.
8. Install new AHU-2, and hot/chilled water piping from chase to unit. Connect coils to hydronic piping.
9. Pressure test piping and allow for building department inspection.
10. Replace ceilings.
11. Install light fixtures.
12. Start-up heat/air-conditioning system.
13. Remove Main and Instrument Lab portable heating/cooling units and temporary wiring.
14. Patch all damaged surfaces.
15. Provide HEPA filters in all work areas to control airborne contaminants, odors and dust.
16. Special clean-up to be provided by a specialty janitorial company when systems are operational. All surfaces to be hand-wiped.
17. Provide accommodations for City employees. Lab employees may need to access work area during the construction process.
18. Contractor shall not move laboratory equipment. City will perform all moving.

Phase 3: Upper Level Crime Laboratory (Rooms 209, 210, 211, 212, 213 and 214)

1. Cover all equipment with 8 mil polyethylene sheets. Tape all edges to be air tight.
2. Remove ceilings and hydronic hot/chilled water piping in Rooms 211, 212, 213, 214.
3. Remove rooftop AHU above Room 211 Crime Lab.
4. Temporarily support light fixtures.
5. Modify roof curb and roof membrane.
6. Clean existing ducts/diffusers. Provide protection at all air inlets and outlets (diffusers, registers, grilles, etc.) to minimize dust infiltration.
7. Extend duct to new AHU-1 unit height.
8. Install new AHU-1 and hot/chilled water piping. Connect coils to hydronic piping.
9. Pressure test piping and allow for building department inspection.
10. Replace ceilings and drywall close partition.
11. Install light fixtures.
12. Start-up heat/air-conditioning system.
13. Remove Crime Lab portable heating/cooling units and temporary wiring.
14. Patch all damaged surfaces.

15. Room 214 ceiling demolition, refrigerant and hot water piping and repair work may only be performed on Friday, Saturday and Sunday from 8 am to 5 pm which includes covering and cleaning spaces. Contractor will not be granted access into this room to resume work no sooner than 11-days later. The time constraints shall only be modified with approval from the Canton/Stark county Crime Lab Director. Special clean-up to be provided by a specialty janitorial company before Monday morning. All surfaces to be hand-wiped.
16. Work shall be limited to 3-day periods in rooms 211, 212 and 213, similar to 214 described above, unless otherwise pre-approved by Crime Lab Director.
17. Provide HEPA filters in all work areas to control airborne contaminants, odors and dust.
18. Special clean-up to be provided by a specialty janitorial company when work will be stopped for more than two days. All surfaces to be hand-wiped.
19. Contractor shall not enter any rooms unless accompanied by a Crime lab employee. Crime lab employee will monitor equipment and sampling protection during all working hours. Provide accommodations for City employee that will monitor all construction services.
20. Contractor shall not move laboratory equipment. City will perform all moving.

Pavement Removal and Replacement

Areas of pavement being removed and not replaced needs to be completed by the end of the project. This includes site restoration of these areas.

It is the intention that areas of pavement removal with new pavement installation will be completed after heavy construction equipment has been removed from the area and the associated constructed local to the pavement areas is substantially complete.

Areas of new pavement will not be used for construction deliveries or vehicle access.

The Contractor shall provide a pavement replacement sequence with his construction schedule prior to the preconstruction meeting. The pavement replacement work program will be reviewed by the Owner/Engineer for acceptance.

All pavement work must be completed prior to the end of construction, including restoration and site grading.

Equipment Submittals

Equipment submittals shall be coordinated with the sequence of construction so as to have equipment submittals successfully completed, equipment fabricated and on site or deliveries schedule appropriately to meet the project schedule.

The successful completion of the following submittals early in the project are critical to meet the schedule. The contractor shall incorporate the submittal schedule for each item listed in the overall project schedule so equipment manufacturing and deliveries are coordinated with the construction schedule.

1.10 APPENDIX

The following non-contract reference items are included in the Appendix, which follows the technical specifications.

1. Quotation from Schreiber, Inc., for "*Canton, OH Proposal No.: 10-13-1984"*, prepared by Larry Willingham, dated November 1, 2013, consisting of 11pages.

2. Quotation from Hydro-Dyne Engineering, Inc., for "*Canton WRF Nutrient Removal and Miscellaneous Improvements Fine Screening Facility Scope of Work #11272-13-14 for (Dual Stage) Hydro-Flo Screens and Washing Compactors"*, prepared by Steve D. Frank, Regional Sales Manager, dated August 30, 2013, consisting of 8 pages.

3. Quotation from Hydro-Dyne Engineering, Inc., for "*Canton WRF Nutrient Removal and Miscellaneous Improvements Fine Screening Facility Scope of Work #11272-12 for (Single Stage) Hydro-Flo Screens and Washing Compactors"*, prepared by Steve D. Frank, Regional Sales Manager, dated August 30, 2013, consisting of 7 pages.

4. Quotation from Gardner Denver Nash Hoffman & Lamson Products, entitled *"Proposal No. 23201R3 Canton Ohio WWTP Equipment Repair…Centrifugal Products"*, prepared by Todd Lilly, Product Specialist, dated October 15, 2013, consisting of 8 pages.

5. Quotation from Farrar Scientific, entitled *"Quote: FS080512 Rev 1 for Refrigerator Environmental Chamber/Incubator Environmental Chamber System"*, prepared by Craig A. Wood, Director of Engineering, dated May 10, 2013, consisting of 2 pages.

6. Report of Geotechnical Subsurface Exploration from Professional Services Industries, Inc. for *"Proposed Building Expansion Canton Water Reclamation Facility…PSI File Number 0145-449"*, prepared by Nicholas S. Campanella and A. Veeramani, P.E., dated October 24, 2011, consisting of 32 pages.

7. Soil Resistivity Test Results from Professional Services Industries, Inc. for *"Canton Water Reclamation Facility…PSI File Number 0138-323"*, prepared by Surya Thapa, P.E. and A. Veeramani, P.E., dated June 14, 2012, consisting of 5 pages.

8. Analytical Report from Alloway, for *"Mudwell – Center Well Sample No. L12-10280-01 Canton Tertiary Demolition Project"*, dated January 12, 2012, consisting of 2 pages.

9. Report of Findings of an Asbestos Survey from HzW Environmental Consultants. LLC. Conducted at (6) Structures Located of the City of Canton Water Pollution Control Center, prepared by Matthew P. Fergus and Joan A. Sablar, dated October 10, 2013, consisting of 58 pages.

10. Report of Thickness Inspection from Acuren, for *"Raw Pump Inlet Discharge Piping City of Canton OH (WRF)"*, prepared by Richard Conley, dated December 10, 2010, consisting of 32 pages.

11. Report of Piping Inspection City of Canton OH (WRF) from Acuren, prepared by Richard Conley, dated December 19, 2011, consisting of 28 pages.

12. Report of Piping Inspection City of Canton OH (WRF) from Acuren, prepared by Richard Conley, dated December 3, 2012, consisting of 31 pages.

13. Agreement between OVIVO USA, LLC and the City of Canton for furnishing goods and services associated with the Membrane Bioreactor ("MBR") system, dated August 20, 2013.

14. Shop Drawings submitted by OVIVO, for equipment to be furnished under the Scope of Supply contained in the MBR Procurement Agreement and as shown on the drawings (to be furnished upon availability).

1.11 OWNER OCCUPANCY

A. The WRF is a vital facility. All work shall be so organized that the existing plant will continue to function until the major new treatment units are completed and placed in service. Continuous treatment shall be provided at the same level during construction as existed prior to construction. The plant must not be taken out of service without the prior approval of the Owner and the Ohio Environmental Protection Agency (OEPA). Where new lines or modifications of existing flow structures are required, temporary bulkheads on pipelines must be built to accommodate the flow. Any switch-over to temporary lines or facilities shall be coordinated with and reviewed by the Engineer.

B. The Contractor shall cooperate with Owner to minimize conflicts between facility operations and construction activities.

1.12 FIELD OFFICES AND FIRST AID

A. CONTRACTOR'S OFFICE

The Contractor shall provide and maintain an office on the site of the work during the construction period of the contract, at which he or his authorized agent shall be present at all times while the work is in progress.

B. AID TO THE INJURED

The Contractor shall keep in his office and on the work site, all articles necessary for giving "First Aid to the Injured." He shall also have standing arrangements for the immediate removal and hospital treatment of any employee or other person who maybe injured on the work site.

1.13 SEQUENCE OF OPERATIONS

A. General Planning

The Contractor shall be responsible for all equipment system and unit process start-up, testing and commissioning of all work until substantial completion is achieved and Owner has accepted the work. Contractor shall prepare initial start-up and commissioning plans for each equipment system which shall be approved by the Engineer and Owner. Plans shall consist of overall description of start-up and commissioning process, list of equipment and schedule, detailed sequence of activities, staff duties and responsibilities, and pertinent contingency plans. Contractor shall coordinate all start-up and commissioning activities with the respective equipment Manufacturer's representatives, Engineer and Owner. In

regards to the Membrane System Supplier (OVIVO), a typical commissioning plan is included in the Appendix, as part of the OVIVO Contract.

City shall furnish all chemicals needed for start-up and commissioning. Contractor shall supply and install any temporary provisions (piping, valves, dechlorination equipment, etc) for collecting spent material.

The Sequence of Operations shall generally consist of the following stages: (A) General Planning; (B) Equipment System Check-out and Field Testing (C) Equipment Start-up, (D) Process Commissioning; (E) Operational Demonstration; (F) Substantial Completion, (G) Process Performance Testing and (H) Correction Period. (See 01650CT for additional requirements).

B. Equipment System Check-Out and Field Testing

Contractor and Manufacturer's representatives shall inspect installed equipment and systems prior to each start-up and verify in writing the Contractor's readiness for start-up. All electrical connections, instrumentation and controls and power supply shall be complete and fully functional. No temporary electrical provisions shall be allowed unless request for construction sequencing and approved by Engineer. Temporary discharge piping provisions and required testing devices shall be in place and operational. All operation and maintenance manuals shall be available prior to start-up.

Equipment System Check-Out includes, but is not limited to factory testing, field testing, dry testing, wet testing, manufacturer's checkout, and start-up.

C. Equipment System Start-Up

Equipment system start-up shall be performed under the direction of the approved Manufacturer's Representative. Manufacturer's factory testing, field testing (wet or dry), check-out and all adjustments shall be satisfied prior to start-up. Contractor, Subcontractor's and Manufacturer's representatives shall furnish all, labor, equipment and materials necessary to complete system start-up. Any repairs, replacements or modification of deficient work shall be performed by the Contractor.

D. Process Commissioning

Commissioning consists of the series of activities or processes/procedures necessary to ensure that systems and equipment are installed, functionally tested, started up and capable of being operated and maintained to perform in conformity with the design intent for the facility improvements.

Upon successful completion of Start-up, process flows and materials shall be used for commissioning the equipment and unit process systems to demonstrate the equipment and unit process systems function properly. Commissioning shall confirm the proper operation of the equipment and unit process systems with process fluids and process solids, adjustments shall be made, operational scenarios checked–out, and the equipment or unit process systems shall be optimized and brought into compliance with design criteria in preparation for Process Performance Testing. The Contractor shall make all adjustments and

corrections necessary to achieve normal, stable operation of systems. During commissioning, the Contractor shall coordinate and implement adequate manufacturer's training of Owner's personnel on all equipment, systems and unit processes, inclusive of process operation, maintenance and system controls. Documentation of commissioning activities and results shall be provided by the Contractor.

E. Operational Demonstration

Following commissioning, Owner's personnel shall operate the plant for a 2 week period during which the work is operated and maintained in a continuously on-line fully functional process status. The operational demonstration shall encompass all the work or the portion thereof designated for substantial completion. The Contractor and key manufacturer's representatives shall provide for on-site supervision and guidance to Owner's personnel. Contractor still maintains responsibility for unit process systems during this period. In the event of any failures, Contractor shall implement any repairs and the demonstration period started over.

F. Substantial Completion

Following successful Operational Demonstration, Owner shall accept the work and continue operating and maintaining respective equipment or plant processes. Specifically, it shall be understood that substantial completion means that respective wastewater treatment processes are performing as intended.

In addition to wastewater treatment processes, all building electrical, mechanical and plumbing systems shall be subject to substantial completion demonstration.

Respective equipment warranty period shall separately commence as each respective system achieves substantial completion.

G. Process Performance Testing

Following Substantial Completion and during Owner's continued operation of the processes, a 30 day process performance test shall be performed in accordance with the Process Performance Guarantee described in the MBR System Supplier's Procurement Agreement. This 30 day test shall be performed again 10 months after commencement of the one year correction period. The one year correction period shall commence on the date of final completion and acceptance of all the work. Contractor shall make available, at all times during the test periods, persons knowledgeable of the systems to direct City's personnel, in their operations. Membrane system repairs or replacement of components shall be performed by the MBR System Supplier and Contractor in accordance with the Procurement Agreement at no cost to the City. Warranty periods shall restart for any specific equipment that is replaced.

H. One Year Correction Period

Following final completion, a one year correction period shall be implemented to satisfy Ohio EPA funding requirements. During this period, the Contractor shall be responsible for implementing any repairs or replacements as may be required in accordance with the General Conditions of the Contract Documents. This one-year correction period shall be in addition to any and all other rights of Owner set forth in the General Conditions, including but not limited to warranty rights.

END OF SECTION 01010CT (10/93)

SECTION 01011CT - SYSTEM PERFORMANCES

PART 1 - GENERAL

1.1 GENERAL

A. It is the intent of this Contract that the final installation shall be complete in all respects.

B. The Contractor shall be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.2 BUILDINGS

A. The building and components shall function properly and in accordance with the plans, specifications and industry standards.

B. The following components are included, but not necessarily limited to, the following:

1. Masonry Systems
2. Roofing Systems
3. Man Doors
4. Coiling Doors
5. Ceiling Systems
6. Windows Systems
7. Painting Systems
8. Floor Systems Equipment

a. Were Architectural
b. Mechanical
c. Electrical

1.3 FACILITIES

A. The facilities and equipment shall function properly and in accordance with plans, specifications and industry standards.

B. The following equipment includes, but is not necessarily limited to, the following:

1. Parshall Flume.
2. Grit and Grease System including traveling bridge, grit pumps, grease augers and grit classifier.
3. Fine Screen System including fine screens, sluicing system and washer/compactors.
4. The new preliminary treatment blower system with piping modifications and control valves.
5. Sluice and Slide Gates with or without electric operators.
6. Valves with or without electric operators.

7. Mixers.
8. The scour air blower system by modifying the existing blowers, modifying existing piping and installation of new valves and flow meters.
9. The process air system including new piping, control valves, meters, diffuser and blowers.
10. Membrane system.
11. RAS pump system with level control and meter.
12. Internal recycle pump system with level control and meter.
13. Permeate System with control valves and pumps.
14. CIP system with chemical storage, pumps, flow meters and valving.
15. WAS pumps.
16. Solids Holding Aeration system including piping, control valve, flow meter, diffuser system and blowers.
17. Stage 1 Dewatering Pump System.
18. Belt Press Feed Pumps System.
19. Polymer System.
20. Conveyor System.
21. Hoist and Conveyor Systems.
22. Process Instruments & Control Systems SCADA System.
23. Mechanical Systems including ventilation, HVAC systems, boiler system, chiller system and heating systems.
24. Electrical Systems including Motor Control Centers, transformers, power distribution systems, lighting circuits and systems and communication systems.

1.4 CERTIFICATION

A. The Contractor shall provide written certification from the manufacturers and/or installers that the various major components are in working order or have been installed in accordance with the manufacturer's instructions.

END OF SECTION 01011CT (10/93)

SECTION 01020CT - GENERAL REGULATIONS AND PERMITS

PART 1 - GENERAL

1.1 PERMITS

The Contractor shall apply for all building or right of way permits from the local building authority having jurisdiction. All permits and inspection fees required shall be obtained and paid for by the Contractor.

1.2 ARCHAEOLOGICAL DISCOVERIES

Contractors and subcontractors are required under O.R.C. Section 149.53, to notify the Ohio Historical Society and the Ohio Historic Site Preservation Board of Archaeological Discoveries located in the project area, and to cooperate with those entities in archaeological and historic surveys and salvage efforts if such discoveries are uncovered within the project area.

Contact: Ohio Resource Protection and Review
Attn.: Mr. Mark Epstein, Director
1982 Velma Avenue
Columbus, Ohio 43211
mepstein@ohiohistory.org

Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 01020CT (11/98)

SECTION 01021CT - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 01021CT (10/93)

SECTION 01023CT - PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.

B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.

C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.

D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.

E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

END OF SECTION 01023CT (10/93)

SECTION 01024CT - SUBSTITUTIONS

PART 1 - GENERAL

1.1 MATERIALS AND EQUIPMENT

A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified.

1. Base Bid Items: The Contractor shall base his bid on the named Standards. Should the Contractor desire to use other equipment and materials than a named Standard, he shall follow the procedures set forth in the Instructions to Bidders.

2. Non-Based Bid Items: Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and Engineer.

B. The written request for a substitution shall provide a side by side comparison of the specified equipment and the proposed substitution. Included shall be any deviations from the specified equipment. The written request shall be in a manner to reduce the Engineer’s need to investigate the proposed substitution materials, construction, service history, operational history and performance longevity. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.

C. The Contractor shall be responsible for all Engineering costs associated with the review of the proposed substitution to determine whether or not such change will be permitted. The Contractor shall also be responsible for any Engineering fees for design modifications and all associated construction cost changes. These fees and associated costs will be included in an executed change order with the Owner whether the proposed substitution is agreeable or not agreeable with the Owner and Engineer.

D. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 01024CT (10/93)

SECTION 01032CT - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.

B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.

C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, a schedule of shop drawing submittals and material deliveries, an erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.

D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

END OF SECTION 01032CT (04/00)

SECTION 01033CT - SURVEYS, LAYOUTS AND LEVELS

PART 1 - GENERAL

1.1 REFERENCE POINTS

A. The Owner shall provide engineering surveys for construction to establish reference points which in his judgment are necessary to enable the Contractor to proceed with the work. The Contractor shall be responsible for surveying and laying out the work and shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Engineer. He shall report to the Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations. The Contractor shall replace and accurately relocate all reference points so lost, destroyed or moved.

1.2 LAYOUT OF WORK

A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall employ a competent surveyor to establish lines and grades to insure the new construction aligns with any existing work.

END OF SECTION 01033CT (07/00)

SECTION 01040 - CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 CONSTRUCTION PROGRESS PHOTOGRAPHS

A. The Contractor shall take digital photographs every four (4) weeks to document the work for all trades in progress. The Contractor shall provide two (2) copies of compact disks (CDs) of the digital photographs taken every month with each pay request. The disks shall be labeled with the project name, time period, and shall be numbered in chronological order with a short description of the photograph.

1. The photographs shall include structures, piping, stored materials, installed equipment, etc.
2. The photographs of all underground construction shall be taken prior to backfill. This shall include underground piping, structures, etc.

B. The Contractor shall have aerial photographs taken prior to beginning work, at three (3) month intervals and at the completion of construction. The Owner will select two (2) aerial photographs from the submitted photographs for the Contractor to make enlargement color photograph for each interval.

END OF SECTION 01040 (10/93)

SECTION 01042CT - QUALIFICATIONS OF TRADESMEN

PART 1 - GENERAL

1.1 CHARACTER OF WORKMEN AND EQUIPMENT

A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.

B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 01042CT (10/93)

SECTION 01043CT - PRODUCT HANDLING AND PROTECTION

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE OF MATERIALS

A. The Contractor shall be responsible for delivery, receipt and proper storage of all materials.

B. Prior to any delivery, the Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment.

C. Deliveries of all construction materials and equipment should be made at suitable times and when the Contractor is on site.

D. The Contractor shall store all materials required for the performance of this contract on site and at locations agreed to by the Engineer/Owner.

1.2 CONTRACTORS RESPONSIBILITIES AT TIME OF DELIVERY

A. Confirm delivery contents against shipping invoice, shop drawings including receipt of O&M Manuals.

B. Unload all equipment and materials in accordance with the manufacturer’s instructions (Refer to O&M manuals).

C. Inspect all equipment and materials against approved shop drawings at the time of delivery.

D. Equipment and materials damaged or not meeting the requirements of the approved shop drawings shall be immediately documented and the Engineer/Owner and manufacturer notified.

E. Equipment received shall be stored in accordance with the manufacturer’s recommendation the same day of the delivery.

1.3 ON-SITE STORAGE REQUIREMENTS OF THE CONTRACTOR

A. Carefully prepare for storage and label all equipment and materials after they have been delivered and inspected.

B. Store materials to permit easy access for inspection and identification. Support all materials off of the ground and protect steel members and packaged material from corrosion and deterioration as per manufacturers' instructions (Refer to O&M manuals).

C. Equipment acceptable to the manufacturer for storage outdoors must be placed on timbers or blocks in a clean and level area free of grass and mud.

D. Pumps, blowers, classifiers, mixers, washer/compactors, instruments, control panels, valves and actuators, motors and other similar equipment and electrical devices shall be stored indoors in a temperature controlled environment.

1.4 STORAGE OF STOCKPILED MATERIALS

A. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.

B. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.

C. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.

D. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

E. Only materials stored on the WRF site will be eligible for payment in accordance with the general conditions. Store materials will be inspected each month to insure that the quality of the material is preserved. Any material which is allowed to deteriorate or the manufacturers storage procedures are not being followed shall not be eligible for payment and if previously paid for, payment will be removed.

END OF SECTION 01043CT (10/93)

SECTION 01051CT - ADDITIONAL WORK, OVERTIME

PART 1 - GENERAL

1.1 NIGHT, SUNDAY AND HOLIDAY WORK

A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least five (5) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

B. Work during the nights, Sundays, or Holidays will not be permitted unless all materials needed for the work are on site and ready for installation.

END OF SECTION 01051CT (10/93)

SECTION 01061CT - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.

B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.

D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.

E. The Contractor shall submit Shop Drawings for all fabricated work, all assembly work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.

F. It is the responsibility of the Contractor to furnish to all subcontractors and other entities reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.

H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.

I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 3.2 times direct labor cost plus expenses for the actual time spent to respond to questions, review and process the third or more submittal of any Shop Drawing.

1.2 SUBMITTAL PROCEDURE

A. All required submissions shall be made to the Engineer/Architect by the Contractor only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.

B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.

C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:

1. Location
2. Project Name
3. Contract
4. Name and Address of Engineer/Architect
5. Name and Address of Contractor
6. Name and Address of Subcontractor
7. Name and Address of Supplier
8. Name of Manufacturer
9. Number and Title of appropriate Specification Section
10. Drawing Number and Detail References, as appropriate.
11. Submittal Sequence or Log Reference Number.

    a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".

D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

_____ _____

Signature Date

_____

Company

E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.

F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.

G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.

1.3 REVIEW PROCEDURE

A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. The order of review will be in the order that shop drawings are received. When multiple Shop Drawings are submitted the Contractor shall indicate any items having priority over other Shop Drawings for review. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.

B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.

C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.

E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

POST CONTRACT AWARD APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____
Page	Paragraph	Description

A. The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.

_____

B. Change in Contract Price (indicate + or -) $ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

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

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.

2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.

3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

   _____ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature:

_____

Firm:

Address: _____

_____

_____

Telephone: _____ Date: _____

Attachments: _____

_____

_____

_____

For use by ENGINEER:

_____Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.
_____Accepted as evidenced by included CHANGE ORDER.
_____Not accepted as submitted. See Remarks.
_____Acceptance requires completion of submittal as required for SHOP DRAWINGS.
_____Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

_____

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_____

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_____

_____

POST CONTRACT AWARD APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____
Page	Paragraph	Description

A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

_____

B. Change in Contract Price (indicate + or -) $ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

D. Signature:

_____

Firm:

_____

Address:

_____

_____

Telephone: _____ Date: _____

Attachments: _____

_____

_____

_____

For use by ENGINEER:

_____Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.
_____Accepted as evidenced by included CHANGE ORDER.
_____Not accepted as submitted. See Remarks.
_____Acceptance requires completion of submittal as required for SHOP DRAWINGS.
_____Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

_____

_____

_____

_____

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_____

_____

_____

END OF SECTION 01061CT (01/96)

SECTION 01063CT - SAMPLES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

1.2 SAMPLE CONSTRUCTION

A. Construct no more than three sample panel not smaller than 6-feet long by 4-feet high of masonry construction for the fine screen building and preliminary solids buildings. The panels shall be constructed next to an existing building. The purpose of constructing the panels is to assist the Owner in selecting masonry units and mortar color. The cost for construction of each panel shall be included in the lump sum price bid.

END OF SECTION 01063CT (10/93)

SECTION 01066CT - TEMPORARY WATER AND DISTRIBUTION

PART 1 - GENERAL

1.1 WATER

A. The Contractor shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At his own expense he shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Engineer

B. Water for Construction is available in small volumes from existing yard hydrants. Water for construction constitutes water needed for daily use and capable of being provided in a ¾ inch or 1 inch hose. This water is from the WRF plant effluent water system which is stored in the elevated storage tank on site and piped throughout the plant. The Contractor shall make arrangements with the Owner/Engineer at the pre-construction meeting to identify locations and means to access the plant effluent water source.

C. Water needs of larger volumes, such as water testing of structural tanks, clear water testing of new process system is also available from the plant effluent water system. However, the rate of flow maybe limited. If greater flow rates of water are needed or the rate of flow available is not acceptable to the Contractor to obtain the volume required, the Contractor may provide a pump and force main system at no cost to the Owner to obtain the plant effluent from the secondary clarifiers troughs and/or Chlorine contact tank. The Contractor shall also consider reuse of the plant effluent water volume used for testing, etc. when possible.

END OF SECTION 01066CT (10/93)

SECTION 01070CT - TEMPORARY HEATING, COOLING, LIGHTING AND POWER

PART 1 - GENERAL

1.1 The Contractor shall provide and/or install the following:

A. Temporary heating system, as required, to protect the work until the work is complete and ready for occupancy by the Owner. Such system shall meet all requirements of the N.E.C., O.B.B.C. and the local codes for temporary construction services.

B. All costs of natural gas, propane, fuel oil, electricity or other energy consumed and costs related to provide temporary heat.

C. All piping necessary to provide fuel for the temporary heating system.

D. All ductwork and vents necessary for the temporary heating system.

E. Power

1. Temporary power facilities for construction purposes the cost of running temporary service from the existing on site MCC panels to the various project construction areas. Power shall be provided in accordance with the Contractor's construction schedule.

2. One (1) full-time electrician to maintain the temporary services. The electrician shall be on site at all times temporary power is required. This shall include both regular and overtime hours. The electrician may be employed in other phases of the work while on the project.

3. The electrical work for construction purposes shall conform to all Federal, State (Ohio Safety Code IC-3, Specific Safety Requirements) as well as requirements of the National Electric Code. The Contractor shall obtain and pay for required applications, permits and inspection pertaining to this work. This cost shall also be included in the Contractor's price.

4. All utility charges or fees for permits, step down transformers, metering or other materials when necessary.

5. Temporary work shall be installed in such a manner as not to interfere with the permanent construction. If such interference does occur, it shall be the responsibility of the Contractor to make such changes as may be required to overcome the interference.

6. The Contractor shall arrange for the installation of temporary service for construction purposes as well as making provisions to adequately protect the transformer and any associated temporary power equipment throughout the course of construction.

F. Heating

1. The Contractor shall provide the electrical facilities for temporary heating and ventilating systems. All temporary systems shall be connected directly to the project temporary power system by the Contractor.

G. Lighting

1. Provide labor and material for the installation and maintenance of temporary light and power as may be required during the period of construction. The following will form minimum requirements:

    a. Temporary general lighting.
    b. General all purpose temporary power and telephone requirements.
    c. Make connections for temporary heat. Check temporary heat requirements in these specifications.
    d. Provide temporary power and telephone connections to the various contractors and Resident Engineer's field trailers.
    e. Power for any electric arc welding shall not be furnished by this temporary power service. Power for any electric arc welding equipment shall be furnished complete by the trades requiring the welding.

2. This service is to consist of distribution system, panel board, grounding, branch circuits, switches, receptacle outlets and all other labor and materials necessary to provide a complete operating system.
3. Temporary wire is to be laid out, balanced, and sized so as to produce a voltage drop of no more than five percent (5%) at the extreme end of the line, when operating a full load.
4. There shall be a minimum of one 200 amp 120/208 three phase panel board for each building area. All panels shall be securely and neatly installed on substantial framework. Any panel installation which does not meet with the Engineer's approval shall be remounted in an approved manner.
5. Temporary lighting distribution will be made from the temporary panels indicated above. From the panel, circuit wiring with "pigtail" medium base lamps will distribute lighting on the basis of 1/8 watt per square foot average for the construction area. Each circuit will consist of "pigtail" receptacles on 20 foot centers, and 200 watt lamps will be installed in every other receptacle for added concentration of lighting as needed. Fixtures shall be wired with #8 AWG wire and suspended not less than 7'-6" above the floor.
6. As interior partitions are erected, the Contractor shall revise the temporary lighting arrangements so that not less than one lamp is provided in each space over one hundred square feet in area. Lights shall also be installed by the Contractor as directed by the Engineer, in smaller areas where required to provide adequate light for work being carried out in the space.
7. In addition to the specific requirements indicated herein, there will be required 480V-3 phase, 208 volts and 120 volt power receptacles. Provide one 480V-3 phase 20 amp outlet and two 20 amp outlets for 208 volt, 3 phase service, and six 20 amp duplex 120V outlets all mounted on a plywood panel and serviced from the local temporary panel. Not less than one such panel shall be provided for each work area.

All receptacle circuits shall be wired with #10 AWG wire minimum and protected by 30 amp circuit breakers or fuses.

8. The Contractor shall provide and pay for all required extensions for lights or power tools beyond the receptacle outlets provided above.
9. The Contractor shall furnish and install 200 watt lamps for general circuit lighting and all fuses as may be required for a complete job. Replacement of lamps, fuses, including theft, will be the responsibility of the Contractor throughout the life of the project.
10. The Contractor shall be responsible for installing and maintaining a reasonably balanced system and shall take current readings on the feeders at regular intervals as required. Any serious phase unbalance shall be corrected by the Contractor.
11. The Contractor shall protect his installation against weather damage, the normal operations of other trades, Owner's personnel, and visitors to the site. The Contractor shall be responsible for the proper use and maintenance of all temporary wiring systems until they are removed.

H. Administration Building

1. The Contractor shall furnish and install temporary cooling systems. See specification Section 01070 for additional information. Quantities and locations of the temporary cooling systems are indicated on the Mechanical Demolition plans. Cooling units shall be portable, nominal 24,000 btuh each, 208-volt 1-phase, 13.2 amps, 630 cfm at 0.5 inches water gauge. Cooling units shall be “Office Pro #24” as manufactured by MovinCool, or approved equal. Furnish with, and install nozzle supply adapters, flexible supply ducts, and condenser heat removal ducts.
2. Contractor shall furnish and install provisions for temporary power for the temporary cooling units. Provisions for the temporary power feeds shall be as specified in Section 16010, Electrical General Provisions. Coordinate voltage/amperage requirements with temporary cooling equipment to be installed. Use the nearest branch circuit panels to the units to provide temporary power after verifying that adequate capacity is available. All temporary cables shall be secured and routed in such a way so as to avoid inconveniencing building occupants to the extent possible. All trip hazards shall be adequately marked and approved by the owner prior to installation.

END OF SECTION 01070CT (10/97)

SECTION 01080CT - FIELD OFFICES AND FIRST AID

PART 1 - GENERAL

1.1 CONTRACTOR'S OFFICE

Each Contractor shall provide and maintain an office on the site of the work during the construction period of the contract, at which he or his authorized agent shall be present at all times while the work is in progress.

1.2 RESIDENT ENGINEER'S OFFICE

The Contractor shall be required to provide and maintain the herein described Resident Engineer's office, services and office equipment until completion of the contract including punch list. All equipment shall be provided with a maintenance contract which provides prompt service. During any time a service or equipment is non-operative, the Resident Engineer may utilize a commercial service or rental equipment at the Contractor's expense until the service or equipment is restored.

The Contractor shall provide and install temporary power and telephone lines to the Engineer's office.

All items shall remain property of the Contractor upon project completion.

A. Office

1. The office shall have two doors minimum and adequate window area. All doors shall be fitted with identical cylinder locks for one key operation. Windows shall be fitted with venetian blinds and 1 in. mesh #12 wire (minimum) security screens.
2. The office shall be equipped with air conditioning, heating, electric lighting, two (2) private line business telephone outlets and one telephone extension outlet, clothes closet, and lavatory with flush type toilet connected to utilities.
3. Where water and sewage facilities are not available, the Contractor shall supply and maintain a portable chemical toilet and a water tank to supply the lavatory. Potable water shall be supplied to the lavatory tank.
4. The minimum floor space shall be 450 square feet. Minimum 10 feet width, divided into at least two (2) offices and one (1) meeting area.

B. Services

1. Fuel and electricity for heating, lighting, and equipment.
2. Potable water service with cooler and paper drinking cup supplies.
3. Daily janitorial services to maintain the office in a clean condition. These services shall include paper towels, toilet paper, soap, etc.
4. Wired local telephone service for 3 line(s) and all long distance telephone calls shall be paid by the Contractor until final completion and final acceptance of the contract.

The Contractor shall figure in his bid a monthly allowance in an amount of $100/mo. for long distance telephone calls made by the Resident Engineer or assistants. On the final pay estimate the Contractor shall credit the Owner or be paid extra for the difference in the sum of the long distance telephone call charges over or under the sum of monthly allowances for the contract period to the date of final acceptance.

Internet service from a local provider with a minimum of 300 minutes per month access time.

C. Office Equipment

1. Two (2) Desks with Desk Chairs
2. Two (2) Plan Racks
3. Two (2) Plan Tables
4. One (1) Conference Table (Approximately 3' x 6')
5. Eight (8) Chairs for Conference Table
6. One (1) Drafting Table with Drafting Stool
7. Two (2) Four-Drawer Letter Size Lockable Filing Cabinets
8. One (1) Bookcase (36" x 30" x 10" each)
9. Four (4) Wastepaper Baskets
10. One (1) Printout Calculator
11. One (1) Current ODOT Specification Book
12. One (1) Two-Drawer Letter Size Lockable Filing Cabinet
13. Two (2) Single Line Business Telephones
14. One (1) Digital Telephone Answering Machine with 30 minute minimum recording time. Hardware, services and maintenance of a copier with collator and automatic feeder in the Resident Engineer's office. The copier shall be a plain paper copier, table top unit, capable of making 8-1/2 by 11 inches and 11 by 17 inches size for size copies. Also included shall be an allowance for copy materials (including paper supply) in the amount of 2,000 copies per month.
15. Hardware, services and maintenance of a plain paper facsimile machine (FAX) in the Resident Engineer's office. The high-speed facsimile machine shall be capable of transmitting standard 8-1/2" x 11" copy by public-switched telephone network. Transmission time shall be under thirty (30) seconds for a full 8-1/2" x 11" copy. The facsimile machine shall be capable of continuous automatic feed of a minimum of 24 sheets to various pre-set telephone numbers and at the transmission times selected. Also included shall be an allowance for materials in the amount of 400 sheets per month.
16. Hardware, services and maintenance of a computer system in the Resident Engineer's Office.

    Computer, Core i5 or i7, 2.2GH or equal;
    4 GB PC-1600 RAM
    512 KB cache
    300 GB hard drive (min);
    101 Key extended keyboard;
    40X CD ROM Drive;
    1 GHz ethernet controller with 2 ports;
    Wireless ethernet controller, 802.11n

4 USB ports (min);
19" SVGA LCD Monitor, 1600 X 1200 (min), with swivel/tilt monitor stand;
64 Bit PCIe-16X video graphics accelerator, min 512 MB;
Sound Blaster compatible 32 Bit sound card;
One pair of 15 Watt speakers;
One CD Disk Storage Tray, 50 disk capacity;
Fifty blank CD's;
Triplite surge protector;
HP Laser Jet 5 Plus printer (min) with 25 foot cable and stand;
5 minute uninterruptable power supply with built in surge protector and line conditioner sized to match computer and monitor;
All interconnecting cables and connectors, software drivers, and disk controllers;
Software: Windows 7, and latest version(s) of Microsoft Office Professional 2010

1.3 AID TO THE INJURED

The Contractor shall keep in his office and on the work site, all articles necessary for giving "First Aid to the Injured." He shall also have standing arrangements for the immediate removal and hospital treatment of any employee or other person who may be injured on the work site.

END OF SECTION 01080CT (8/99)

SECTION 01085CT - PROJECT IDENTIFICATION

PART 1 - GENERAL

1.1 PROJECT SIGN

A. The Contractor shall be responsible for constructing, installing, maintaining and removing all project signs.

B. The Contractor shall be responsible for obtaining all permits for project signs from any local authority having jurisdiction including the payment of fees, if any.

C. The Contractor shall install one project sign at a location to be determined by the Owner. The sign shall contain all of the data and graphics depicted on the Drawings.

END OF SECTION 01085CT (12/09)

SECTION 01088CT - TEMPORARY TRAFFIC CONTROL DEVICES

PART 1 - GENERAL

1.1 BARRICADES, SIGNS AND LIGHTS

A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.

B. No manhole or sewer excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.

C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

1.2 MAINTENANCE OF TRAFFIC

A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation when work takes place on public roadways.

B. The Contractor is required to provide maintenance of traffic on the plant site for normal daily traffic movement by plant personnel, vendors and/or deliveries to the plant or Contractors. The Contractor shall coordinate with the Owner and Contractors when areas of pavement will be out of service. When necessary, temporary roadways will be the responsibility of the Contractor.

C. This work shall include providing suitable and satisfactorily trained and properly attired flagmen for use at any location where existing roadway is narrowed to a width of less than 2 full lanes (18 feet).

D. The Contractor is also responsible for maintaining local access to all residences and businesses along the route of the sewer and to provide whatever temporary materials are necessary to provide a safe, adequate drive surface.

E. At all boring locations, Contractor shall provide suitable flashers, barricades, and traffic control devices as may be deemed necessary by the Engineer. This may extend to maintain facilities on a 24 hour basis until such time as the areas are completely backfilled.

END OF SECTION 01088CT (10/93)

SECTION 01091CT - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 UNNECESSARY NOISE, DUST AND ODORS

A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

1.2 SEWAGE, SURFACE AND FLOOD FLOWS

A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

1.3 WORK IN FREEZING WEATHER

A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

1.4 POLLUTION CONTROL

A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.

B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NDPES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work shall be in accordance with ODOT Supplemental Specification 832 Temporary Sediment and Erosion Control.

C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.

D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 01091CT (01/10)

SECTION 01094CT - CLEANING AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL

A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.

B. As circumstances require and when ordered by the Engineer, the Contractor shall broom sweep and/or hose-wash the hard surface of the road or any driveway or sidewalk surface on which construction activity under this contract has resulted in dirt or any other foreign material being deposited.

C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.

D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.

E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.

F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 01094CT (10/93)

SECTION 01097CT - MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance information shall be submitted for all manufactured items, i.e. equipment, hardware, pumps, valves, motors, etc.

B. This manual will either contain or make reference to all information that has been issued during the construction and start-up periods, as well as information necessary for the proper operation and maintenance of equipment.

C. It shall be the responsibility of the Contractor who supplies such equipment to obtain from his vendors the required information and submit to the Engineer. This information will be accepted only if properly identified and only after it has been revised, where necessary, to conform to previous transmittals of the same material that have been "approved as noted" by the Engineer.

D. The initial submittal shall be on 8-1/2" X 11" size paper or folded to that size, unless indicated otherwise in the specific specification or agreed to by the Owner. The initial submittal shall consist of three (3) hard copies of the manufacturer's O&M instruction manuals prior to the equipment delivery. These copies will be used for review by the Engineer for completeness and by the Owner/Engineer (2 field copies) during construction, equipment installation, start-up and demonstration.

E. Any revisions noted during equipment installation, start-up, training or initial operation shall be made by the manufacturer.

F. One (1) final draft hard bond copy of the O&M Instruction Manual shall be submitted to the Engineer for final acceptance. When the final draft is found acceptable to the Engineer, the Contractor will be notified by the Engineer, and the Contractor shall submit an additional two (2) hard bound copies and six (6) electrical disc copies of the O&M instructions manual for final distribution to the Owner.

G. The Contractor shall disclose to the Engineer/Owner the purchase prices of the equipment once the Contractor has secured an agreement with the equipment manufacturer.

H. The O&M Instruction Manuals shall be assigned a value of 10% of the total equipment purchase price. The Contractor shall be provided 70% of the 10% once the O&M instruction manual submitted and the equipment delivery have been found to be acceptable. The remaining 30% of the 10% will be release upon receipt of the final two (2) hard bound copies and six (6) electronic disc copies.

I. In general and where applicable, the information shall consist of, but not be limited to the following:

1. Descriptive literature, bulletins or other data covering equipment or system.
2. Complete list of equipment and appurtenances included with system, complete with manufacturer and model number.
3. Utility requirements.
4. General arrangement drawing.
5. Sectional assembly.
6. Dimension print.
7. Materials of construction.
8. Certified performance curve.
9. Performance guarantee.
10. Parts list.
11. Recommended spare parts list with part and catalog number.
12. Lubrication recommendations and instructions.
13. Schematic wiring diagrams.
14. Schematic piping diagrams.
15. Instrumentation data.
16. Drive dimensions and data.
17. Control data.
18. Operating instructions.
19. Maintenance instructions including troubleshooting guidelines and preventative maintenance instructions with task schedule.
20. Required tools and equipment for operation and maintenance.
21. Safety considerations for O & M procedures.

END OF SECTION 01097CT (10/93)

SECTION 01098CT - PROJECT RECORDS, DRAWINGS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.

B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

1.2 EXPOSED DURING CONSTRUCTION RECORDS

A. The Contractor shall record the location of all buried pipes, utilities, etc. exposed during construction. The item shall be located by coordinate and elevation or by not less than three reference points and depth measurement with respect to a surface feature such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.

1.3 MONTHLY UPDATE

A. The record documents being maintained by the Contractor shall be reviewed with the Engineer monthly. Failure to provide record information in sufficient detailed as deemed by the Engineer can result in holding of payment for that item of work until the documents have been corrected.

END OF SECTION 01098CT (10/93)

SECTION 01099CT - FINAL COMPLIANCE AND SUBMITTALS

PART 1 - GENERAL

1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.

A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).

B. Contractor's Certification of Completion.

C. Contractor's Affidavit of Prevailing Wage.

D. Consent of Surety Company for Final Payment.

E. Affidavit of Final Acceptance Date and Correction Period.

F. Certificate of insurance verifying completed operations insurance coverage.

END OF SECTION 01099CT 4/04

SECTION 01210CT - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Selected materials and equipment are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. paragraph 11.02 Allowances of the General Conditions.

B. Types of allowances include the following:

1. Cash allowances (Lump Sum or Unit Price)
2. Contingency allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Owner/Engineer of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Owners/Engineers request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Owner/Engineer from the designated supplier.

1.4 SUBMITTALS

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

B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.5 UNUSED MATERIALS

A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

1. When requested by the Owner/Engineer, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Architect, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. See Section 01010 Summary of Work, for identification of all Allowances.

END OF SECTION 01210CT 11/93

SECTION 01310AIA - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Division 1 Section "Summary of Work" for a description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
2. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
3. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

B. Coordination: The Contractor shall coordinate all construction operations of all subcontractors and entities to ensure efficient and orderly installation of each part of the Work. The Contractor shall coordinate the operations off all subcontractors and entities with operations, included in different Sections that are dependent on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with all subcontractors and entities to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings. Prepare similar memoranda for Owner.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of all subcontractors and other entities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Startup and adjustment of systems.
8. Project closeout activities.

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

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

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

1.5 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three (3) days of the meeting.

B. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with subcontractors and other entities.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer and Owner of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. The Contract Documents.
    b. Options.
    c. Related requests for interpretations (RFIs).
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written recommendations.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Progress Meetings: Conduct progress meetings at a minimum at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Requests for interpretations (RFIs).
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.

19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute to Owner and Engineer the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

D. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each portion of the Work is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.

12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310AIA 11/02 (R 11/03)

SECTION 01320AIA - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for preparing a Contractor's Construction Schedule and other responsibilities of the Contractor.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.4 SUBMITTALS

A. Qualification Data: The Contractor shall utilize a computer based critical path scheduling software such as Micro Soft Project. The Software shall have the capability of updating. The Contractor can utilize their own staff provided they are skilled in using the software or they shall utilize a subconsultant to assist with the scheduling. The Contractor shall submit with their bid their intended method of scheduling the work.

B. Submittals Schedule: Submit (3) copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Engineers final release or approval.

C. Preliminary Construction Schedule: Submit (10) opaque copies.

D. Preliminary Network Diagram: Submit (10) opaque copies, large enough to show entire network for entire construction period. Show logic ties for activities.

E. Contractor's Construction Schedule: Submit (10) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

F. Daily Construction Reports: Submit (3) copies at monthly intervals.

G. Material Location Reports: Submit (3) copies at monthly intervals.

H. Field Condition Reports: Submit (3) copies at time of discovery of differing conditions.

I. Special Reports: Submit (3) copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineers request.

B. Prescheduling Conference: Conduct conference at Preconstruction Meeting site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Discuss project constraints, including.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review time required for review of submittals and resubmittals.
5. Review requirements for tests and inspections by independent testing and inspecting agencies.
6. Review time required for completion and startup procedures.
7. Review and finalize list of construction activities to be included in schedule.
8. Review submittal requirements and procedures.
9. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities.

B. Coordinate Contractor's Construction Schedule with the, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary [schedule]. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define all activities.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal" and “Shop Drawings and Submittals” " in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

4. Startup and Testing Time: Include not less than 7 days for startup and testing unless a different number of days is included in the specific equipment specification.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: If Work or portions of Work are to be performed under separate contracts, include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.

l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Structural completion.
   b. Permanent space enclosure.
   c. Completion of mechanical installation.
   d. Completion of electrical installation.
   e. Substantial Completion.

9. Other Constraints: Identify each constraint as describe in the Summary of Work Construction Sequencing or elsewhere indicated.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion and other milestones or task items listed in the Summary of Work.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14-days of date established for the Notice to Proceed. Outline significant construction activities for the first 60-days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Engineer’s approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and commissioning.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. Material deliveries.
2. High and low temperatures and general weather conditions.
3. Accidents.
4. Meetings and significant decisions.
5. Unusual events (refer to special reports).
6. Stoppages, delays, shortages, and losses.
7. Orders and requests of authorities having jurisdiction.
8. Change Orders received and implemented.
9. Directives received and implemented.
10. Equipment or system tests and startups.
11. Partial Completions and occupancies.
12. Substantial Completions authorized.

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

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one 1 day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

PART 3 - EXECUTION

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320AIA 11/02

SECTION 01410CT – FIELD TESTING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes, but is not limited to, services performed by an independent testing laboratory. Laboratory services covered under this section are for testing materials used for field constructed elements of the work. Performance testing of manufactured items and shop fabricated materials shall be covered under their respective specification section.

B. All testing performed under this item shall be for the protection and benefit of the Owner and shall not be construed by the Contractor as a comprehensive quality control program intended to protect the Contractor, his subcontractors, or his suppliers. The testing frequency and types of testing shall be at the discretion of the Owner.

C. Inspections, tests, and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures and testing, which facilitate overall compliance with requirements of the contract documents. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities, or other authorized entities are not limited by the provisions of this Section.

D. The Contractor is required to cooperate with the independent testing laboratories performing required inspections, test, and similar services and the Engineer or his representative.

E. Materials and installed work may require testing or retesting at anytime during progress of work. Retesting of rejected materials or installed work shall be done at Contractor's expense.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. The Contract Documents may include testing requirements furnished under other Sections. Work elements which may include other testing requirements are:
1. Water distribution and process pressure pipe systems.
2. Storm sewer systems.
3. Sanitary sewer systems.
4. Water tightness of tanks.
5. Pile foundations.
6. Air balancing.
7. Electrical systems tested and certified by the electrical subcontractor.

1.3 SELECTION AND PAYMENT

A. The Contractor will employ an independent testing laboratory to perform specified testing. Payment shall be incidental to the related work bid item. The laboratory shall be mutually agreed upon by the Owner, Engineer, and Contractor.

1.4 REFERENCES

A. AASHTO T-19, Standard Method of Test for Unit Weight and Voids in Aggregate.

B. AASHTO T-37, Standard Method of Test for Sieve Analysis of mineral Filler for Road and Paving Materials.

C. AASHTO T-230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.

D. ASTM C-29, Standard Method of Test for Unit Weight and Voids in Aggregate.

E. ASTM C-31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

F. ASTM C-33, Standard Specification for Concrete Aggregates.

G. ASTM C-39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

H. ASTM C-40, Test Method for Organic Impurities in Fine Aggregates for Concrete.

I. ASTM C-42, Standard Test Methods for Obtaining and Testing Drilled Cored and Sawed Beams of Concrete.

J. ASTM C-88, Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.

K. ASTM C-94, Standard Specification for Ready-Mixed Concrete.

L. ASTM C-117, Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.

M. ASTM C-136, Standard Method for Sieve Analysis of Fine and Course Aggregate.

N. ASTM C-142, Test Method for Clay Lumps and Friable Particles in Aggregate.

O. ASTM C-143, Standard Test Method for Slump of Hydraulic Cement Concrete.

P. ASTM C-172, Standard Practice for Sampling Freshly Mixed Concrete.

Q. ASTM C-173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

R. ASTM C-231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

S. ASTM C-535, Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.

T. ASTM C-1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

U. ASTM D-698, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-kg) Rammer and 12-inc. (305-mm) Drop.

V. ASTM D-2487, Standard Test Method for Classification of Soils for engineer purposes.

W. ASTM D-2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

X. ASTM D-4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

Y. ASTM D-4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

Z. ASTM D-4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

AA. ODOT Supplement 1021, Method of Test for Determination of the Percent of Fractured Pieces in Gravel.

AB. ODOT Supplement 1029, Method of Test for Determining the Percentage of Deleterious Materials in Course Aggregate.

AC. ODOT Supplement 1036, Method of Test for Determination of Percent Air Voids in Compacted Dense Bituminous Paving Mixtures.

AD. ODOT Supplement 1044, Mix Design Method for Bituminous Aggregate Base.

AE. Uni-Bell PVC Pipe Association UNI-B-6-98 for Low Pressure Air Testing of Installed Sewer Pipe.

AF. ASTM – C924-02

AG. ASTM – C969 – Standard practice for infiltration and exfiltration acceptance of installed concrete sewer pipe.

1.5 SUBMITTALS

A. Prior to the start of work, submit testing laboratory name, address, and telephone number, and names of full-time registered Engineer or specialist and responsible officer.

B. Submit copy of the testing laboratory's evaluation report issued by one of the evaluation authorities identified in Article 1.6 of this Section with memorandum of remedies of any deficiencies reported by the inspection.

C. Submit the chain of custody and other QA/QC procedures for each test to be utilized by the laboratory.

D. Submit a sample test report for review by the Engineer to demonstrate conformance with Article 3.2 herein.

1.6 QUALITY ASSURANCE

A. Except as otherwise indicated, the testing laboratory engaged shall be prequalified by the Ohio Department of Transportation for the types of services specified herein.

B. The field personnel utilized to perform all field-testing and preparation shall be certified for those tests being performed.

1.7 RESPONSIBILITIES

A. Testing Laboratory Responsibilities:
1. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with the specified standards.
3. Ascertain compliance of materials and mixes with requirements of the contract documents.
4. Immediately notify the Engineer and Contractor of observed irregularities or nonconformance of work or products.
5. Perform additional tests required by the Engineer.
6. Testing personnel are to report to the Engineer or his representative upon arrival on site for instructions and requirements. Prior to leaving the site, furnish the Engineer or his representative all test results whether in a formal or informal format.
7. Attend preconstruction meetings and progress meetings.

B. Contractor Responsibilities:

1. Provide access to materials proposed to be used which require testing.
2. Cooperate with laboratory personnel and provide access to the work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to work to be tested.
   b. To obtain and handle samples at the site or at the source of products to be tested.
   c. To facilitate tests.
   d. To provide storage and curing of test samples as required by the testing laboratory.
4. Notify the Engineer and laboratory 24 hours prior to expected time for operations requiring testing services for scheduling purposes. Materials will not be permitted to be placed without the proper testing being performed in conformance with this Section.

1.8 LIMITS OF LABORATORY AUTHORITY

A. The laboratory may not release, revoke, alter, or enlarge the requirements of the contract documents.

B. The laboratory may not approve or accept any portion of the work.

C. The laboratory may not assume any duties of the Contractor.

D. The laboratory has no authority to stop the work.

1.9 SCHEDULE OF TESTS

Testing anticipated on this project shall include, but is not limited to:

A. Earthwork

1. Special backfill material sieve analysis per ASTM C-136, one test per source.
2. On-site trench backfill analysis per ASTM D-2487, as directed by Engineer.
3. Pipe bedding and cover sieve analysis per ASTM C-136, one test per source.
4. Drainage fill sieve analysis per ASTM C-136, one test per source.
5. Soil compaction per ASTM D-698.
   a. Embankment testing shall be at least one (1) test/5,000 S.F. of each lift;
   b. Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
   c. Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or 5,000 S.F. of slabs subject to greater frequency due to soil conditions or Engineer's direction.
6. Backfill compaction per ASTM D-4253 and D-4254, one test per 50 L.F. of each lift.
7. Low Strength Mortar testing per ASTM D-4832.

B. Concrete

1. Concrete aggregate deleterious substances per ASTM C-40, ASTM C-117, and ASTM C-142, one test per source.
2. Concrete aggregate abrasion per ASTM C-535, one test per source.
3. Sodium sulfate soundness of coarse aggregate per ASTM C-88, one test per source.
4. Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C 94.

    a. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
    b. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    c. Air Content: ASTM C-173, volumetric method of lightweight concrete; ASTM C-231 pressure method for normal weight concrete; at least one for each pour of each type of air-entrained concrete, and each time a set of compression test specimens is made.
    d. Concrete Temperature: ASTM C-1064, test hourly when air temperature is 40º F. (4º C.) and below, and when 80º F. (27º C.) and above; and each time a set of compression test specimens is made.
    e. Compression Test Specimen: ASTM C-31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
    f. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
        i. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
        ii. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
    g. Two (2) tests beams shall be made for each 250 square yards of concrete pavement and/or slabs on grade placed.
        i. For traffic to be allowed on pavement or slab, the modulus of rupture shall be a minimum of 600 psi for Class C concrete or 400 psi for ODOT Class MS or FS.

h. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.

5. Nondestructive Testing: Penetration resistance, sonoscope, or other nondestructive devices may be permitted but shall not be used as the sole basis for acceptance or rejection.

6. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

   a. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

C. Pavement
   1. Aggregate base sieve analysis per ASTM D-2940, one test per source.
   2. Sodium sulfate soundness of aggregate base per ASTM C-88, one test per source.
   3. Percent of fractured pieces for aggregate base per ODOT Supplement 1021, one test per source.

D. Asphalt
   1. Provide testing for mixture acceptance in accordance with Ohio Department of Transportation Procedures. The person performing the testing must have a current Level 1 Bituminous Concrete approval from ODOT.

E. Sewers
   1. Deflection Testing
      a. All thermoplastic gravity sanitary sewer pipe shall be tested for allowable deflection.
      b. Deflection tests shall be performed before final acceptance and no sooner than thirty (30) days after installation of final backfill
      c. Maximum allowable pipe deflection shall be five (5) percent of the average inside diameter for the size and class of pipe specified.
      d. Acceptance testing shall be performed with a non-adjustable “go, no-go” mandrel with a minimum of eight (8) contact points. Adjustable mandrels for acceptance testing shall be used only with permission of the Engineer.
      e. The mandrel size shall be ninety-five (95) percent of the average inside diameter for the size and class of pipe specified.
      f. If the "go, no-go" mandrel will not pass through a section of pipe a deflectometer or adjustable mandrel may be used to determine the extent and/or severity of the non-acceptable area. A “go, no-go” mandrel shall be re-run through the pipe section for final acceptance testing at no additional cost to the Owner.

g. The Contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.

h. All sewer runs shall be cleaned prior to testing.

i. The acceptance test shall be performed without mechanical pulling devices.

j. All pipe failing the deflection test shall be exposed, repaired or replaced and retested at no additional cost to the Owner.

k. See also requirements of Section 11831CT, 02737CT and 02739CT.

2. Leakage Testing

a. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

b. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.

c. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.

d. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.

e. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.

f. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

3. Infiltration and Exfiltration Testing

a. All sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.

b. All sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.

c. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.

d. Each manhole run shall be tested separately.

4. Exfiltration Testing

a. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.

b. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.

c. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.

d. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to seventy-two (72) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.

e. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

		Volume of Leakage	
Water Level Change in Test Manhole		4 Ft. Dia. MH	5 Ft. Dia. MH
(Inches)	(Feet)	(Gals.)	(Gals.)
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.90
2	0.17	15.67	24.48

5. Infiltration Testing
   a. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
   b. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.
   c. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
   d. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

6. Allowable Leakage
   a. The maximum allowable leakage for either infiltration or exfiltration shall be *100* gallons per inch of internal pipe diameter per mile per day.
   b. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.
   c. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.
   d. See also requirements of Section 11831CT, 02737CT and 02739CT.

7. Low Pressure Air Testing
   a. PVC sanitary sewers 54-inch diameter and less may be air tested as specified. If the groundwater level is two (2) feet or more above the top of the pipe at the upstream end or if the air pressure required for the test is greater than 5 psig, the air test method should not be used for RCP sanitary sewers.
   b. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses. Backfill shall be brought to final grade before testing. Testing shall be done prior to surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
   c. Test equipment consists of valves and pressure gages to control airflow and to monitor pressure within the test section.
   d. The sewer shall be flushed and cleaned prior to testing to clean out any debris. The pipe surface should be wet for more consistent results.

e. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged and securely braced to prevent air leakage, and possible blowouts.

g. Equipment used shall meet the following minimum requirements and be approved by the Engineer:

   i. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

   ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

   iii. All air used shall pass through a single control panel.

   iv. Three (3) individual hoses shall be used for the following connections:

      a). From control panel to pneumatic plugs for inflation.

      b). From control panel to sealed line for introducing the low pressure air.

      c). From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

h. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 9 psig. The plugs must hold against this pressure without having to be braced. No persons shall be allowed in the alignment of the pipe during plug testing.

i. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches approximately 4 psig greater than the average groundwater back pressure, but not greater than 9 psig for PVC pipe or 5 psig for RCP.

j. In areas where groundwater is known to exist, the Contractor must determine the average groundwater back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole. See Figure No. 1. This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.

k. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in Reference Table 1.

l. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.

m. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.

n. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.

o. The Contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.

p. Pressurizing equipment shall include a regulator or relief valve set at no higher than 9 psig for PVC pipe or 5 psig for RCP pipe to avoid over-pressurizing and damaging an otherwise acceptable line.

q. No one shall be allowed in the trench or manholes during testing.

r. Plugs shall not be removed until all pressure has been released.

s. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.

t. The air test data sheet marked Exhibit “A” at the end of this section shall be filled out for each section of piping tested in this manner.

v. Testing concrete pipe sewer lines by the low pressure air test method will be per ASTM C924-02 and C1103.

8. Hydrostatic Testing – Water Mains and Process Pressure Pipe

a. The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.

b. Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. A cure time of seven (7) days is recommended when Type I Portland Cement is used; three (3) days is recommended when Type III high-early Portland Cement is used.

c. Test ends should be restrained to withstand the appreciable thrusts that are developed under test pressure.

d. Air pressure testing of installed pressure pipe is expressly prohibited.

e. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.

f. The hydrostatic testing sheet marked "Exhibit D" following this section shall be filled out for each section of piping tested in this manner.

g. After the pipe is laid and before backfill is placed around the joints, such lengths of the main as determined by the responsible agency shall be tested under a hydrostatic pressure of 1.5 times the working pressure at the highest point along the test section, but, in no case, shall water mains be tested at less than 150 pounds per square inch or process pipes be tested at less than 25 pounds per square inch.

h. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a booster pump connected to the pipe in a manner satisfactory to the Engineer. The duration of the test shall be for a minimum of sixty (60) minutes.

i. No pipe installation will be accepted unless the leakage rate for the section of pipe being tested does not exceed a rate as shown on hydrostatic test chart, during a 24-hour test duration.

j. The Contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

k. See also requirements of Section 11831CT, 02737CT and 02739CT.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

3.1 SEQUENCING AND SCHEDULING

A. The Contractor shall coordinate the sequence of work activities so as to accommodate required testing and shall allow sufficient time for testing of materials by the laboratory so as to cause no delay in the work or the work of any other Contractor. In addition, the Contractor shall coordinate his work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests.

3.2 LABORATORY TEST RESULTS

A. The testing laboratory shall submit a certified written report of each inspection, test, or similar service concurrently to the Owner, Engineer, and Contractor.

B. Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:

1. Name of testing laboratory.
2. Project name and construction contract reference number.
3. Dates and locations of samples and tests or inspections.

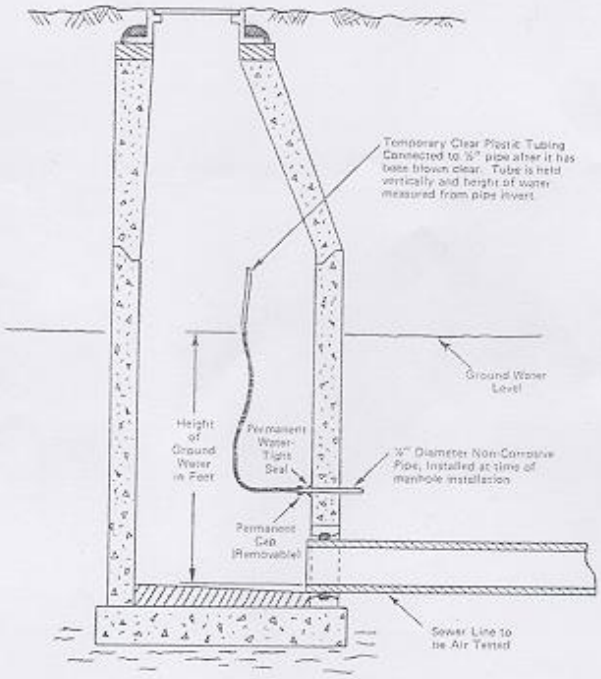
4. Date of report.
5. Names of individuals making the inspection or test.
6. Designation of the work and test method.
7. Test results.
8. Notation of significant ambient conditions at the time of sample taking and testing.

END OF SECTION 01410CT – 9/05

UNI-B-6-98

FIGURE NO. 1

MANHOLD CROSS-SECTIONAL VIEW
OF THE PROPER METHOD FOR
DETERMINING GROUND WATER HEIGHT



9

AIR TEST DATA SHEET

JOB NO. _____ DATE: _____

PROJECT: _____ SANITARY: _____ STORM: _____

CONTRACTOR: _____ PROJECT REPRESENTATIVE: _____

SPECIFIED MAXIMUM PRESSURE DROP _____ PSIG PIPE MATERIAL: _____

REQUIRED TEST PRESSURE (*) _____ PSIG (include groundwater back pressure head)

PIPE UNDER TEST				TEST DURATION PER UNI-B-6 (MIN:SEC)	(*) INITIAL PRESSURE (PSIG)	TIME ALLOWED FOR AIR TO STABILIZE (MIN)	START TEST PRESSURE (PSIG)	STOP TEST PRESSURE (PSIG)	ELAPSED TIME (MIN:SEC)	PASS (P) OR FAIL (F)	(*) GROUND WATER ELEV. ABOVE PIPE
UPSTREAM M/H STA #	DOWNSTREAM M/H STA.#	DIA (D) INCHES	LENGTH (L) FEET								

If section fails, the following items should be completed:

Identify section(s) that failed. _____

Leak (was) (was not) located. Method used: _____

Description of leakage found: _____

Description of corrective action taken: _____

REMARKS: _____

EXHIBIT 'A'

CT CONSULTANTS, INC.

HYDROSTATIC TESTING

JOB NO.: _____ PROJECT: _____

CONTRACTOR: _____ CLIENT: _____

WATERLINE TESTED AT _____ (STREET NAME) , _____ (STATION OF GAUGE)

FROM STATION _____ TO STATION _____ ON _____ (DATE)

WATERLINE SIZE _____ , _____ (TYPE)

TESTED _____ (TOTAL L.F.) , _____ (PIPE SIZE) AT _____ (PSI) FOR _____ (DURATION)

ALLOWABLE LEAKAGE _____ (GALS./HR.) PER 1000 L.F. OR _____ (TOTAL GALS.) PER _____ (TOTAL L.F.)

1st TEST _____ (PASS \ FAIL) , _____ (PRESSURE LOST) AND _____ (GALLONS LOST)

2nd TEST _____ (PASS \ FAIL) , _____ (PRESSURE LOST) AND _____ (GALLONS LOST)

APPROVED BY _____ (INSPECTOR)

COMMENTS _____

ALLOWABLE LEAKAGE PER 1000 FEET OF WATER MAIN:

PIPE SIZE INCH DIAMETER	ALLOWABLE LEAKAGE GALS. / 1000 FEET
6	1
8	1.3
10	1.6
12	1.9
16	2.5
20	3.2
24	3.8
30	4.8
36	5.7

NOTE: IN NO CASE SHALL THE TESTED SECTION EXCEED 2000 FEET IN LENGTH.

Exhibit D

SECTION 01650CT - STARTING OF SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section includes general requirements for the commissioning of the work and start-up and operation of systems and equipment. See also 01010 Part 1.13 for additional requirements.

1.2 SUMMARY

A. Starting, testing, and operating the completed work including systems and equipment occurs when substantial completion is achieved and the completed work including systems or equipment are accepted by the Owner. Contractor shall cooperate and coordinate with the Owner or Owner's Representative in the operation, maintenance, and adjustment of the work.

B. All work under this Section shall be scheduled.

1.3 DEFINITIONS

A. Commissioning: The series of activities necessary to bring a component, system, or unit process from installation to readiness for substantial completion. Commissioning includes but is not limited to field testing, dry testing, wet testing, performance testing, manufacturer's checkout, start-up, and operational demonstration. (See Section 01010 Part 1.13 D).

B. Start-up: Narrowly defined as placing a component, system, or unit process on-line. Can be a commissioning activity or a normal operating activity. (See Section 01010 Part 1.13C).

C. Operational Demonstration: A commissioning activity performed by the Contractor wherein the Contractor assists the Owner to operate and maintain a fully functional component, system, or unit process for a period of time after stable operation has been achieved. (See Section 01010 Part 1.13E).

D. Field Testing: Testing performed on-site by the Contractor to satisfy requirements of the manufacturer and Contract Documents. (See Section 01010 Part 1.13B).

E. Manufacturer's Checkout: Field inspection, testing, adjustments, and sign off by the Manufacturer's representative, indicating that the component, system, or unit process meets the Manufacturer's requirements. (See Section 01010 Part 1.13B).

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

A. The Contractor shall inspect systems and equipment prior to each start-up and verify their readiness for start-up. Conditions hazardous to equipment or personnel shall be corrected by the Contractor prior to start-up of equipment.

1. Start-up operations shall not proceed using temporary power or temporary instrumentation and control wiring. All electrical and control connections shall be permanent and complete, and all such electrical components and equipment fully functional.
2. Use of repair parts during start-up operations shall not be permitted, except in such situations where the actual on-site verification of such repair parts' operability is specified.
3. The Contractor shall verify that all copies of the Maintenance and Operating Instructions have been received.

3.2 PREPARATION

A. Prior to start-up of equipment or system, all necessary test equipment shall be in place and operable.

B. Manufacturer's representative(s) shall be present for the initial start-up of systems or equipment.

C. The Contractor shall request permission to start-up equipment, including electrical gear.

1. The Start-up Request shall be submitted to the Engineer a minimum of one (1) week before the scheduled start-up. Requests shall be made during normal working hours.
2. The Engineer will indicate approval or disapproval of the request.
3. Approval of the request is based solely on impact on plant operations. Approval does not relieve the Contractor of any responsibility for plant and personnel safety.

D. Normal installation checks, such as for rotation, are not considered start-ups and do not normally require start-up notification. For all equipment and systems so designated in the Contract Documents, or so designated by the Engineer, such checks shall be under the supervision of the Manufacturer's representative, the Owner and the Engineer.

1. All electrical apparatus which is energized, shall be clearly marked.

3.3 CONDUCT OF START-UP AND COMMISSIONING

A. Start-up

1. All initial start-ups of equipment or systems shall be performed under the technical direction of the Manufacturer's representative.
2. Any lack of readiness of associated systems or failure of a system or equipment previously started prior to the date of final acceptance of the project shall require additional initial start-up service of the manufacturer to be performed.
3. The Contractor shall repair, replace or modify any equipment or system which fails to perform as specified in the individual Sections of Divisions 2 through 16 of the Contract Documents. Such repair, replacement or modification of deficient work shall be performed under the terms of the General Conditions.
4. During the Operational Demonstration and at other times when the system is on-line and an integral part of the Wastewater Treatment Plant operations and process, start-ups shall be performed as required by the Owner or Owner's Representatives.

B. The Contractor shall commission all work.

C. The Contractor is responsible for the performance and operation of the systems and equipment during commissioning.

D. When Owner personnel are operating systems or equipment, the Contractor shall make available, at all times, persons knowledgeable about the systems or equipment, to direct the Owner personnel, through the Engineer, in its operation.

E. The Contractor shall make all adjustments and corrections necessary to achieve normal, stable operation of system.

F. Any failures of equipment or systems operated under the direction of the Contractor shall be considered deficiencies and shall be corrected in accordance with the General Conditions.

G. During the Operational Demonstration, the work will be on-line and an integral part of the Wastewater Treatment Plant operations and process. Therefore:

1. The Contractor shall <u>not</u> commence, resume, terminate, or suspend the operations without the permission of the Owner and only in a sequence and manner suitable to the Owner.
2. The operation of the work shall be in strict accordance with the operational orders of the Owner.
3. The Contractor shall immediately, on a 24 hour per day, 7 day per week basis, adjust or repair any malfunction in the work which in the opinion of the Owner, jeopardizes or may jeopardize the proper operation of the Wastewater Treatment Plant.
4. The Contractor shall not start-up, shut down, adjust, or otherwise alter the operation of any component, system, or unit process without the permission of the Owner except in the case of any emergency.

5. All required maintenance and servicing prior to the date of substantial completion shall be performed by the Contractor.

H. Manufacturer's Representative Reports.

1. The Manufacturer's representative shall prepare a daily report on each site visit for each system or item of equipment inspected, adjusted, started-up or worked on.
2. The report shall state the purpose of the visit, the representative's observations and conclusions, and recommendations for further visits or action.
3. The reports shall be submitted within three (3) days of the visit.

I. Substantial Completion and Acceptance shall occur after the operation of demonstration has been performed to the satisfaction of the Owner and Engineer. (See Section 01010 Part 1.13F).

J. Demonstration period shall be not less than (7) seven days if not specified elsewhere in the contract documents.

END OF SECTION 01650CT

SECTION 01821CT - COURSEWARE - ONLINE TRAINING MODULES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for development of online learning modules for instructing Owner's personnel in areas related to the operation and maintenance of the Canton Water Reclamation Facility. The Courseware – Online Training Module Subcontractor is referred to as the Subcontractor throughout this specification.

B. Online learning modules will be developed by the Subcontractor; quizzes and tests will be prepared with the full cooperation of the Contractor and Equipment Manufacturers. Course work, Hosting services and Programming will be provided by the Subcontractor.

C. The Contractor shall provide the Subcontractor all Operation and Maintenance Manuals for the Course Modules Topics listed in this specification. The Contractor shall provide electronic copies of all source material, including, but not limited to, the standard O&M manual content (including start up, shut down, maintenance procedures, and troubleshooting techniques) for the selected equipment. The Contractor shall also provide any relevant Standard Operating Procedures, vendor training materials, product brochures and images, as well as a copy of the relevant plant site drawings. Electronic versions of the above shall be submitted to the Subcontractor, though exceptions can be made for older documents that may exist only in hardcopy. Subcontractor will communicate with Contractor to obtain the necessary materials to complete the online courses.

D. The Contractor shall provide coordination between the Subcontractor and the Manufacturers to make sure that the Manufacturers provide all relevant information needed to train a new operator on mandatory procedures.

E. The Contractor, Owner and MBR manufacturer will provide information on performing daily and routine operations of the membrane system through Owner's SCADA interface. In addition to the screen by screen loop descriptions, written information will be provided to include daily operation procedure descriptions, references to SCADA screens, identification of SCADA screen buttons used, the function of the identified buttons, and screen shots of all relevant SCADA screens.

F. The Contractor shall coordinate a meeting between the Plant Integrator and the Subcontractor to discuss the Owner’s SCADA interface.

G. The Subcontractor shall design Modules that will be able to evaluate and test the Owner's operators on the following:

1. Start-up /Shut down of equipment
2. Basic operations, maintenance and safety
3. Trouble shooting techniques

H. Related Sections include the following:

1. Division 1 Section 01310 "Project Management and Coordination" for requirements for preinstruction conferences.
2. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. All courseware produced shall be available on a website hosted on the Subcontractor's server and accessible via web browser over the internet.

B. Instruction Program: Submit two (2) hard copies of the course for review. Once finalized, two (2) hard copy and an electronic version of each online course module shall be provided to Owner for use for other non-online training programs.

1. Identification: On each copy, provide an applied label with the following information: Name of Project and Date recorded.

C. Qualification Data: Vendor Training Review

1. The Subcontractor will attend a training session provided by the manufacturer for chosen pieces of equipment. The purpose is to document any additional information stated but not captured in the operation and maintenance manual as well as note any discrepancies or contradictions with the materials. Contractor shall coordinate with the Subcontractor for the scheduling of the selected vendor training sessions. Comments and Notes will be provided to Contractor to submit to Engineer. The Subcontractor will work with Owner to select 6 training sessions to be reviewed.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Courseware Development: Customized Online Learning Modules on a website provided by the Subcontractor, the Subcontractor shall consider Canton's structure and training requirements to allow all training topics to be accessed on the same website.

B. The Subcontractor shall develop the Courseware as required. The new courseware will be loaded into the appropriate category section of the website. Site administrator access will be provided by the Subcontractor to Owner. The administrator(s) will be responsible for creating, editing, and deleting user accounts. The administrator(s) will have the ability to track course module activity, run reports, and view and print user certificates of completion.

C. Course Modules Topics – Course Modules will be will be developed on the following topics:

1. Preliminary - Grit and Grease Tank Bridges
2. Preliminary - Grit Pumps and Classifiers
3. Preliminary - Grease Pumps and Augers
4. Preliminary - Blowers 25 HP Turbo Type
5. Fine Screening - 6mm Stage 1 and 2mm Stage 2 Screens
6. Fine Screening - Washer/Compactor
7. Dewatering - Horizontal Centrifugal Pumps
8. MBR - Anaerobic and Anoxic Mixers - Non Submersible Bridge Mounted Mixers
9. MBR - Internal Recycle and RAS Pumps - Submersible Pumps
10. MBR - Swing and Pre-Aeration Zones - Fine Bubble Diffuser System
11. MBR - Membrane Zone - Submerged Membrane Units 1
12. MBR - Membrane Zone - Submerged Membrane Units 2
13. MBR - Membrane Zone - Permeate Pumps Centrifugal Type
14. MBR - Membrane Zone - Permeate Sampling Isolation with 2 Pumps
15. MBR - Process Air Blowers - Turbo Type, 300 HP
16. MBR - Ex. Scour Air Blowers - Hoffman, 500 and 800 HP
17. MBR - WAS Pumps in Tunnel - Progressive Cavity or Rotary Lobe
18. MBR - CIP System - Chemical (Bleach and Acid) Feed Pumps - Centrifugal Type, and Storage Tanks
19. MBR - Alum Chemical System - Chemical Feed Pumps – Peristaltic Type, and Storage Tanks
20. MBR - Glycerin Chemical System - Chemical Feed Pumps - Peristaltic Type, and Storage Tanks
21. Sludge Holding - Positive Displacement or Hybrid Type, 75 HP
22. Belt Press Feed - Progressive Cavity or Rotary Lobe
23. Solids Conveyors –Screw Conveyors
24. New Boiler System

D. The website for online training shall include the following:

1. SCADA/HMI Simulation will be included in courseware for instruction of the SCADA/HMI system through onscreen simulations.
2. Online document storage and document management.
3. Online access shall be browser independent.
4. Instructional online videos on website navigation shall be provided.

E. Training Module Development: Develop a learning objective and teaching outline for each course module. Include a description of specific skills and knowledge that participant is expected to master. For each course module, include start-up /shut down of equipment, basic operations, maintenance and safety, and troubleshooting techniques.

F. The hosting of this service shall last a minimum of 5-years.

PART 3 - EXECUTION

3.1 PREPARATION

A. Site Visits

1. The Subcontractor shall make a minimum of 1 visit, totaling 1 day. The purpose of the visits is to photograph the equipment in question, and shoot additional supporting video, if necessary.

B. Evaluation: The Online Education Program will include the following functions:

1. Intermittent Quizzes and Test Questions
2. Wrong answer notification
3. 100% proficiency is required before a certificate of completion is generated
4. A real time clock on screen that verifies the time spent on the course material
5. The software program will automatically bookmark when the operator leaves a course (in case of power outage or an emergency in the facility)

C. The online education program shall be approved by the state-regulating agency for continuing education. This is in the event of the facility choosing to apply for CH/CEU credits for their training program.

3.2 TIMELINE

A. The Subcontractor, working with Owner, Engineer and Contractor, will develop a specific timeline for project deliverables along with major and minor milestones. This project is to be completed within 12-18 months depending on how quickly source materials are provided and the speed at which review proceeds.

END OF SECTION 01821CT

DIVISION 2

SITE CONSTRUCTION

SECTION 02060CT - BUILDING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of buildings.
2. Demolition and removal of structures.
3. Abandoning in place and/or removing below grade construction
4. Demolition and removal of site improvements.
5. Disconnecting, capping or sealing, removing and abandoning in-place site utilities
6. Salvage items for reuse by the Owner.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 - Section "Contract Closeout" for record document requirements.
2. Division 13 - Section Removal of Waste Materials at the Tertiary Filter Facility.

1.3 DEFINITIONS

A. Demolish: Completely remove and legally dispose of items off site.

B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

C. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to the Owner, wrapped on a pallet or incorporate in new construction as indicated on the drawings or specifications. Include fasteners or brackets need for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes the property of the Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets and other items of interest or value to Owner that may be uncovered during demolition remain the property of the Owner.

C. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of demolition activities indicating the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Dates for shutoff, capping, and continuation of utility services.

E. Inventory of items to be removed and salvaged.

F. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.

G. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

H. Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing agencies and EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Predemolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section "Project Meetings."

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of Work.

B. Owner assumes no responsibility for actual condition of buildings to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. On-site storage or sale of removed items or materials will not be permitted.

D. Asbestos: A report on the presence of asbestos throughout the plant facility is on file for review and use. The current status of asbestos materials on site is as follows.

1. The Owner implemented an asbestos abatement Contract in 1994.
2. Asbestos remains in some building materials on site. These materials include floor tile, roofing materials, window sealants, cement board on the building facades and the incinerator brick and rope.
3. Remaining asbestos material are considered not-friable and in good condition.

E. It is required that the demolition contractor due to quantity of asbestos containing materials remaining in buildings, conduct personal exposure monitoring on their employees during the demolition activities.

1. Asbestos material removal is considered to be classified as "Category 1 – Nonfriable Containing Asbestos Materials".
2. The Contractor shall use means and methods of removal to maintain the material in a non-friable consistency.
3. Do not disturb asbestos or any material suspected of containing asbestos, except as required by the Work to be performed in accordance with the project drawings and specifications.

1.8 REMOVAL OF ASBESTOS CONTAINING MATERIALS (ACM)

A. Notification to regulatory agencies of asbestos containing material is required, at a minimum of ten (10) business days prior to the start of the project. The agencies to be notified are as follows:
   a. Ohio Department of Health (ODH).
   b. Ohio Environmental Protection Agency (OEPA).
   c. Any applicable local agency such as county air pollution control.
   d. The Engineer administrating this contract.

B. All applicable governmental regulations and guidelines will be followed at all times.

C. All records, procedures, licenses, and methods, including required posters, signs, and log books required by governmental agencies and/or this contract shall be maintained on-site during the project.

D. Contractor shall apply for and pay for all permits associated with the abatement process.

E. Prior to the start of work, the Contractor will submit to the Engineer copies of the state or local license for the waste hauler, as well as the name and address of the disposal facility where the ACM's are to be deposited. Include contact person and telephone number.

F. All ACM debris will be transported in a closed covered container in accordance with local, state, regional, and federal regulations.

G. At the end of the project, the Contractor will submit copies of all manifests and disposal site receipts to the Engineer.

1.9 SCHEDULING

H. Arrange demolition schedule to facilitate the new construction, according to the construction sequence in Specification 01010 – Summary of Work and so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

C. Inventory and record the condition of items to be removed and salvaged.

D. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

F. Verify that hazardous and waste materials have been remediated before proceeding with the building and structure demolition operations.

3.2 PAVEMENTS, SIDEWALKS, CURBING, SIMILAR STRUCTURES

A. Work shall be in accordance with ODOT Item 202.

B. Sawed joints shall be straight, neat and free from chipped or damaged edges.

C. For removal of reinforced or nonreinforced concrete, the minimum depth of saw cut shall be 3 in.

D. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.

E. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

F. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

3.3 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES

A. Work shall be in accordance with ODOT Item 202.

B. Existing drainage structure designated by the Engineer to be removed shall be completely removed.

C. Catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 ft. below the finished subgrade or ground surface. The remaining void shall be filled with selected backfill material compacted to 100% optimum density per ASTM D 698.

D. Manholes designated by the Engineer to be abandoned shall be adjusted to 1' below proposed ground grade and the casting welded closed or an 8" reinforced concrete slab placed over the manhole.

E. Live sewers connected to structures removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.

F. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a site designated by the Engineer or incorporated in the work where called for on the Drawings, scheduled, or so directed.

3.4 GUARDRAIL AND FENCE

A. Where so required by the Drawings, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.

B. Wood posts and other materials not considered salvageable by the Engineer shall be disposed of by the Contractor.

C. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

3.5 SUPERSTRUCTURES, TANKS, CHAMBERS AND SIMILAR STRUCTURES

A. Care shall be used in demolishing structural elements which are continuous with structural elements remaining in service. Concrete and masonry shall be cut with a masonry or concrete saw before removing unwanted portions.

B. Methods and equipment used in demolition work shall be chosen so the structural integrity and watertightness of both newly constructed and existing plant structures remain unimpaired by the performance of the demolition work.

C. Existing structures and equipment which are damaged in appearance and/or function by performance of demolition work shall be replaced or repaired to approved first-class condition by the Contractor at no increase in Contract Price.

D. Extreme care shall be used when removing existing concrete from around reinforcing steel which must be used for securing new concrete. If this reinforcing steel is damaged, the Contractor shall remove additional existing concrete until sufficient existing reinforcing steel is exposed to provide adequate embedment length in the new concrete, as approved by the Engineer.

E. Abandoned pipes shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.

3.6 EQUIPMENT REMOVAL

A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall become the property of the Contractor, except for items identified to be salvaged. The Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner. A listing of materials to be salvage follows.

3.7 DISPOSAL OF DEBRIS

A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be disposed of offsite.

B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

3.8 BACKFILLING

A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 02300- Earthwork.

3.9 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

1. The City will lower liquid levels within process tanks to the lowest level possible using existing plant drain pumps and drain pipes.
2. The Contractor will remove solids left on the bottom of process tanks, with the exception of the mud-well.
3. The City will hose the bottom of the process tanks.
4. The City will not pressure wash any process tanks, this includes tank floors, walls, columns or the underside of slabs and walkways.
5. Once the City provides the tank to the Contractor for construction, it is the Contractors responsibility to keep debris and liquid out of the tanks.

B. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during demolition operations.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.

3.10 EXPLOSIVES

A. Explosives: Use of explosives will not be permitted.

3.11 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

3.12 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 02060CT 5/94

SECTION 02237 – LIGHTWEIGHT FILL (EPS BLOCKS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install lightweight fill (EPS block) at the location shown on the plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lightweight fill (EPS block) shall be expanded polystyrene (EPS) material. Lightweight fill shall be fabricated as blocks measuring approximate 2.0 ft x 4.0 ft. x 8.0 ft. Manufacturer's standard size blocks will be acceptable. Special-size blocks may be required at the edges of lightweight fill section to fill the volume shown on the plans. Lightweight fill (EPS block) shall have the following properties:

PHYSICAL PROPERTY	**ASTM DESIGNATION**	**ACCEPTANCE VALUE**
Density	C 303	0.9 lb/c.ft. Minimum
Compressive Strength (at 1% Deformation)	D 1631	3.6 psi Minimum
Flexural Strength	C 203	25 psi Minimum
Water Absorption	C 272	4.0% Maximum by Volume

2.2 QUALITY CONTROL

A. A Certificate of Compliance from the manufacturer of the lightweight fill (EPS block) shall be furnished to the Engineer. Shop drawings showing special size blocks and the layout of lightweight fill (EPS block) blocks in each layer shall be submitted to the Engineer for approval prior to fabrication of the blocks. The long axis of blocks in adjacent layers shall be rotated horizontally 90 degrees and the edges of blocks in adjacent layers shall be offset as shown on the plans to minimize continuous joints.

B. The Contractor shall prevent damage to the lightweight fill (EPS block) during delivery, storage and construction. Lightweight fill (EPS block) shall be protected from petroleum products, ultraviolet light, and/or mechanical damage. Any lightweight fill (EPS block) damaged by the Contractor's equipment or operations shall be replaced by the Contractor at his expense. It shall be the Contractor's responsibility to ensure that the EPS blocks are not exposed to hydrocarbons contamination during the life of the contract.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Lightweight fill (EPS block) shall be placed to the lines and grades shown in the plans and as directed by the Engineer. Surfaces to receive lightweight fill (EPS block) shall be finished such that there is no more than 0.5" variation in vertical grade over any 10 ft. interval, and are within 2.0" of the grade shown on the contract plans. The surface of a layer of lightweight fill (EPS block) blocks on which additional blocks are to be placed shall be plane, with no more than a 0.5" variation in vertical grade over any 10 ft. interval. All blocks shall fit accurately against adjacent blocks, without voids wider than 0.5" at any vertical joint. The finished surface of the lightweight fill (EPS block) shall be constructed to a tolerance of plus or minus 6" from the grade shown on the contract plans. Lightweight fill shall not be less than 10" in thickness. All excess EPS block cuttings and debris resulting from saw cutting and other construction related activity shall be contained, collected and hauled offsite for disposal by the Contractor.

B. Sliding of lightweight fill (EPS block) blocks along horizontal joints shall be prevented by timber fasteners placed as shown on the plans or by gluing. Timber fasteners shall have 16 prongs approximately 1½" on-center which penetrate a minimum of ¾" into the foam block above and below or as approved by the Engineer. Timber fasteners shall be placed a minimum of 16-inches from block edges and approximately 16" on centers. Glue shall be as recommended by the manufacturer of the lightweight fill (EPS block).

END OF SECTION 02237

SECTION 02240AIA - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes construction dewatering.

B. Related Sections include the following:
   1. Division 2 Section "Excavation Support and Protection."
   2. Division 2 Section "Earthwork" for excavating, backfilling, site grading and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

   1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
   2. Prevent surface water from entering excavations by grading, dikes, or other means.
   3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
   4. Remove dewatering system if no longer needed.

1.4 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

   1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
   2. Include a written report outlining control procedures to be adopted if dewatering problems arise.
   3. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

D. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.

1. Note locations and capping depth of wells and well points.

E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks , maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 OBSERVATION WELLS

A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION 02240AIA 8/00

SECTION 02260AIA - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Division 2 Section "Dewatering" for dewatering excavations.
2. Division 2 Section "Earthwork" for excavating and backfilling and for existing utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36, or ASTM A 992.

C. Steel Sheet Piling: ASTM A 328, ASTM A 572, or ASTM A 690; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3-inches.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

   1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Engineer.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
2. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 02260AIA 8/00

SECTION 02295CT - HORIZONTAL BORING AND PIPE JACKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The work under this section shall include all underground utility crossings where indicated on the contract drawings by boring a casing and placing the carrier pipe within the casing. It is intended that this section apply to all State highways, railroads, and other facilities or structures designated by the Engineer. This section shall also include all necessary excavation, water removal, casing and carrier pipe, and the furnishing of all labor, material, tools, equipment and accessories to complete the work as specified, shown on the contract drawings, or as directed by the Engineer.

B. The Contractor shall provide all shoring, blocking or other special supports required, together with all watchmen and other services necessary to complete the work.

1.3 QUALITY ASSURANCE

A. Boring shall follow the guidelines of "The Horizontal Earth Boring and Pipe Jacking Manual" published by the National Utility Contractor's Association.

1.4 JOB CONDITIONS

A. The Contractor shall provide a safe working condition for his personnel and the public with sheeting, if required, for the receiving and boring pits and include barricades around the pits.

1.5 SUBMITTALS

A. Certificates of compliance shall be submitted for casing pipe.

B. Plans and description of the boring arrangement to be used shall be submitted to the Engineer for approval and no work shall proceed until such approval is obtained.

1.6 ALTERNATIVES

A. The Contractor is not limited to any one method for boring. The following methods can be used:

1. Auger Boring.
2. Slurry Boring.
3. Hand Tunneling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Casing pipe shall conform to ASTM A139, or API 5L, Grade B, and shall be the size and have wall thickness indicated on the drawings.

B. Carrier pipe shall conform to drawings.

C. Drilling fluid shall consist of a mixture of water and a gel-forming colloidal material such as bentonite or approved equal.

D. Materials used for sheeting, sheet piling, cribbing, bracking, shoring and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots and of proper dimensions, as required by the Occupational Safety and Health Administration regulations.

2.2 EQUIPMENT

A. All equipment used in the execution of work covered under the utility permit shall have the built-in capacity, stability and necessary safety features required to fully comply with the specifications and requirements without showing evidence of undue stress or failure.

B. It shall be the responsibility of the Contractor to assure that the equipment to be used in the crossing operation is in sound operating condition. Backup equipment may be required where job site conditions indicate that severe damage to the roadway or a hazardous condition may result in the event of an equipment breakdown and where the condition of the equipment to be used indicated that routine component replacement or repair will likely be necessary during the crossing.

C. Jacks shall be hydraulic, mechanical or manual power units providing horizontal thrust for pushing casing and carrier pipe. Jacks shall have sufficient power to satisfactorily complete the proposed crossing according to manufacturer's recommendations.

D. Dewatering equipment shall be used to evacuate ground and surface water from the boring and receiving pit areas.

1. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site and they shall be in constantly attended operation on a 24-hour basis until their operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of the roadway.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavation of the receiving and boring pits shall adequately and safely accommodate the boring equipment, materials and workmen.

B. The face and sides of each pit shall be properly sloped or sheeted and care shall be taken to ensure the safety of the workmen, the integrity of the surface being bored and the traveling public.

C. When augers, or similar devices, are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe.

D. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered.

E. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half (1/2) inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

F. Preparation of the pit floors, whether of dirt, stone or concrete slab, shall be determined by the job conditions. Dewatering provisions shall be considered and implemented as required.

G. If an obstruction is encountered during installation to stop the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout at the Contractor's expense. The new boring location, direction and depth shall be chosen by the Owner.

H. The casing shall be bored in a straight line and on a uniform and level grade.

I. After the casing is installed, the carrier pipe shall be pushed through on skids to prevent injury to pipe or joints. Every precaution shall be taken to insure that the joints are and will remain in perfect condition.

J. Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside of the pipe by more than approximately one (l) inch, grouting or other methods approved by the Engineer shall be employed to fill such voids. Cost of such grouting shall be at the Contractor's expense.

3.2 GROUTING

A. Where grouting is required in accordance with specifications of the Owner it shall be as follows:

1. A uniform mixture of grout shall be placed under pressure between the casing and carrier pipe. Grouting shall start at the lowest point and proceed upwards simultaneously on both sides of the carrier pipe. A plug shall be installed in each grout hole as the grouting is completed.
2. Grouting shall be kept as close to the heading as possible. Grouting shall proceed as directed by the Engineer.

3.3 BLASTING

A. Blasting will not be permitted.

3.4 INSURANCE

A. Insurance

1. The Contractor shall be responsible for obtaining any and all insurance required by the proper authorities to perform this work at his own expense. The Contractor shall save harmless the Owner, and any all public agencies affected by this Contract for work performed under this Item from any claims, damages or injury and shall immediately make whatever repairs are necessary to correct any damage to any highway facility and/or right-of-way.

END OF SECTION 02295CT 1/88

SECTION 02300CT - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. The Work covered by this Section shall include all excavation, trenching and related work for the construction of the designated structures and pipelines, backfill and other incidental work.

B. The Work covered by this Section consists of:
1. making all necessary excavations for the construction of all Work;
2. preparing subgrade for foundations, slabs, walks, and pavements;
3. doing all pumping, fluming, and dewatering necessary to keep the trenches and other excavation free from water;
4. providing for uninterrupted flow of existing drains and sewers, and the disposal of water from any sources during the progress of the Work;
5. supporting and protecting all trench walls, structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
6. removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary;
7. removing after completion of the Work all sheeting and shoring or other soil support materials not necessary to support the sides of trenches;
8. removing and disposing all surplus excavated material;
9. doing all backfilling and grading, of compacting backfill to limits specified or ordered by the Engineer;
10. restoring all property damaged as a result of the Work involved in this Contract.

C. The Work includes transporting surplus excavated materials not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, and disposal of all types of surplus material off the site.

D. The Work includes low strength mortar backfill material intended for use in backfilling as shown on the Drawings.

1.2 RELATED DOCUMENTS AND SECTIONS

A. Section 01410CT - Field Testing Requirements

B. Section 02070 - Geosynthetics

C. Section 02230AIA - Site Clearing

D. Section 02240AIA - Dewatering

E. Section 02260AIA - Excavation Support and Protection

F. Section T02267 - Erosion Control During Construction

G. Section 03310CT - Concrete Work

H. Specific Project Requirements

1.3 DEFINITIONS

A. Backfill: Soil or granular materials used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, not including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow: Satisfactory soil imported for use as fill or backfill.

D. Excavation: Removal and disposal of material encountered above subgrade or foundation elevations.
   1. Additional Excavation: Excavation below subgrade or foundation elevations as directed by Engineer.
   2. Trench: Narrow linear excavation
   3. Unauthorized Excavation: Excavation below subgrade or foundation elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
   4. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface or subsurface conditions encountered, including rock, soil materials and obstructions.

E. Embankment: A structure consisting of soil, granular material, shale, rock, or other approved material, constructed in layers to a predetermined elevation and cross-section.

F. Granular materials: Natural aggregate, such as broken or crushed rock, gravel, or sand that can be readily incorporated into an 8-inch layer, and in which at least 65% by weight of the grains or particles are retained in a No. 200 sieve.

G. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the laboratory when the sample is tested in accordance with ASTM D-698 Method A, C, or D.

H. Optimum Moisture: The water content at which the maximum density is produced in a soil by a given compaction effort (ASTM D-698).

I. Pavement Prism: Also referred to as the zone of influence. The area below a line drawn 45 degrees to the horizontal from the surface at the edge of pavement, sidewalk or curb.

J. Pipe Embedment: The material placed in a trench surrounding a pipe or conduit consisting of the foundation, bedding, haunching, and initial backfill.

K. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material one (1) cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.

L. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered shale: mudstone, claystone, siltstone and hard clay.

M. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical reaction.

N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, pavement, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.

P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Comply with all provisions of Section 01061CT, Shop Drawings and Submittals.

B. Product Data: For the following:
   1. Source-locations of all materials shall be identified to the Engineer.
   2. Source quality laboratory test of all fill materials as required to show compliance with material specifications.

C. Shop Drawings: Submit information for the following items:

   1. Sheeting and bracing *(prepared and stamped by a professional engineer, registered in the State of Ohio).*

1.5 REFERENCES

A. AASHTO M 43 Standard Specification for Size of Aggregate for Road and Bridge Construction

B. ASTM C-150 Standard Specification for Portland Cement

C. ASTM C-618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

D. ASTM D-698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop

E. ASTM D-1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils

F. ASTM D-2487 Standard Test Method for Classification of Soils for Engineering Purposes

G. ASTM D-2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports

H. ASTM D-4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

I. ASTM D-4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

J. State of Ohio - Department of Transportation - Construction and Material Specifications, Item 304, Aggregate Base.

K. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.16, Suitable Materials for Embankment Construction.

L. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.02.A.2, Fine Aggregate for Portland Cement Concrete

1.6 QUALITY ASSURANCE

A. Qualifications

B. Regulatory Requirements

C. Certifications

D. Field Samples

E. Mock-ups

F. Pre-Construction Conference

1.7 PROJECT CONDITIONS

A. Environmental Requirements

B. Existing Conditions

1. Existing ground elevations of the site are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination on the site of the Work, as to the existing elevations and contours, and the amount of work required.

C. Existing Utilities

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
2. Notify Engineer not less than two days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Engineer's written permission.
4. Contact utility-locator service for area where Project is located before excavating.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the site, store and protect under provisions of Section 01043CT, Product Handling and Protection.

1.9 SEQUENCING AND SCHEDULING

A. Refer to 01410CT for testing laboratory service scheduling.

1.10 PROHIBITION OF EXPLOSIVES

A. The use of explosives is not permitted.

1.11 FIELD MEASUREMENTS

A. The Contract Drawings may indicate locations where certain utilities, structures or facilities might possibly interfere with the installation of new improvements. The Contractor shall dig such exploratory test pits as may be necessary to determine the exact location and elevation of the indicated subsurface structure and shall make acceptable provision for their protection, support and maintenance in operation.

The Engineer shall be provided advance notification when and where excavation for test pits will take place. The Contractor shall provide the Engineer a record of field locations of all listed utilities, structures or facilities a minimum of five (5) days prior to initiating construction of the project. Locations and elevations are to be provided by a Surveyor registered in the State of Ohio.

PART 2 - PRODUCTS

2.1 GRANULAR PIPE EMBEDMENT

A. Crushed gravel or crushed limestone meeting AASHTO M 43 gradation shall be used for bedding, haunching, and initial backfill as shown on the Drawings.

2.2 SAND PIPE EMBEDMENT

A. Fine aggregate consisting of natural sand meeting the gradation requirements of ODOT Item 703.02.A.2 or shown on the Drawings. The material shall not be lumpy or frozen, and shall be free from slag, cinders, ashes, rubbish, and other deleterious or objectionable material. Sand shall not contain a total of more than 10% by weight of loam and clay.

2.3 ONSITE BACKFILL

A. Excavated soil material, capable of meeting specified compaction, and approved by the Engineer for use as backfill in designated locations.

B. Based upon subsurface investigation, the Owner does not guarantee the onsite soils in its present state consists of the proper moisture content to achieve the specified compaction without drying or adding water.

C. Unsuitable Backfill Material

1. Onsite materials that are unsuitable for backfill, unless otherwise specifically shown in the Drawings, include rock or other materials greater than six (6) inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, frozen earth, and the following soils classified per ASTM D-2487:

Symbol	Description
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

2.4 SPECIAL BACKFILL MATERIAL (ODOT Item 304)

A. Special backfill material shall meet the gradation requirements of ODOT Item 304 and shall consist of crushed gravel or crushed limestone in combination with natural sand or stone. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1 inch	70-100
¾ inch	50-90
No. 4	30-60
No. 40	9-33
No. 200	0-15

2.5 LOW STRENGTH MORTAR BACKFILL

A. Cement shall conform to ASTM C-150, Type 1

B. Fly ash shall be Class F, ASTM C-618.

C. Aggregate

1. Fine Aggregate shall be natural sand consisting of mineral aggregate particles. The gradation of the sand shall be as follows:

Sieve Size	Percent Passing
3/4"	100
200	0 - 10

2. It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

D. Mortar Mix Proportioning

1. The initial trial mixture shall be as follows:

Quantity of Dry Materials per Cubic Yard	
Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

* saturated-surface dry

2. These quantities of materials are expected to yield approximately l cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

2.6 ENGINEERED FILL

A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1½ inch	95-100
¾ inch	70-92
3/8 inch	50-70
No. 4	35-55
No. 30	12-25
No. 200	0-8

2.7 ACCESSORIES

A. Warning Tape

1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

B. Detectable Warning Tape

1. Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PROTECTION

A. Excavation; Temporary Sheeting, Shoring, and Bracing

1. All excavation shall be in accordance with the Occupation Safety and Health Administration (OSHA) regulations.
2. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent neighboring structures from damage by settlement.
3. Bracing shall be arranged so as not to place a strain on portions of completed work until construction has proceeded enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.
4. All sheeting shall be removed unless specifically authorized in writing by the Engineer to be left in place.

B. Construction Sheeting Left in Place

1. The Contractor shall furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.
2. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under this Contract.

3.2 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

A. The Contractor shall:

1. replace, move, repair and maintain all utilities and all other structures encountered in the work
2. coordinate and communicate with applicable utility companies
3. repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of this contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the satisfaction of the Engineer.

3.3 DEWATERING

A. Drainage and Removal of Water

1. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures.

2. The Contractor shall, when ordered by the Engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the Contract Documents, drainage water will not be permitted to flow through the conduit.
3. The trench shall be kept free from sewage and storm, surface, and subsurface water to at least 2 feet below the bottom of the excavation.
4. Where open water courses, ditches, or drain pipes are encountered during the progress of the Work, the Contractor shall provide protection and securing of the continuous flow in such courses or drains and shall repair any damage that may be done to them.

3.4 EXCAVATION CLASSIFICATION

A. All excavated materials are unclassified as defined in Article 1.3.

3.5 GENERAL EXCAVATION

A. All necessary excavation for buildings, structures, pavements, and site improvements shall be performed to accommodate the completion of all related Contract Work.

B. The Drawings show the horizontal and the lower limits of structures. The methods and equipment used by the Contractor when approaching the bottom limits of excavation shall be selected to provide a smooth surface and to prevent disturbing the soil below the bottom limits of excavation. All soil loosened during excavation shall be removed from the bottom of the excavation.

C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

D. Excavation which is carried below the bottom limits of structures shall be classified as Unauthorized Excavation, unless said excavation below bottom limits of structures has been authorized by the Engineer prior to each occurrence.

E. Unauthorized Excavation shall be filled with Class B concrete to the bottom limits of structures. Under circumstances where structural integrity is not a factor, the Engineer may authorize the filling of Unauthorized Excavation with Low Strength Mortar Backfill or Special Backfill material compacted to 100% density as specified under the compaction requirements in this Section. Such work shall be at the cost of the Contractor.

3.6 TRENCH EXCAVATION

A. Excavation for trenches in which pipelines, sewers, and conduits are to be installed shall provide adequate space for workmen to space and joint pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench shall not exceed the limits shown on the Drawings.

B. Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the Drawings. If over-excavation occurs, the trench bottom shall be filled to grade with compacted granular bedding material.

C. Trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day.

D. In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

3.7 EXCAVATION OF UNSUITABLE MATERIALS

A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall not exceed the vertical and lateral limits as prescribed by the Engineer.

B. In utility trenches, the voids left by removal of unsuitable excavated material shall be filled with AASHTO M 43 No. 1 and No. 2 aggregate conforming to the material requirements of Article 2.1 of this Section.

C. In excavations other than utility trenches, the voids left by removal of unsuitable excavated material shall be filled with material consisting or either: (1) Special Backfill Material; (2) Class B concrete; or (3) Low Strength Mortar Backfill, whichever is ordered by the Engineer.

D. Removal of unsuitable excavated material and its replacement as directed will be paid on basis of Contract Conditions relative to Changes in Work unless specific unit prices have been established for excavation of unsuitable material.

3.8 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

A. It shall be the responsibility of the Contractor to dispose of all surplus material that cannot be used in backfill or embankments at his expense outside the limits of the project. Unsuitable excavated material, including rock or large boulders, shall be disposed of outside the limits of the project.

B. Surplus material may be wasted adjacent to or incorporated in the regular construction only when ordered in writing by the Engineer.

3.9 BACKFILL

A. Pipelines, Sewers and Conduits

1. All pipe shall have bedding extending the width of the trench with depth in conformance with the Drawings. The bedding material shall be thoroughly compacted by tamping until no further densification is possible.
2. Pipe cover material shall be used for filling above the pipe bedding along the sides of the pipe and to a height of twelve (12) inches over the top of the pipe. The pipe cover material shall be brought up evenly on both sides of the pipe to eliminate the possibility of lateral displacement of the pipe and shall be thoroughly compacted by tamping until no further densification is possible. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.
3. All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer.
4. After the pipe cover has been placed and compacted around the pipe as specified above, the remainder of the trench may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a pipe and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.
5. Puddling of sand bedding and pipe cover material is acceptable provided an acceptable method for removal of water is provided.

B. Structures

1. Backfilling shall not commence before concrete has attained specified strength. Do not use equipment for backfilling and compaction operations against structures that will overload the structure.
2. Backfilling around and over structures shall be carefully placed and tamped with tools of suitable weight to a point one (1) foot above the top of same. Additional backfill may be required to protect the structure from damage from heavy equipment. Backfill shall be placed in uniform layers not exceeding eight (8) inches in depth. Each layer shall be placed, then carefully and uniformly compacted to the specified density so as to eliminate the possibility of displacement of the structure.
3. After the backfill has been placed and compacted around the structure to the height specified above, the remainder may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed.

   In no case will backfilling material from a bucket be allowed to fall directly on a structure, and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

C. Where any new, proposed, or future pavement, driveway, parking lot, curb, curb and gutter, or walk is to be placed over a backfilled area, Special Backfill material shall be used for any portion of the trench falling within the pavement prism.

D. Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with approved Granular Pipe Embedment Material compacted in place in eight (8) inch layers to the required density. The approved Granular Pipe Embedment Material shall extend outward from the spring line of the conduit a distance of two (2) feet on either side and thence downward at its natural slope.

3.10 LOW STRENGTH MORTAR BACKFILL

A. Low strength mortar backfill shall be discharged from the mixer as recommended by the supplier and approved by the Engineer.

B. Low strength mortar backfill may be placed in the trench in as few lifts as may be practical.

C. Secure conduit or pipelines before placing low strength mortar backfill to prevent conduits and pipelines from floating during backfilling.

D. For low strength mortar backfill placed against existing structures of unknown strength, backfill material shall be brought up uniformly in maximum 12 inch lifts and allowed to cure for a minimum of 24 hours or until it can carry a person's weight without leaving imprints before the next lift is placed.

E. Low strength mortar backfill shall be brought up to subgrade elevation or the pavement prism, whichever may be applicable.

3.11 SUBGRADE

A. All soil subgrade shall be prepared in accordance with this subsection.

B. Drainage

1. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains to insure the thorough drainage of the subgrade surface at all times.

C. Unsuitable Subgrade

1. Where unsuitable subgrade or subgrade not meeting the required bearing capacity is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.

2. Suitable material required for the embankment to replace the undercut will be paid on basis of Contract Conditions relative to changes in Work.
3. Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in this article, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the Owner.

D. Full Width New Pavement Construction
1. After the surface of the subgrade has been shaped to approximate cross section grade, and before any pavement, base or subbase material is placed thereon, the subgrade shall be compacted. When the rolling is completed, all surface irregularities shall be corrected and the surface of the subgrade shall be shaped as necessary to conform to the grade and cross section shown on the Drawings within the tolerance set forth in this Section and shall be so maintained until the overlying course is in place.

3.13 TOLERANCES

A. The Contractor shall check the work under this item with templates, slope boards or other devices satisfactory to the Engineer. The completed work shall conform to the Drawings within the following tolerances:
1. For subgrade, the surface shall at no place vary more than ½ inch from a ten-foot straight edge applied to the surface parallel to the centerline of the pavement, nor more than ½ inch from subgrade elevation established by construction layout stakes.

3.14 CONSTRUCTION WITH MOISTURE AND DENSITY CONTROL

A. All backfill, shall be constructed using moisture and density control. All subgrade, except rock and shale in cut sections, shall be constructed using moisture and density control.

B. Backfill and subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of Article 3.17 of this Section shall be sprinkled with water as directed by the Engineer to bring the moisture content to within the range of optimum plus or minus three (3) percent. Water shall be thoroughly incorporated into the material by means of discs or other approved equipment.

C. Backfill and subgrade material containing excess moisture shall be dried, prior to installation, to a moisture content not greater than three (3) percentage points above optimum, except that for material within the moisture content range specified herein that displays pronounced elasticity or deformation under the action of loaded construction equipment, the moisture content shall be reduced to optimum or below if

necessary to secure stability. For subgrade material, these requirements for maximum moisture shall apply at the time of compaction of the subgrade and also at the time of placing pavement or subbase. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the Engineer.

3.15 PROOF ROLLING

A. Proof rolling shall be performed on areas described on the Drawings or as directed by the Engineer.

B. Proof rolling equipment shall consist of a single unit, tandem axle dump truck capable of being loaded to 30,000 pound axle load with a gross vehicle weight of 60,000 pounds. Tire pressure shall be maintained at 90 psi. Loading shall be verified by a certified weight slip.

C. Procedure

1. The designated areas of subgrade, prior to the placing of the overlying course, shall be compacted to requirement of this Section. The Contractor shall be responsible for performing a minimum of two (2) proof rollings of the subgrade, as directed by the Engineer, prior to paving. The first proof rolling shall be performed after the installation of underground improvements and rough grading has been completed. After fine grading and just prior to paving, the subgrade shall be proof rolled again. The proof roller shall operate in a systematic manner so that the number of coverages over all areas can be readily determined and recorded. Maximum spacing shall not exceed six (6) feet.
2. Moisture content of the subgrade at the time of proof rolling shall conform to the requirements of this Section.
3. The equipment shall be operated at the speed directed, but in no case shall the speed exceed five (5) miles per hour, and the normal operating speed shall not be less than two (2) miles per hour.
4. Where the operation of the proof roller shows the subgrade to be unstable or to have non-uniform stability, the Contractor shall correct the unstable areas so that the stability of the subgrade will be uniform and satisfactory. The subgrade shall then be checked for conformance to the plan lines and any irregularities of the surface caused by operation of the proof roller shall be corrected and the subgrade shall be shaped to the plan lines within the tolerances specified in this Section.
5. The proof roll is a subjective test and does not relieve the Contractor of his responsibility under the Contract to provide an acceptable subgrade.
6. If the subgrade fails due to the Contractor using it as a haul road or due to his negligence, the subgrade shall be repaired, retested, and proof rolled again at no additional cost to the Owner.

3.16 COMPACTION REQUIREMENTS

A. The bottom of excavations upon which concrete foundations or structures are to be placed shall be compacted so as to obtain 100% of maximum dry density per ASTM D-698 in the top twelve (12) inches.

B. The top twelve (12) inches of stripped original subgrade and final subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
   1. Subgrade under new, proposed, or future pavement shall be compacted 18 inches beyond the edge of pavement, paved shoulders or paved medians.

C. Compaction of subgrade for sidewalks (regardless of paving material) shall be 100% of maximum dry density per ASTM D-698 in the top six (6) inches.

D. Compaction of non-paved areas shall be 90% of maximum dry density per ASTM D-698.

E. Aggregate pipe embedment and aggregate backfill around structures shall be compacted to not less than 100% of maximum dry density per ASTM D-4253 and ASTM D-4254.

F. Final backfill shall be compacted to not less than 100% of maximum dry density per ASTM D-698.

G. Fill placed within the interior of structures shall be compacted to not less than 100% of maximum dry density per ASTM D-698.

H. Embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by ASTM D-698.

EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight Pounds/Cubic Foot	Minimum Compaction Requirements Percent Laboratory Maximum
90-104.9	102
105-119.9	100
120 and more	98

I. Test Sections

1. If it is determined by the Engineer that the composition of the material is such that it cannot be tested for density using a nuclear densometer or other methods; or where, in the opinion of the Engineer, in-place compaction testing is not feasible; and if approved by the Engineer, the Contractor may construct a test section to demonstrate acceptable compactive effort in lieu of in-place compaction testing. Test sections shall be constructed at no additional cost to the Owner.
2. The test section shall be completed by repeatedly compacting the material until no further density is achieved. This value shall be the Minimum Test Section Density (MTSD). The compaction equipment used to complete the test section shall be of suitable size to compact the material and shall be the same equipment used to compact the in-place material.
3. The test section shall be constructed with moisture density control as specified in this Section.
4. The material shall be compacted to at least 98% of the MTSD.
5. Each lift of in-place fill or backfill shall be densified using a compactive effort equal to or greater than the effort applied to achieve the MTSD; i.e., if six passes were required to achieve MTSD, then each lift of material shall be compacted using six or more passes.
6. Construct a new test section when, in the opinion of the Engineer, the fill or backfill material has changed character or when the supporting material has changed character.

3.18 GRADING

A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading

1. Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   a. Lawn or unpaved areas shall be graded to plus or minus *(1 inch)*.
   b. Walks shall be graded to plus or minus *(1 inch)*.

C. Grading inside Building Lines

1. Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION

SECTION 02516CT - PAVEMENT REPLACEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all of the equipment, labor and materials necessary to install, replace, and/or restore existing pavement structures together with their respective appurtenances as shown on the plans and as specified herein. This work shall include all of the sub-grade preparation, sub-base, base, intermediate pavement course(s), and finish pavement courses together with curbing, guttering, tack and/or prime coating, sealing and other pertinent work as necessary to meet the conditions of this contract.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 REPAIR OR REPLACEMENT WORK

A. For the repair and/or replacement of all existing pavement structures and their respective appurtenances that are removed and destroyed or otherwise damaged by the Contractor in the course of his performance of the work required under this contract, the Contractor shall furnish all equipment, labor, and materials as necessary to properly restore to a condition equal to that at his entry, and to the satisfaction of the Engineer, the Ohio Department of Transportation, the County Engineer, City Engineer, all cinder, slag, gravel, water-bound macadam, bituminous macadam, asphalt and brick or concrete driveways, curbs, sidewalks and roadways in strict accordance with the drawings and as specified herein.

B. In general, this item will include concrete, steel reinforcement, brick, stone, slag, cinders, gravel, asphalt and other bituminous materials and curbs, gutters, driveway culverts, road and curb drains and the demolition, excavation and removal of existing driveways, sidewalks and roadways.

1.5 REFERENCE TO OTHER PARTS

A. Other sections of these specifications shall apply, as and where applicable to this section and such sections will be the same as though they were included in this section.

B. For all old work where pavement is being repaired and/or replaced as a result of damages occurring thereto during the course of the work of this contract, all clearing and grubbing, removal and storage of topsoil, excavation and/or placing of compacted fill and granular backfill, shall be done as required under other parts of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Generally, for all repair and replacement work, all new materials shall match the existing and adjoining work in both composition and quality unless otherwise ordered, specified herein, and/or shown on the drawings. In any stone driveway or roadway, the material used for stone fill shall conform to the existing material.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. All pavement work shall be done in strict accordance with the specifications of the governmental body concerned and the latest ODOT specifications as applicable or at the direction of the Engineer.

B. All pavements disturbed by the Contractor's operations shall be relaid to the thickness of the adjoining pavement and, in all cases, the restoring of pavements, shall apply both to foundation courses and to the wearing surface.

C. Should cracks or settlements appear in adjoining pavements, the paving shall be removed to the extent necessary to secure firm and undisturbed bearing and shall be replaced in a satisfactory manner.

D. No permanent pavement shall be installed, repaired, and/or restored unless, or until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.

E. Where new or replacement concrete pavement or base is placed adjacent to existing concrete pavement or base, contraction joints shall be provided in the new or replacement pavement so as to form a continuous joint with that in the existing pavement.

3.2 ROADWAY SUBGRADE

A. The entire area to be occupied by the roadways and parking areas shall be cleared, topsoil removed and stored, and the excavation or compacted fill made as required and brought to the proper cross-sections. Pipe trenches and other excavations shall be backfilled as required, and thoroughly compacted within the limits of the roadways or parking areas.

B. After the surface of the subgrade has been properly shaped and before any stone or slag is placed, the entire subgrade shall be thoroughly rolled and compacted to a depth of 12 inches under this section. Rolling shall be done with an approved type of self-propelled roller, weighing not less than ten (10) tons. All hollows and depressions which develop during the rolling shall be filled with acceptable materials, and the subgrade rerolled. The process of filling and rolling shall be repeated until no depressions develop, and the entire subgrade has been brought to a uniform condition of stability.

C. All places which, in the opinion of the Engineer cannot be properly rolled, shall be tamped with handheld mechanically or pneumatically powered tampers.

D. In making the compacted fill and in doing the final subgrade rolling, the Contractor shall see that the material to be compacted and/or rolled has the proper moisture content to secure maximum compaction. When, in the opinion of the Engineer, the material is too wet, the compacting shall be delayed until the material has dried sufficiently. When, in the opinion of the Engineer, the material is too dry, the material shall be sprinkled with water in an amount to secure the proper moisture content.

END OF SECTION 02516CT 1/88

SECTION 02553CT - NATURAL GAS DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes natural gas distribution systems, outside the buildings.

B. Related Sections include the following:

1. Division 15 Section "Natural Gas Piping" for above ground natural gas piping, outside of and inside the buildings.

1.3 DEFINITIONS

A. Gas Distribution: Piping from gas main to individual service-meter assemblies, and piping from service-meter assemblies to locations outside the buildings or structures.

B. Natural Gas Piping: Piping that conveys natural gas from gas distribution point to natural gas utilization devices and appliances, outside and inside the buildings.

C. PE: Polyethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Ratings:

1. Piping and Valves: 100 psig minimum, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:

1. PE pipe and fittings.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of earthquake valves and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. Comply with the International Fuel Gas Code for materials, installation, testing, inspection, and purging.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store PE pipes and valves protected from direct sunlight.

1.8 PROJECT CONDITIONS

A. Verify existing site utility locations.

B. Interruption of Existing Natural Gas Service: Do not interrupt natural gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of gas supply according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of natural gas service.
2. Do not proceed with interruption of natural gas service without Construction Manager’s written permission.

1.9 COORDINATION

A. Coordinate connection to natural gas piping with the Plumbing Contractor.

B. Coordinate natural gas distribution with other utility Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 PIPES AND FITTINGS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B; Schedule 40, black.

1. Malleable-Iron Fittings: ASME B16.3, Class 150, standard pattern, with threads complying with ASME B1.20.1.
2. Steel Fittings: ASME B16.9, wrought-steel butt-welding type; and ASME B16.11, forged steel.
3. Steel Flanges and Flanged Fittings: ASME B16.5.
4. Unions: ASME B16.39, Class 150, black malleable iron; female pattern; brass-to-iron seat; ground joint.

C. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket type or ASTM D 3261, butt type with dimensions matching ASTM D 2513, SDR 11, PE pipe.

D. Transition Fittings: Manufactured pipe fitting with one PE pipe end for heat-fusion connection to PE pipe and with one ASTM A 53/A 53M, Schedule 40, steel pipe end for threaded connection to steel pipe.

E. Service-Line Risers: Manufactured PE pipe fitting with PE pipe inlet for heat-fusion connection to underground PE pipe; PE pipe riser section with protective-coated, anodeless, steel casing and threaded outlet for threaded connection to aboveground steel piping.

2.3 JOINING MATERIALS

A. Components, Tapes, Gaskets, and Bolts and Nuts: Suitable for natural gas and as recommended by piping manufacturer.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off gas to premises or piping section.

B. Inspect natural gas piping according to the International Fuel Gas Code to determine that natural gas utilization devices are turned off in piping section affected.

C. Comply with all requirements of the International Fuel Gas Code.

3.3 PIPING APPLICATIONS

A. Flanges, unions, and transition and special fittings with pressure ratings same as or higher than system pressure rating may be used, unless otherwise indicated.

B. Aboveground Piping:

1. Steel pipe, butt-welding-type fittings, and welded joints. Joints for connection to service regulators, and valves with flanged connections may be flanged. Joints for connection to service regulators, and valves with threaded connections NPS 2-1/2 to NPS 4 may be threaded.

C. Underground Piping: PE pipe, PE fittings, and heat-fusion joints.

D. Underground-to-Aboveground Piping Connections: Service-line riser.

E. PE-to-Steel Piping Connections: Transition fitting.

3.4 PIPING INSTALLATION

A. Install underground, natural gas distribution piping with bury depth as indicated on the plans.

B. Install underground, PE, natural gas distribution piping according to ASTM D 2774.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Coordinate connection of the gas distribution piping to the natural gas piping with the Plumbing Contractor. Refer to Division 15 Section "Natural Gas Piping" for additional information.

3.6 LABELING AND IDENTIFYING

A. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape over natural gas distribution piping during backfilling of trenches for piping.

B. Refer to Division 2 Section "Earthwork" for warning tapes.

3.7 PAINTING

A. Refer to Division 9 Section “Special Coatings” for field-applied finishes.

B. Paint all exposed metal piping, supports, and piping specialties, except units with factory-applied paint or protective coating.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas distribution according to requirements of the International Fuel Gas Code and authority having jurisdiction.

B. Repair leaks and defective valves and specialties and retest system until no leaks exist.

C. Report results in writing.

END OF SECTION 02553CT 5/02

SECTION 02618CT - DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all ductile iron pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All ductile iron pipe shall conform to AWWA C151 with the ends being designed for one of the type joints as specified herein.

B. To assure that the iron is suitable for satisfactory drilling and cutting, the chemical constituents shall meet the physical property recommendations of ASTM A 536.

C. The minimum wall thickness of the pipe barrel shall be that indicated in ANSI A21.50 (AWWA C150) for laying condition "2", 150 psi internal working pressure and a surge pressure of 100 psi and 5 ft. depth of cover unless otherwise indicated on the drawings. ANSI A21.50 (AWWA C150) CLASS 52 shall be the minimum thickness class for ductile iron pipe furnished under this specification unless otherwise shown on the drawings.

2.2 COATING AND LINING

A. The outside surface of all ductile iron pipe shall be shop coated with either a coal tar or asphalt base bituminous material. If this coating material is found to be damaged prior to the pipe trench being backfilled, the Contractor shall provide and apply additional material of that required to repair the damages. The Contractor shall have sufficient coating material available at the job site prior to laying the pipe.

B. The interior of the pipe shall be lined with cement mortar and seal coated in complete conformance with ANSI A21.4 (AWWA C104).

2.3 JOINTS

A. Mechanical Joints and Push-on Joints including their respective appurtenances shall conform to ANSI A21.11 (AWWA C111).

B. Flanged Joints shall conform to AWWA C110 or ANSI A21.10. Flanged joints shall not be installed underground except within structures as indicated on plans or directed by the Engineer.

C. Appurtenances used to make flanged joints shall include: 1/8" thick red rubber gaskets, bolts having American Standard Heavy Unfinished Hexagonal Head and Nut dimensions in conformance with ANSI B18.1, and material for bolts and nuts shall conform to ASTM A 575 or A 576.

D. Ball and socket joints (river crossing) shall be restrained, boltless and capable of deflecting up to 15 degrees and shall be installed in accordance with the manufacturer's recommendations.

2.4 POLYETHYLENE ENCASEMENT

A. The ductile iron pipe, fittings and appurtenances buried underground, shall be encased with 8 mil polyethylene film conforming to AWWA C105, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.

B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.

C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 02618CT 1/89

SECTION 02647CT - POST HYDRANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related sections include the following:

1. Section 02300CT - Earthwork
2. Section 09801 - Special Coatings
3. Section 11831 - Process Pipe and Fittings

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all the materials for and shall properly set in place, all post hydrants assemblies complete with copper supply lines and appurtenances, backflow assemblies, gravel drain, gravel drain pits, concrete and anchors, together with wrenches and keys for the proper completion of the work included under this contract.

B. This specification section is intended to apply only for 3/4”, 1” and 2” post hydrants as noted on the drawings.

C. The Contractor shall supply concrete anchors and/or other thrust restraint if so directed by the by the Engineer.

D. It is the intent of this contract that the final installation shall be complete in all respects and the Contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 WORKMANSHIP

A. All work shall be installed in strict accordance with the requirements, codes and ordinances of the Owner and shall meet the inspection of same. Workmanship shall be first class in every respect and all work shall be carried out by persons who are thoroughly experienced in this line of work.

1.5 SUBMITTALS

A. The Contractor shall submit detail drawings, drawn to scale, catalog data, three (3) copies of head loss charts and cuts of all equipment he proposes to furnish.

PART 2 - PRODUCTS

2.1 GENERAL

A. Post hydrants shall have a bury depth of not less than 4'-0".

B. Post hydrants shall be of the freeze resistant type with operating valves buried below the frost line which are easily removable without digging up the hydrant.

C. The post hydrant casing shall be bronze or aluminum.

D. The post hydrant shall be supplied with a wheel handle, T-handle or cast steel lever handle. No pedal-operated or self-closing hydrant will be permitted.

E. Outlet and inlet connections shall be of the same size as the post hydrant supplied.

F. Each post hydrant connected to a non-potable water source shall be stenciled with the words "Unsafe Water - Do Not Drink". The size of the stenciled letters shall be 1 inch. Stencil on the hydrants is to be on the nozzle section.

G. Post hydrants connected to potable water service mains shall be of the non-pollutable type.

H. The hydrant shall be supplied with a vacuum breaker on the outlet.

2.2 POST HYDRANT MANUFACTURERS

A. Post hydrants connected to potable or non-potable water sources shall be freeze resistant, compression type post hydrants model numbers M-75, M-100 or M-200 as manufactured by Murdock, Inc. or approved equal.

2.3 ASSESSORIES

A. Corporation and Curb Stops
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ford Meter Box Company, Inc. (The); Pipe Products Div.
      b. Master Meter, Inc.
      c. Mueller Co.; Water Products Div.
      d. Red Head Manufacturing & Supply.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

E. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

PART 3 - EXECUTION

3.1 INSTALLING HYDRANTS

A. Post hydrants shall be installed where shown on the plans or as directed by the Engineer. The completed installation shall be completely accessible and shall be such that the possibility of damage from vehicles or injury to pedestrians will be minimized.

B. All post hydrants shall be installed plumb. Post hydrants shall be set according to the contract drawings.

C. Each post hydrant shall be connected to the main with a branch connection of the same size as the post hydrant inlet.

D. A drainage pit shall be excavated near each post hydrant and filled with coarse gravel. Gravel shall be completely encapsulated in a filter fabric material that will prevent fines from plugging the gravel pores. No drainage pit shall be connected to a sewer.

3.2 CLEANING AND PAINTING

A. The post hydrant shall be painted in accordance with Section 09801.

B. Post hydrants connected to potable (City) water mains shall be pained OSHA Blue. Post hydrants connected to well water lines or non-potable water lines shall be painted Aqua..

3.3 HYDROSTATIC TEST

A. Each post hydrant shall be tested at the shop by hydraulic pressure.

B. The criteria for testing the approved post hydrants shall conform to the requirements of the Owner with regards to pressures and length of tests.

C. Any post hydrant found defective shall be rejected.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M manuals shall be in compliance with the General Requirements.

END OF SECTION 02647CT 1/89

SECTION 02701CT - PARSHALL FLUMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. The following equipment and related work is specified and furnished under other items:
   1. Section 03300CT – Concrete Work
   2. Division 16 - Electrical

1.2 DESCRIPTION OF WORK

A. This section includes furnishing and installing a reinforced fiberglass parshall flume that will be installed for the purpose of measuring plant influent flow, as shown on the Drawings and as described herein.

B. The parshall flume assembly shall include a stilling well, staff gage, a primary measuring element, sensor, transmitter, concrete anchor clips, temporary internal bracing and other appurtenances required for a complete and in place, ready for service installation.

C. It is the intent of this contract that the final installation shall be complete in all respects and the Contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.

D. The supplier of reinforced fiberglass fabrications shall have had at least five (5) years experience in production of parshall flumes similar in size to the flume(s) specified herein.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

B. The Contractor shall provide confirmation from the manufacturer that the equipment being supplied meets the design conditions, conditions of service and overall system installation.

C. The equipment shall be constructed in accordance with the following industrial specifications:
   1. ASTM D638 – Standard Test Methods for Tensile Properties of Plastics.
   2. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   3. ASTM D1941-91(2001) Standard test Methods for Open Channel Flow Measurement of Water with a Parshall Flume.
   4. ASTM D2583 – Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

5. ISO 9826-92 – Measurement of Liquid Flow in Open Channel – Parshall and SANIIRI Flumes.
6. United States Department of Interior, Bureau of Reclamation – Water Measurement Manual.

1.4 RESPONSIBILITY AND COORDINATION

A. Under this Contract, the Contractor shall be responsible for the purchase, storage, and installation of the parshall flume, level sensor, transmitter, and any accessories required. The device shall be completely wired, tested, and be suitable for operation.

B. The Drawings and Specifications are intended to illustrate and define the equipment installation; however, the Contractor shall properly install, adjust, and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the Specifications.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions.

B. Shop drawings shall be presented to the Engineer for approval. All shop drawings shall clearly identify the specific equipment and material being supplied, the quantity being supplied, and all accessories, dimensions, descriptions, mounting and connection details, and any other information necessary to determine compliance with the plans and specifications.

C. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, startup, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements.

D. Samples: 8-inch square sample of representative fiberglass reinforced plastic laminate.

E. Manufacturer’s installation instructions.

1.6 WARRANTY

A. The equipment manufacturer shall warrant that all equipment furnished by him shall be free of defects in the material and workmanship for a period of one (1) year from the date of acceptance.

PART 2 - PRODUCTS

2.1 PARSHALL FLUME

A. The Parshall flume shall have a throat width of 10 feet and a depth at entrance of 4'-0". The flume shall be accurate in dimension and include in one integrally molded piece the approach, throat and downstream sections. The inside surface of the flume shall be smooth and free of any irregularities. The outside surface shall include flanges and anchoring ribs for firm, permanent anchorage in concrete.

B. The flume shall be shipped in one piece ready for setting in the channel formwork, prior to pouring of the concrete. The flume shall be furnished with tie strips bolted in place across the top of the flume to retain the vertical sides of the liner during concrete backfilling. These tie bars may be removed following setting of the backing concrete.

C. The flume liner shall be fabricated in one piece utilizing LEO-LITE 87 resin, reinforced with fiberglass mat to provide a minimum wall thickness of 1/4 inch and a glass content not less than 30% by weight.

D. Resin used shall be LEO-LITE 87. A maximum of 4% by weight of thixotropic agent, Cab-o-sil or equal, may be added to the resin to prevent run-off. Resin with sufficient thixotropic agent added to form a paste shall be used to seal any machined edges.

E. Glass reinforcement shall consist of chemically bonded surfacing mat and either chopped strand, chopped strand mat, woven roving, or woven cloth, or any combinations thereof as required by the finished product. Surfacing mat shall by Type A or Type C, 10 to 20 mils thick, with a silane finish and a styrene- soluble weight. Chopped strand and chopped strand mat shall be Type E glass with silane finish and strene-soluble binder. Strand shall not be larger than number 130. The glass content of the finished laminate shall not be less than 30% by weight. Woven cloth or woven roving (60 end max.) shall be Type E glass with "Volan" methracrylate chromic chloride or silane type finish.

F. Manufacturer shall maintain a continuous quality control program and shall upon request furnish the Engineer with certified test reports consisting of physical tests listed in Table 1.

G. Procedure to be used in determining the properties listed in Table 1 shall be in accordance with the following designations: Ultimate Tensile Strength ASTM designation D 638. Flexural Strength ASTM designation D 790; Modulus of Elasticity ASTM designation D 790.

H. Hardness tests shall be made of the resin-rich surface of the product. Flexural tests shall be made with the resin-rich surface in compression.

I. Test samples shall be full thickness of the item produced and shall not be machined on the surface.

J. Mechanical properties shall equal or exceed those of Table 1 listed below.

TABLE 1

Laminate Physical Properties 73° F	3/16"	1/4"
Ultimate Tensile Strength (PSI x 10^3 Min.)	11	12
Flexural Strength (PSI x 10^3 Min.)	16	19
Flexural Modulus of Elasticity (PSI x 10^6 Min)	.8	.8
Barcol Hardness (Min.)	35	35

K. The parshall flume liner shall be as manufactured by Plasti-Fab, Inc., Tualatin, Oregon; Virtual Polymer Compounds, LLC, Median, New York; or approved equal.

2.2 FLOW SENSING ELEMENT

A. The system shall consist of two (2) units; a DC operated 2 wire transmitter and a flush mounting sensing element. System accuracy shall be +/- 1% or better of the total flow.

B. The sensing element shall be for vertical surface mounting on the flume wall and shall be equipped with mounting track for easy insertion or removal of the element. Mounting track shall be calibrated in one inch increments to visually determine the depth of flow in the flume.

C. The sensing element shall be provided with internally characterized solid-state electronic circuitry that shall match the flow characteristics of the parshall flumes supplied throat width dimension.

D. The sensing element shall be coated with a chemically inert non-stick material that shall be impervious to the process fluid. The sensing element electronic shall be encapsulated so operation of the element will not be affected or damaged by complete submersion should it occur.

E. The sensing element shall be provided with 25 feet of integrally mounted cable for connection to remote mounted electronic transmitter.

F. The flow sensing element shall be as manufactured by Drexelbrook Engineering, or equal.

2.3 TRANSMITTER

A. The transmitter shall be an electronic solid-state unit which shall operate on 120 V. ac input power and shall produce a 4-20 ma DC (2 wire) output signal.

B. The transmitter shall have an enclosure rated for area of use (See electrical drawings for area rating) for surface mounting and shall be equipped with a 0-100% output indicating meter, no interacting span and zero adjustments over the entire range, and radio frequency elimination filters. There shall be a 0-30 second time delay.

2.4 STILLING WELL

A. A 12-inch diameter stilling well with 2” opening shall be affixed to the flume.

B. The stilling well shall be located as shown on the drawings. A 2” interconnecting pipe shall connected the flume to the stilling tube.

2.5 STAFF GAGE

C. A highly visible, laminated staff gage shall be provided and installed.

D. Staff gage to be graduated in 1/10th foot increments.

2.6 EQUIPMENT DESIGN PARAMETER

Parshall Flume	1 each
Thoat Width	10 feet
Entrance Depth	4 feet
Minimum Flow Reading	12.0 MGD
Average Flow Reading	39.0 MGD
Peak Flow Reading	115.0 MGD

PART 3 - EXECUTION

3.1 MANUFACTURERS SERVICES

A. The manufacturer shall provide a factory trained engineer to start-up, test and adjust, and train plant personnel in the operation and maintenance of the equipment for a period of at least one (1) day.

3.2 PARSHALL FLUME INSTALLATION

A. The parshall flume shall be installed in accordance with the manufacturer’s instructions and in accordance with the requirements specified herein.

B. The parshall flume shall be installed on a level structural base of reinforced concrete that has been poured, allowing for a minimum of 6” clearance between the lowest portion of the flume and the structural base.

C. Verify that internal bracing is firmly in place and is adequate to prevent deformation of the flume when external load of concrete or grout is installed. Add additional bracing if required to prevent movement.

D. Tie the flume clip anchors to concrete reinforcing or special anchors with PVC coated number 8 tie wire.

E. Completely fill the void between the flume floor and the structural concrete base with high strength, non-shrink grout.

F. Floor grouting shall be poured only to a depth of the highest elevation of the floor plus 1/2 inch. DO NOT POUR GROUT FOR THE FLOOR AND WALL VOID AT THE SAME TIME.

G. Once the floor void is cured, the interior floor of the flume is to be counter weighted to avoid hydraulic rise while grouting in the flume.

H. Flume walls are to be grouted in the same manner. Unless otherwise approved by the Engineer, flume walls are to be poured in a minimum of two lifts.

END OF SECTION 02701CT

SECTION 02735CT - PVC PIPE (ASTM D 1785)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all polyvinyl chloride (PVC) pipe as specified herein, shown on the Drawings or as directed by the Engineer.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All PVC pipe used, as covered under this section, shall conform to ASTM D 1785, with end being designated for one of the type joints as specified herein. PVC compounds shall conform to ASTM D 1784.

B. PVC pipe under this section shall be Schedule 40, 80 or 120 as indicated on the drawings.

C. Materials of construction, including joints and fittings, shall be suitable for exposure to raw sewage.

2.2 JOINTS AND FITTINGS

A. Solvent cemented joints for pipe and fittings shall conform to ASTM D 2855.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.

B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.

C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 02735CT 1/89

SECTION 02737CT – FILAMENT WOUND FIBERGLASS GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes the furnishing and installing of all pipelines 12 in. diameter and larger as shown on the drawings or as required to complete the work.

B. This section designates the manufacturing, design and installation requirements of Filament Wound Fiberglass (glass-fiber-reinforced polymer) pipe. Fiberglass pipe and couplings shall be manufactured in accordance with ASTM D3262 (latest edition).

C. Material to be furnished and installed, but not limited to:

1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, joints and jointing materials, and pipe supports.
2. Make connections to all existing and/or new facilities and provide temporary services.

1.2 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

B. The equipment shall be constructed in accordance with the following industrial specifications:

1. ASTM D3262 Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting- Resin) Sewer Pipe
2. ASTM D3681 Standard Test Method for Chemical Resistance of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
3. ASTM D 4161 Standard specification for “fiberglass” pipe joints using flexible elastomeric seals
4. ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D638 Standard Test Method for Tensile Properties of Plastics
6. ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics
7. ASTM F 477 Specification for elastomeric seals (gaskets) for joining plastic pipe
8. ASTM C 33 Standard specification for concrete aggregates

1.4 SUBMITTALS

A. The Contractor shall submit for review and approval piping layouts, schedules, shop fabrication drawings, specifications, catalog cuts, and other data necessary to show conformance of the complete piping systems to these specifications. The Contractor's submittal shall include dimensions, fittings, locations of equipment, and appurtenances, joint locations and details, types and locations of supports, coordination with all other work and existing conditions, and all other pertinent technical specifications for the piping systems to be furnished. All pipe dimensions shall be field verified and shown on the pipe shop drawings.

B. Shop fabrication drawings shall show alloys, diameters, pipe wall thicknesses, flanges and other joint preparation details, dimensions, fittings, and other appurtenances to be supplied.

C. A pipe manufacturer's certificate stating that the materials have been sampled and tested in accordance with the provisions for and meet the requirements of the designated specification and shall be signed by an authorized agent of the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be as manufactured and fabricated by FLOWTITE Glass-Fiber-Reinforced Polymer Pipe as manufactured by U.S. Composite Pipe South or approved equal.

B. Pipe should be designed to handle all loading conditions in accordance with the AWWA M45 Manual – Fiberglass Pipe Design. Load conditions should include loading from earth, hydrostatic and live loads.

C. Pips shall be manufactured and tested in accordance with ASTM D3262.

D. Couplings joints shall meet the requirements of ASTM D4161.

E. Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi. Testing for this deflection shall be in accordance with ASTM D2412 referenced in Section 1.3, Quality Assurance.

F. The outside diameter of pipe shall be per the ASTM D3262-Table 3.

G. Pipe shall be supplied in nominal lengths of 10 to 40 feet. Actual lay length shall be nominal ±1 inch. Special short lengths may be used where surface geography or installation conditions require shorter lengths.

2.2 MATERIALS

A. The manufacturer shall use only approved polyester resin systems with a proven history of performance of in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

B. The reinforcing glass fibers to be used to manufacture the components shall be of the highest quality commercial grade of glass filaments suitably treated with binder and sizing compatible with impregnating resins. Pipes for the conveyance of sanitary sewage shall use E-glass CR (Corrosion Resistant) glass.

C. The internal liner shall be a glass reinforced thermoset liner suitable for service in a sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements off ASTM D3681.

D. Silica sand shall be minimum 98% silica with a maximum moisture content of 0.2%

E. Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product. Calcium carbonate is not be used as a substitute for resin or silica sand.

F. Elastomeric gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

G. All fittings shall be fabricated from pipe meeting the requirements of these standards. Ductile iron, stainless steel or fusion bonded epoxy coated steel fittings may also be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of pipe and fittings shall be in accordance with the specifications as described herein and manufacturer's recommendations. Whenever there is a conflict, the more stringent requirement shall be met.

B. The use of slings, ropes or forklifts are recommended. The use of chains or cables is not permitted.

C. End of pipes and coupling components shall be cleaned and lubricated with a lubricant furnished by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer. Suitable equipment and end protection shall be used to push and pull the pipes together.

D. The long-term horizontal deflection of the buried pipe shall not exceed 5% of the nominal diameter of the pipe. Testing for this deflection shall be in accordance with Section 3.4, Field Testing.

E. No foreign matter shall be permitted to enter the pipe. Any sand or mud which may have entered the pipe at any time shall be removed before any additional pipe is laid. The pipe line shall be kept completely clean and free of foreign matter at all times.

3.2 MARKING

A. Each special, fitting and straight pipe that is to be installed under this contract shall be marked (plainly, legibly and quite visibly) to indicate its respective design head, effective area of circumferential reinforcement per lineal foot of pipe wall, location in the pipeline and, in addition, each bevel pipe shall have its respective amount of bevel and point of maximum length marked at the end of its spigot.

3.3 DELIVERY AND STORAGE

A. Delivery and storage shall be per Section 01043CT.

B. Packaging, handling, and shipping shall be done in accordance with the manufacturer's instructions.

C. The pipe shall be handled with proper equipment and in a manner to prevent distortion or damage. The use of hooks or clamps that could kink or bend the ends are not permitted.

3.4 FIELD TESTING

A. Each special, fitting and straight pipe that is to be installed under this contract shall be marked (plainly, legibly and quite visibly) to indicate its respective design head, effective area of circumferential reinforcement per lineal foot of pipe wall, location in the pipeline and, in addition, each bevel pipe shall have its respective amount of bevel and point of maximum length marked at the end of its spigot.

B. All materials, process of manufacturing and finished pipe shall be subject to inspection and approval.

C. The long-term horizontal deflection of the buried pipe shall not exceed 5% of the nominal diameter of the pipe. Deflection testing of the pipe shall be performed by the Contractor a minimum of 30 days from the date of completed backfill.

D. Field testing (36" and Smaller): A full line low air pressure test shall be performed from manhole to manhole at 5 psi. The test shall be performed in accordance with ASTM F1417.

E. Field testing (42" and Larger): Individual joints shall be pressure tested with a portable tester to 5 psi. This testing may be done with air or water.

F. The maximum allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.

3.5 CERTIFICATION

A. The Contractor shall furnish a sworn statement from the material manufacturer certifying that all the required tests have been made and that the pipe and fittings comply with the requirements specified herein.

B. Should the Owner or Engineer request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

END OF SECTION 02737CT

SECTION 02739CT - CCFRPM PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Codes and Standards:

1. ASTM D3262 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe

2. ASTM D4161 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

3. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

4. ASTM D3681 – Standard Test Method for Chemical Resistance of “Fiberglass” Pipe in a Deflected Condition.

5. ASTM D638 – Test Method for Tensile Properties of Plastic.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all the materials for and shall properly place, at the locations shown on the contract drawings or as directed, all Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, the Contractor shall comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. The Contractor shall submit for review and approval piping parts necessary, shop fabrication drawings, specifications, catalog cuts, and other data necessary to show conformance of the complete piping systems to these specifications.

The Contractor's submittal shall include dimensions, fittings, locations of equipment, and appurtenances, joint locations and details, types and locations of supports, coordination with all other work and existing conditions, and all other pertinent technical specifications for the piping systems to be furnished. All pipe dimensions shall be field verified and shown on the pipe shop drawings.

B. Shop fabrication drawings shall show alloys, diameters, pipe wall thicknesses, flanges and other joint preparation details, dimensions, fittings, and other appurtenances to be supplied.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe and fittings shall be as manufactured and fabricated by HOBAS Pipe USA or approved equal.

B. All pipe to be furnished under this section shall be manufactured according to applicable ASTM and AWWA standards. All pipe shall be Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) pipe designed for the pressures and service herein indicated.

C. The manufacturer shall use only polyester resin systems with a proven history to perform in this particular application. The historical data shall have been acquired for a composite material of similar construction and composition as the proposed product.

D. Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

E. Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally effect the performance of the product.

F. Gaskets shall meet ASTM F477 and be supplied by qualitative gasket manufacturers and be suitable for the service intended.

G. The actual outside diameter of the pipes shall be in accordance with ASTM D3262. For other diameters, outside diameters (OD’s) shall be per manufacturer’s literature.

H. The pipe shall be manufactured by the centrifugal casting process to result in a dense, nonpourous, corrosion-resistant, consistent composite structure. The interior surfaces of the pipes exposed to sewer flow shall be manufactured using a resin with a 50% elongation (minimum) when tested in accordance with ASTM D638. The interior surface shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a sand and resin layer which provides UV protection to the exterior. Pipes shall be Type 1, Liner 2, Grade 3 per ASTM D3262.

2.2 JOINTS FOR CCFRPM PIPE

A. Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins, when needed, may utilize gasket sealed closure couplings.

B. No field welding of joints will be permitted, except for repairing leaks due to cut gaskets and then only by specific permission of the Engineer.

C. Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane to avoid obstructions, to plumb stems or for other reasons, the degree of deflection shall be approved by the Engineer. No joint opening shall exceed 75% of the Manufacturer's recommended maximum joint opening allowance.

2.3 FITTINGS FOR CCFRPM PIPE

A. Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion bonded epoxy-coated steel and stainless steel fittings may also be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Each pipe section shall be supported at one end by the joint previously laid, while the temporary support is prepared for the other end. No damage should be caused to either pipe section or its pipe accessories, in making adjustments of the temporary supports to obtain proper grade and alignment.

B. End of pipes and coupling components shall be cleaned and lubricated with a lubricant furnished by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer. Suitable equipment and end protection shall be used to push and pull the pipes together.

C. Contractor shall not exceed forces recommended by the manufacturer for coupling pipe.

D. No foreign matter shall be permitted to enter the pipe. Any sand or mud which may have entered the pipe at any time shall be removed before any additional pipe is laid. The pipe line shall be kept completely clean and free of foreign matter at all times.

3.2 MARKING

A. Each special, fitting and straight pipe that is to be installed under this contract shall be marked (plainly, legibly and quite visibly) to indicate its respective design head, effective area of circumferential reinforcement per lineal foot of pipe wall, location in the pipeline and, in addition, each bevel pipe shall have its respective amount of bevel and point of maximum length marked at the end of its spigot.

3.3 DESIGN CONDITIONS

A. The pipe shall be designed to meet the following requirements:

1. Case 1

a. Trench load (earth load but no truck load) in combination with internal working pressure where earth load shall be based on six (6) feet of cover unless additional cover is called for on the plans. (Backfill unit weight - 130 pcf).

2. Case 2

a. Trench load (earth load plus truck load) in combination with internal working pressure where H-20 truck load shall be based on four (4) feet of cover except where less cover is called for on the plans. (Backfill unit weight - 130 pcf).

3. Case 3

a. Trench load (earth load plus truck load) in combination with the sum of the internal working pressure plus the surge pressure where earth load shall be based on six (6) feet of cover unless additional cover is called for on the plans.

B. The minimum internal design pressures that shall be used for the above Cases 1,2 and 3 are as follows:

System Pressure From/To	Max Differential Pressure Operational	Design Surge	Design Pressure
Beginning to End	6 psi	400%	25 psi

3.4 DELIVERY AND STORAGE

A. Delivery and storage shall be per Section 01043CT.

B. Packaging, handling, and shipping shall be done in accordance with the manufacturer's instructions.

C. The pipe shall be handled with proper equipment and in a manner to prevent distortion or damage. The use of hooks or clamps that could kink or bend the ends are not permitted.

3.5 TESTING

A. Pipes shall be manufactured and tested in accordance with ASTM D3262.

B. Couplings joints shall meet the requirements of ASTM D4161.

C. Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.

D. The extrapolated 50-year strain corrosion value shall not be less than 0.9% as determined in accordance with ASTM D3681 and ASTM D3262.

E. Field testing shall include deflection testing. The maximum allowable long term deflection is normally 5% of the initial diameter.

F. The maximum allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.

3.6 CERTIFICATION

A. The Contractor shall furnish a sworn statement from the material manufacturer certifying that all the required tests have been made and that the pipe and fittings comply with the requirements specified herein.

B. Should the Owner or Engineer request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

END OF SECTION 02739CT 1/89

SECTION 02833CT - CHAIN LINK FENCING AND GATES (GALVANIZED STEEL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of chain link fences and gates is indicated on drawings. Chain link fence shall have a top rail and a bottom tension wire. Barb wire will be installed as noted on the drawings.

B. Fence shall match existing fence consisting of 6 foot high fabric, top rail, bottom tension wire, twisted fabric top and bottom (no knuckled) and 3 strands of barb wire and of the materials specified herein.

1.3 QUALITY ASSURANCE

A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings. The chain link fence should conform to the following requirements:
ASTM A116 - Zinc Coated Galvanized Steel Woven Wire Fence Fabric
ASTM A123 - Zinc Hot Dip Galvanized Coatings on Iron and Steel Products
ASTM A153 - Zinc Coating of Iron and Steel Hardware.
ASTM C94 - Ready-Mixed Concrete.
ASTM F567 - Installation of Chain-Link Fence.
ASTM F669 - Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence
ASTM F1083 - Pipe, Steel, Hot-Dipped Zinc-Coated, Galvanized welded, for Fence Structures
ASTM F1083 Pipe, Steel, Hot Dipped Zinc-Coated, Galvanized welded, For Fence Structures.
CLFMI - Chain Link Fence Manufacturer’s Institute Product Manual
OSHA 1910 Parts D and E

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

B. Provide confirming site layout drawing for final review and verification for locations of pull post spacing as required for longer line runs, gates end and corner post.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

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

1. Galvanized Steel Fencing and Fabric:

a. Allied Tube and Conduit Corp.
b. American Fence Corp.
c. Anchor Fence, Inc.
d. Or equal.

2.2 STEEL FABRIC

A. Fabric: No. 9 gauge wire, two inch mesh, knuckled at the top selvage and twisted at the bottom. Fabric shall be as indicated on drawings or same height as required for replacement unless otherwise noted. Furnish one-piece fabric widths for fencing up to 12' high.

B. Fabric Finish: Galvanized, double-dipped. Coating should conform to ASTM A 392 Class 2, minimum 2.0 ounce zinc per square foot of surface per coating.

2.3 FRAMING AND ACCESSORIES

A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

B. End, Corner and Pull Posts: Minimum sizes and weights as follows:

1. Up to 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

1. Up to 6' fabric height, 1.90" OD steel pipe, 2.72 lbs. per lin. ft. or 1.875" x 1.625" C-sections, 2.28 lbs. per lin. ft.

D. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

Leaf Width	Gate Post	lbs./lin. ft.
Up to 6'	3.5" x 3.5" roll-formed section	4.85
	or 2.875" OD pipe	5.79
Over 6' to 13'	4.000" OD pipe	9.11
Over 13' to 18'	6.625" OD pipe	18.97
Over 18'	8.625" OD pipe	28.55

E. Top and Bottom Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top and bottom rail securely to each gate corner, pull and end post.

1. 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

F. Tension Wire: 7 gage, coated coil spring wire, metal and finish to match fabric.

1. Locate at bottom of fabric.

G. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.

H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

I. Post Tops: Provide weathertight closure cap with loop to receive tension wire or toprail; one cap for each post.

J. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

K. Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

L. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.
2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

M. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

N. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 deg. gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

O. Slide Gates: Cantilever type, with enclosed roller bearing truck assembly supported at the top gate frame member.

P. Concrete: Provide concrete consisting of portland cement, ASTM C 150, aggregates, ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings shown, in firm, undisturbed or compacted soil.

1. If not indicated on drawings, excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.

1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

a. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.

D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.

H. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.

J. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

K. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

1. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.

L. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 02833CT

SECTION 02901CT - SODDING, SEEDING AND MULCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Installation of seeded and sodded areas shall be to the extent shown on Contract Drawings and shall include supplying all seed, sod, soil conditioning materials, mulching materials and watering and the incorporation of these materials into the work as specified.

B. The Contractor shall place stockpiled topsoil in those areas requiring seeding or sod. If the quantity of stockpiled topsoil is insufficient, the Contractor shall furnish and install additional topsoil as required to complete the work.

1.3 QUALITY ASSURANCE

A. Any subcontract restoration shall be to a qualified firm specializing in landscape work.

B. Topsoil: Before delivery of topsoil, furnish Architect/Engineer with written statement giving location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown during past 2 years.

Contractor shall have a soils test done at his expense and analyzed by an approved testing agency, to determine soil amendments for topsoil and provide a copy to the Engineer prior to the start of fine grading.

C. Seed: All seed specified shall meet the current specifications of O.D.O.T. as to the percentage purity, weed seed, and germination. All seed shall be approved by the State of Ohio, Department of Agriculture, Division of Plant Industry and shall meet the requirements of these specifications.

Contractor shall provide the Engineer with a list of the seed he intends to use, including, varieties of seed, labels, and suppliers name and phone number, four (4) weeks prior to the start of seeding, for approval.

D. Sod: All sod shall meet the current specifications of O.D.O.T. for percentage of weeds.

The Contractor shall provide the Engineer with the following information from the sod supplier: the name of the producer, the location of sod field, the date the sod was cut and the thickness the sod was cut.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.5 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.

C. Soil Stabilization: The Contractor shall provide permanent or temporary soil stabilization to denuded areas within fifteen days after final grade is reached on any portion of the site. Any such area which will not be regraded for longer than fifteen days shall also be stabilized. Soil stabilization includes any measures which protect the soil from the erosive forces of raindrop impact and flowing water. Applications include seeding and or mulching. The Contractor shall consider time of year, site conditions and estimated time of use for the project. If necessary, the Contractor shall coordinate soil stabilization practices with the local Soil and Water Conservation District.

D. All work shall be guaranteed for one full growing season to commence upon final acceptance of lawn work.

E. Spring-sown work shall be installed between April 1st and May 30th and Fall-sown work shall be installed between September 1st and October 15th. No permanent seeding shall take place between May 30th and September 1st and between October 15th and April 1st. The dates for seeding may be changed at the discretion of the Architect/Engineer.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be furnished by the Contractor. Stockpiled material, if any, shall be utilized prior to obtaining additional topsoil.

B. New topsoil shall conform to the U.S. Department of Agriculture soil texturing triangle. Screen topsoil from clay lumps, brush, weeds, litter, roots, stumps, stones larger than 1/2 inch in any dimension, and any other extraneous or toxic matter harmful to plant growth.

Obtain topsoil only from naturally well drained sites where topsoil occurs in a depth of not less than 4 inches. Do not obtain from bogs or marshes.

C. Soil amendments shall be added according to the soils test requirements. Amendments can include, but are not limited to fertilizer, lime, compost and organic matter.

2.2 SEED

A. Seed shall be vendor mixed, delivered in original bags and shall be proportioned as follows unless otherwise noted on the plans:

Common Name	Proportion by Weight
Kentucky Bluegrass	40%
Penn Lawn Fescue	40%
Perennial Rye	20%

1. Supplier's name and analysis of seed is to be submitted to the Engineer.

2.3 MULCH

A. Mulch shall be clean straw free of seed and weed seed.

B. If hydroseeding is used, wood fiber mulching material may be used and shall consist of virgin wood fibers manufactured expressly from whole wood chips and shall conform to the following specifications.

- Moisture content	10.0% ± 3.0%
- Organic content	99.2% ± 0.8% O.D. Basis
- pH	4.8 ± 0.5
- Water holding capacity, minimum (grams of water per 100 grams of fiber)	1,000

Wood fiber mulching material shall be processed in such a manner as to contain no growth or germination inhibiting factors, and must contain a biodegradable green dye to aid in visual metering during application.

2.4 SOD

A. Sod shall be well-rooted Kentucky Blue Grass (Poa pratensis) blend grown on a mineral soil and obtained from a commercial sod nursery. Sod shall be free of all noxious weeds such as wild mustard, thistles, quack grass, etc. and reasonably free from dandelions and crabgrass.

B. Sod shall have been recently mowed to a height of not more than 2 inches and shall be cut in strips not less than 3 feet long nor more than 6 feet long and shall be cut in a uniform width of not over 18 inches.

C. Sod shall be delivered to the job within 24 hours after being cut and shall be installed within 36 hours after being cut.

D. During wet weather the sod shall be allowed to dry sufficiently to prevent tearing during handling and placing and during dry weather have been watered before lifting to insure its vitality and to prevent dropping off of soil during handling.

PART 3 - EXECUTION

3.1 PREPARATION - GENERAL

A. A soils test of the topsoil shall be done by the Contractor at his expense. A copy of the test shall be submitted to the Engineer.

B. Rough grading must be approved prior to placing topsoil.

C. Loosen subgrade of lawn areas. Remove any stones greater than 1 inch in any dimension. Remove sticks, roots, rubbish, and other extraneous matter.

D. Spread topsoil to a minimum depth of 4 inches, to meet lines, grades, and elevations shown on plan, after light rolling and natural settlement. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Topsoil shall be tilled thoroughly by plowing, discing, harrowing, or other approved methods. Add specified soil amendments and mix thoroughly into the topsoil.

E. Preparation of Unchanged Grades: Where seed or sod is to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for planting as follows: Till to a depth of not less than 6 inches. Apply soil amendments and initial fertilizers as specified. Remove high areas and fill in depressions. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Soils test requirements apply here as well.

1. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of project limits. Do not turn existing vegetation over into soil being prepared for seed or sod.
   If necessary, supply and install topsoil in areas where there is no topsoil left after vegetation has been removed in conformance to Section 2.01.
2. Allow for sod thickness in areas to be sodded.
3. Apply specified soil amendments at rates specified in the soils test and thoroughly mix into upper 2 inches of topsoil. Add topsoil if existing grade has less than 4" of topsoil. Delay application of amendments if planting will not follow within a few days.

F. Fine grade areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Limit fine grading to areas which can be planted immediately after grading.

G. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

H. Restore areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

3.2 SEEDING

A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Seed shall not be sown when the ground is frozen, muddy, or when weather conditions prevent proper soil preparation, interference with sowing and/or proper incorporation of seed into the soil.

B. Sow seed using a spreader or hydroseeder. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing 2 1/2 lbs. per 1000 s.f. at right angles to each other. Total amount to equal 5 lbs. per 1000 s.f. unless otherwise altered by the plans or Engineer.

C. Mulch shall be spread uniformly to form a continuous blanket at a rate of 100 lbs. per 1,000 s.f. Mulch shall be 1 1/2" loose measurement over seeded areas.

Anchor mulch using an O.D.O.T. specified SS-1 at 60 gal./ton non-toxic tackifier such as Hydro-stik, or equal, or by securing with a netting such as Conwed, or equal.

D. Unless otherwise directed by the Architect/Engineer, the seeded area shall be watered, as soon as the seed is covered, at the rate of 120 gallons per 1000 square feet. The water shall be applied by means of a hydro-seeder or a water tank under pressure with a nozzle that will produce a spray that will not dislodge the mulching material. Cost of this watering shall be included in the cost of seeding and mulching.

E. Contractor has the option to hydroseed large lawn areas, using equipment specifically designed for such application. The rate of application of wood fiber mulching materials is 40 lbs./1,000 s.f. The Contractor shall submit data regarding the hydroseed mixture, mulch and application rates for the Engineer's review and approval prior to performing the work. Contractor shall not hydroseed within close proximity to buildings and structures when unfavorable wind conditions may blow the hydroseed material onto the structure.

3.3 DORMANT SEEDING METHOD

A. Seeding shall not take place from October 15 through November 20. During this period prepare the seed bed, add the required amounts of lime and fertilizer. Then mulch and anchor.

B. From November 20th through April 1st, when soil conditions permit, prepare the seed bed, lime and fertilize, apply the selected seed mixture, mulch, and anchor. Increase the seeding rate by 50 percent.

3.4 SODDING

A. Do not plant dormant sod or place if ground is frozen or extremely wet.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. Anchor sod on slopes with wood pegs to prevent slippage.

C. Water sod thoroughly with a fine spray immediately after planting.

D. Upon completion, the surface of the sod shall coincide with the finished grade.

3.5 RECONDITIONING EXISTING LAWNS

A. A soils test shall be required for existing lawns prior to any reconditioning. The soils test shall be done at the Contractors expense. A copy shall be submitted to the Engineer prior to starting.

B. Recondition all existing lawn areas damaged by Contractors operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.

C. Provide soil amendments as called for in the soils test.

D. Provide new topsoil, as required, to fill low spots and meet new finish grades.

E. Cultivate bare and compacted areas according to the topsoil specifications.

F. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.

G. All work shall be the same as for new seeding or sodding.

H. Water newly planted seed or sod areas. Maintenance of reconditioned lawns shall be the same as maintenance of new lawns.

3.6 ESTABLISHMENT

A. Maintain work areas as long as necessary to establish a uniformly close stand of grass over the entire lawn area. A uniformly close stand of grass is defined as the seeded areas having 90%+ coverage of grass at 60 days after seeding. 90%+ coverage is defined as very little or no dirt showing when seeded area is viewed from directly overhead.

B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth acceptable lawn.

1. Mowing

   a. Mow lawn areas during the period of maintenance to a height of 2 inches whenever the height of the grass becomes 3 inches. A minimum of 3 mowings is required during the period of maintenance.

2. Refertilizing

   a. Distribute fertilizer on the seeded area between August 15 and October 15, during the period when grass is dry. The fertilizer shall be as specified in the soils test.

3. Reseeding

   a. Reseed with the seed specified for the original seeding, and at the rate of 4 lbs. per 1,000 s.f. in a manner which will cause minimum disturbance to the existing stand of grass and at an angle of not less than 15 degrees from the direction of rows of prior seeding.

4. Resodding

   a. Resodding shall be with sod as herein specified. Trenches shall be filled and resodded.

5. Watering

   a. The Contractor shall keep all work areas watered daily to achieve satisfactory growth unless otherwise approved by the engineer in writing. Water shall be applied at a rate of 120 gallons(m) per 1000 square feet. If water is listed as a pay item, it shall be separately paid for based on the actual amount of water used, measured in thousands of gallons. If there is no pay item for watering, then the contractor shall include the price of watering in the price per square yard of seeding or sodding.

6. Any mulching which has been displaced shall be repaired immediately. Any seed work which has been disturbed or damaged from the displacement of mulch shall be repaired prior to remulching.

3.7 INSPECTION AND ACCEPTANCE

A. When seeding or sodding work is complete and an acceptable stand of growth is attained, the Contractor shall request the Engineer to make an inspection to determine final acceptance.

B. Acceptance shall be based upon achieving a vigorous uniformly stand of the specified grasses. If some areas are satisfactory and some are not, acceptance may be made in blocks, provided they are definable or bounded by readily identified permanent surfaces, structures, or other reference means. Partial acceptance decisions may be made by the Engineer and will be for no less than 75% of the total job. Excessive fragmentation into accepted and unaccepted areas shall be avoided. Unaccepted areas shall be maintained by the Contractor until acceptable.

C. No payment shall be made until areas are accepted.

D. All seeded/sodded areas shall be guaranteed for one full growing season to commence upon final acceptance of the areas.

END OF SECTION 02901CT 5/97

DIVISION 3

CONCRETE

SECTION 03255CT - EXPANSION AND CONSTRUCTION JOINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. This work includes furnishing and installing all joints where necessary.

B. In general, the work may include the following types of joints:

1. Types A and H Expansion Joints
2. Types B Waterstop Construction Joint
3. Type CJ Control Joint

C. Refer to the contract drawings and specifications for locations and details of the joints to be used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The non-extruding preformed filler for joint Type A shall conform to the requirements of "Standard Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction" ASTM D 1752, Type I, Sponge Rubber. Preformed filler shall be "Sponge Rubber" as manufactured by W.R. Meadows Company, Everlastic 1300 Series concrete gray sponge by Williams Products, Inc. or equal.

B. The preformed filler for joint Type H shall conform to the requirements of ASTM D 1752, Type III, self-expanding cork. Self-expanding cork shall be as manufactured by W.R. Meadows Company, or equal.

C. Preformed filler strips up to one (1) inch thickness shall be made as a single piece. Strips greater than one (1) inch thickness shall be fabricated by cementing together a minimum number of pieces. All cementing or vulcanizing shall be done at the point of manufacture.

D. The joint sealer shall be cold applied in accordance with manufacturer's recommendations.

1. Where the joint is not in contact with water, "No-Trak" as manufactured by A.C. Horn, Inc., "Gardox" by W.R. Meadows, Inc., or equal, shall be used.

2. Where the joint is in contact with water, “Sikaflex-IA” as manufactured by Sika Corporation, or equal shall be used.

E. Type “B” joints shall be as detailed on the drawings. The preformed plastic waterstops shall meet or exceed all requirements of Federal Specifications SS-S-210A, “Sealing Compound for Expansion Joints”. Such preformed plastic waterstop shall be “Snyko-Flex” waterstop manufactured by Synko-Flex Products, 2100 Travis Street, Houston, Texas, or an approved equivalent.

F. Type “CJ” premolded insert shall be “Speed-E-Joint” by W.R. Meadows, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Form work shall be designed to hold the preformed filler in alignment within the joint during and after concrete is poured. General description of the joints are as follows:

1. Type “A” expansion joint shall consist of non-extruding preformed filler only to separate the adjoining faces of concrete without the use of a waterstop. The top shall be finished by a joint sealer for slabs. Unless otherwise shown, preformed filler shall be half (1/2”) inch thick and shall be of a width equal to the faces of concrete which it is separating. Where required, the preformed filler shall be attached to concrete by the use of an approved adhesive. Apply bond breaker to edge of preformed filler material only, prior to placing joint sealer. The joint sealer shall bond only to the concrete surfaces.
2. Type “B” waterstop construction joint shall consist of a standard construction joint and waterstop as detailed on the drawings.
3. Type “H” joint shall consist of self-expanding cork to separate the adjoining faces of concrete without the use of a waterstop. The top shall be finished by a joint sealer.
4. Type “CJ” Control joints shall be made by inserting a removable preformed insert to create a joint which is then filled with a joint sealer, if required.

END OF SECTION 03255CT 11/03

SECTION 03310CT - CONCRETE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including form work, reinforcing, mix design, placement procedures and finishes.

1. Extent of concrete work is shown on drawings.
2. Concrete paving and walks are specified in Division 2.
3. Precast concrete is specified in other Division-3 sections.

1.3 SUBMITTALS

A. Product Data: Submit 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 as requested by Engineer.

B. Shop Drawings; Reinforcement: Submit original shop drawings prepared for fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. Samples: Submit samples of materials as requested by Engineer, including names, sources, and descriptions.

D. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests.

1. The proposed mix design submittal(s) shall follow the procedures of Chapter 5, Sections 5.2 to 5.3 of ACI-318.
2. Reference should be made to ACI-211.5R "Guide for Submittal of Concrete Proportions" for the required submittal information. Sample forms for presenting the necessary information can be found in the addendum at the end of this section. Example Form B should follow a completed Example A in the submittal when laboratory trial batches are used to document a water-cementious materials ratio curve.

3. Additional data summarizing the past performance records should be an integral part of the submittal if the submittal is based on past performance with the proposed materials and proportions.

E. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Materials 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.

1.4 QUALITY ASSURANCE

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

1. ACI 301 "Specifications for Structural Concrete for Buildings."
2. ACI 318 "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
4. ACI 347 "Guide to Form work for Concrete."
5. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

C. Engage a testing agency acceptable to Engineer to perform initial material evaluation and certification tests for mix designs and to design concrete mixes.

D. Pre-installation Conference: Conduct conference at project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials, inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's Superintendent
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Ready-mix concrete producer.
e. Concrete Subcontractor
f. Primary admixture manufactures.

1.5 PROJECT CONDITIONS

A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.

B. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two (2) edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Engineer's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Cylindrical Columns and Supports: Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

F. Form Ties: Factory-fabricated, adjustable-length, snapoff metal or glass fiber-reinforced plastic form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to the exposed surface.

1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.
2. All form ties shall have a factor of safety of two (2) to determine the recommended safe working load.

2.2 REINFORCING MATERIALS

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

B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. (Flat sheets only)

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, II or I/II and ASTM C595M, Type IP, unless otherwise specified. (See Table I, Concrete Requirements).

1. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.

B. Fly Ash: ASTM C 618, Class F.

C. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

1. Limit use of fly ash to not exceed 25% of cement content by weight.
2. Limit use of granulated blast-furnace slag to not exceed 30% of cement content by weight.

D. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete, with nominal maximum aggregate size of 1 inch.

1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
2. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.
3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).

E. Lightweight Aggregates: ASTM C330

1. Maximum nominal aggregate size of 1-inch.

F. Water: Drinkable and complying with ASTM C94.

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

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

a. "Air-Mix"; Euclid Chemical Co.
b. "Sika Aer"; Sika Corp.
c. "MB-VR or MB-AE"; Master Builders.

H. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.

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

a. "WRDA"; W.R. Grace.
b. "Eucon WR-75"; Euclid Chemical Co.
c. "Pozzolith Normal"; Master Builders.

I. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F and containing not more than 0.1 percent chloride ions.

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

a. "Sikament 300"; Sika Chemical Corp.
b. "Eucon 37"; Euclid Chemical Co.
c. "Rheobuild or Polyheed"; Master Builders.

J. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.

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

a. "Accelguard 80"; Euclid Chemical Co.
b. "Pozzutec 20"; Master Builders.
c. "Daraset"; W.R. Grace & Co.

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

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

a. "Pozzolith"; Master Builders.
b. "Eucon Retarder 75"; Euclid Chemical Co.

c. "Plastiment"; Sika Chemical Co.

L. 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.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Catexol 1000CL; Axim Concrete Technologies.
b. MCI 2000 or MCI 2005; Cortec Corporation.
c. DCI or DCI-S; W.R. Grace & Co., Construction Products Div.
d. Rheocrete 222+; Master Builders, Inc.
e. FerroGard-901; Sika Corporation.

M. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.

N. Fiber Reinforcement:

1. Synthetic fiber reinforcing shall be added to the concrete for the areas so indicated in the drawings. Only fibers designed and manufactured specifically for use in concrete shall be acceptable as secondary reinforcement, complying with ASTM C1116, not less than 3/4 inch long.
2. The fibers may be added at the batch plant. The incorporation of said fibers shall be documented on the delivery ticket from the ready mix producer. Fibers shall be added to the concrete in strict accordance with manufacturer's printed instructions. The minimum dosage rate shall be 1.5 lbs/cubic yard.
3. Nylon fibers containing 100% virgin nylon monofilaments shall be utilized to impart a "non-hairy" surface to the finished concrete.
4. Products: Subject to compliance with requirements, provide the following fibrous reinforcement or approved equal:

a. Nycon Fiber; Nycon, Inc.
b. Nylo-Mono; Forta Corp.
c. Fibrasol N; Axim Concrete Technologies

2.4 RELATED MATERIALS

A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Waterstops: Provide waterstops at construction joints and other joints as indicated and specified in Section 03255.

C. Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

D. Vapor Retarder: Provide vapor retarder cover, ASTM E1745 Class C, over prepared base material where indicated below slabs on grade. Use only materials which are resistant to deterioration when tested in accordance with ASTM E 154, as follows:

1. Polyethylene sheet not less than 10 mils thick.
2. Water resistant barrier paper consisting of heavy Kraft papers laminated together with glass fiber reinforcement and over-coated with black polyethylene on each side.

a. Product: Subject to compliance with requirements, provide Moistop Ultra 10 by Fortifiber Corporation, Stego Wrap 10-mil by Stego Industries or equal.

E. Non-Shrink Grout: CRD-C 621 and ASTM C-1107, factory pre-mixed grout.

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

a. Non-metallic

1) "Set Grout"; Master Builders.
2) "Euco-NS"; Euclid Chemical Co.
3) "Five Star Grout"; U.S. Grout Corp.

F. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

G. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

H. Liquid Membrane-Forming Curing Compound: Liquid type membrane- forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg./sq. m. when applied at 200 sq ft./gal.

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

a. "Masterkure"; Master Builders.
b. "Ecocure"; Euclid Chemical Co.
c. "Horn Clear Seal"; A.C. Horn, Inc.

I. Bonding Compound: Polyvinyl acetate or acrylic base.

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

a. Polyvinyl Acetate (Interior Only):

1) "Euco Weld"; Euclid Chemical Co.
2) "Weldcrete"; Larsen Products Corp.
3) "Everweld"; L&M Construction Chemicals, Inc.

b. Acrylic or Styrene Butadiene:

1) "Day-Chem AD Bond"; Dayton Superior Corp.
2) "Everbond"; L & M Construction Chemicals.
3) "SBR Latex"; Euclid Chemical Co.

J. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

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

a. "Epoxtite Binder 2390"; A.C. Horn, Inc.
b. "Sikadur 32 Hi-Mod"; Sika Chemical Corp.
c. "Euco Epoxy 452 or 620"; Euclid Chemical Co.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 211. If the trial batch method is used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer.

1. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Engineer and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.

C. Design mixes to provide normal weight concrete with the following properties, as indicated in Table I.:

TABLE 1

CONCRETE REQUIREMENTS

Concrete Class	Cement Type	Min. 28-Day Compressive Strength PSI	*Max. Water-Cement Ratio	Min. Cement Content Sacks	Slump Min.	Inch Max.	Entrained Air %
B	I	2000	0.74	4-1/2	2	6	5±1-1/2
C	I	4000	0.50	6.38	1	4	6±2
D	II or IP	4000	0.45	6	-	-	6±1

* Maximum Water - Cementitious Materials Ratio

1. All reinforced concrete shall be Class D, except as otherwise specified or shown on the drawings.
2. Concrete used for mud mats, fill and channeling in manholes and chambers shall be Class B unless otherwise noted on the drawings.
3. Class C concrete conforming to ODOT 499 (Class C) shall be used for all concrete pavement, curbing, driveways, and sidewalks, unless noted otherwise on the drawings.
4. Class B concrete may be used for encasing pipelines, fill, and pipe bedding.
5. Class B concrete shall be used as concrete fill in concrete tanks for shaping or sloping bottoms.

   a. The following steps shall be taken for installation of the Class B concrete:

      1) Scrub concrete slabs and/or walls with a stiff wire brush and streams of clean water as a minimum, to remove laitenance.
      2) Apply a bonding agent in accordance with the manufacturer's surface preparation and application recommendations.
      3) The Class B concrete shall then be placed and screeded to bring the surface to final grade.

6. Class D concrete shall be used for sewerage treatment plants and sewerage pump stations, as noted on the drawings.

D. 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; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

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; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

F. Admixtures:

1. Use high range water-reducing admixture (super plasticizer) in Class D concrete unless noted otherwise.
2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
3. Use air-entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within limits shown in Table I.
4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as shown in Table I:

    a. Concrete containing HRWR admixture (super-plasticizer): Not more than 8" after addition of HRWR to site-verified 2"-3" slump concrete.

2.6 CONCRETE MIXING

A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

1. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

    a. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS

A. Design, erect, support, brace, and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain form work construction tolerances complying with ACI 347.

B. Design form work to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. 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 work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete form work 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.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER INSTALLATION

A. Following leveling and tamping of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6" and seal with manufacturers recommended mastic or pressure-sensitive tape.

3.4 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.

1. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

B. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

C. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

1. Joint filler and sealant materials are specified in Section 03255 of these specifications.

D. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4 of slab depth, unless otherwise indicated, or early entry dry saw cutting.

1. Form contraction joints by inserting premolded plastic strips into fresh concrete until top surface of strip is flush with slab surface.
2. Follow the directions of Insert Manufacturer for finishing the slab and joints.

E. If joint pattern not shown, provide joints not exceeding 15' in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).

1. Joint sealant material is specified in Section 03255 of these specifications.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto. Electrical conduit shall not be embedded in concrete.

B. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.7 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, from-coating compound before placing reinforcement.

C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

3.8 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

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

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" 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. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement operations.

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.

    a. The concrete shall be maintained within this temperature range for not less than seven (7) days.

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 or against cold reinforcing steel.
3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of 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 embedment in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineers.

3.9 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed-to- view in the finish work or by other construction, unless otherwise indicated. 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" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are 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 other similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed; provide smooth rubbed finish to smooth form finish. Refer to "Concrete Surface Repairs."

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment.

1. Scarify or roughen entire surface by grinding or similar effective means.
2. Combined one part Portland cement to 1-1/2 parts fine sand by volume and a 50:50 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, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.
3. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.

D. Grout Cleaned Finish: Provide grout cleaned finish on scheduled concrete surfaces which have received smooth form finish treatment.

1. Scarify or roughen entire surface by grinding or similar effective means.
2. Apply Thoroseal plaster mix coating by Thoro System Products or approved equivalent with an approximate thickness of 1/8-inch to ¼-inch.
3. Follow the manufacturer's recommendations and guidelines regarding surface preparation, application methods and curing.
4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring 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.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

1. After placing slabs, plane surface to tolerances for floor flatness F(F) 15 and floor levelness F(L) 13, measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both, Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F(F) 18 F(L) 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F(F), 20 and F(L) 17, measured according to ASTM E1155. Grind smooth surface defects which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

F. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
2. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete from rapid moisture loss before and during finishing operations.

1. The evaporation graph, Figure 1, of ACI 308 - Curing Concrete, shall be used to determine the evaporation rate during concrete placement. If the rate of evaporation equals or exceeds 0.2 lbs/sq.ft./hr., steps shall be taken to prevent excessive evaporation from the surface.
2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

    a. Initial curing may be any of the methods listed herein that maintain a satisfactory moisture content and temperature.

3. Begin final curing procedures, if they differ from initial curing, immediately following initial curing and before concrete has dried. Continue curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of all structural concrete as herein specified.

1. Provide moisture curing by following methods.

    a. Keep concrete surface continuously wet by covering with water.
    b. Continuous water-fog spray.
    c. Cover concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture cover curing as follows:

a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

C. Provide curing and sealing compound to pavement, walks, and curbs only, as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours) and after surface water sheen has disappeared. Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

E. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing methods.

1. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.12 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for five (5) days after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members. Lab cured cylinders will not be considered.

C. Form facing material may be removed five (5) days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.13 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in 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 form work.

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 Engineer.

3.14 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 herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and 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 with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

   1. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

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

E. Reinforced Masonry: Provide concrete grout conforming to ASTM C476 for reinforced masonry and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.

   1. Saw-cut out honeycomb, rock pockets, voids over 1/4" in any dimension, down to solid concrete but, in no case to a depth of less than 1." Make edges of cuts slightly undercut to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with Portland Cement patching mortar, or precast cement cone plugs secured in place with bonding agent. When other materials are used, apply them in accordance with manufacturer's recommendations.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
2. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
3. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
4. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
   Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.
5. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. 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.

6. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
7. Perform structural repairs with prior approval of Engineer or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
8. Repair methods not specified above may be used, subject to acceptance of Engineer.
9. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material.

3.16 THROUGH SECTION CONCRETE CRACK REPAIRS

A. Sealing through wall or slab cracks.

1. Seal cracks for a water-tight or structurally bonded repair with epoxy or chemical grouting procedures.

a. The Contractor shall make proper repairs with epoxy injection or chemical injection with moisture reactive hydrophilic polyurethane foam grout, as directed by the Engineer.

3.17 MUD MATS

A. Where called for on the plans or as directed by the Engineer, the Contractor shall construct concrete mud mats immediately after cleaning the excavation bottom, to preserve the bearing surface condition. Concrete for mud mats shall be not less than 3 in. thick. Bottom of excavation shall be free of water, mud and loose material prior to mud mat placement. See Section 02300CT.

1. Mud mat concrete shall be cast against the side walls of all excavations to completely seal the bottom.

ADDENDUM
EXAMPLE FORM A

CONCRETE SUPPLIER:_____

PROJECT:_____ CONTRACTOR:_____

MIXTURE ID:_____ SPECIFIED f'c:_____PSI

MATERIAL MIXTURE PROPORTIONS lbs-mass/cu.yd. (pcy)

1.0 Cement Type_____ Source:_____

Sp. Gr._____ _____pcy _____cu. ft.

1.1 Other Cementitious Materials:_____ Class:_____ Source:_____

Sp. Gr._____ _____pcy _____cu. ft.

2.0 Aggregate (No. 1) Type:_____ Size:_____ Source:_____

SSD Sp. Gr._____ _____pcy _____ cu. ft.

Dry Rodded Unit Wt.:_____pcf

Alternate (No. 1) Lightweight Aggregate Type:_____ Size:_____Source:_____

Sp. Gr. Factor _____ over dry pcy _____ cu. ft.

Loose Unit Wt._____pcf Estimated Wet_____pcf

2.1 Aggregate (No. 2) Type:_____ Size:_____ Source:_____

SSD Sp. Gr._____ _____pcy _____cu. ft.

Dry Rodded Unit Wt.: _____pcf (If Fine Sized - FM _____)

2.2 Aggregate (Nos. 3, 4, n) Type:_____ Size:_____ Source:_____

SSD Sp. Gr._____ _____pcy _____cu. ft.

Dry Rodded Unit Wt.: _____pcf

3.0 Water: _____gal. _____pcy _____cu. ft.

EXAMPLE FORM A (CONTINUED)

4.0 Admixtures expressed as fluid ounces/cubic yard, and estimated range

Source:_____ Name:_____ Type_____ _____oz

Source:_____ Name:_____ Type_____ _____oz

Source:_____ Name:_____ Type_____ _____oz

Total Admixture Liquid Vol. _____ cu. ft.

(*) Note: Show volume in 4.0 if not included in cubic feet of air or water.

5.0 Other Materials - fibers, color pigment or other additions

Sp. Gr._____ _____pcy _____cu. ft.

Total Mixture Mass and Volume: _____pcy _____cu. ft.

Fresh Concrete Properties

Slump _____ +/-_____ in.

Unit Weight _____ pcf

Air Content _____+/-_____%

If Trail Batch Data -

Identify Batch No. _____

Batch Date _____

Concrete Temp._____°F

Comp. Strength-Average _____°F

Coarse & Fine Aggregate Gradation

Percent Passing

Sieve Size	Aggregate No. 1	2	3	4	Combined
2 in.	____	____	____	____	_____
1-1/2 in.	____	____	____	____	_____
1 in.	____	____	____	____	_____
3/4 in.	____	____	____	____	_____
1/2 in.	____	____	____	____	_____
3/8 in.	____	____	____	____	_____
No. 4	____	____	____	____	_____
No. 8	____	____	____	____	_____
No. 16	____	____	____	____	_____
No. 30	____	____	____	____	_____

EXAMPLE FORM A (CONTINUED)

7 day avg. _____psi	No. 50	____	____	____	____	_____
28 day avg. _____psi	No. 100	____	____	____	____	_____
	No. 200	____	____	____	____	_____

Comments:_____

_____

Signature: _____ Date:_____

Title: _____

Organization: _____

EXAMPLE FORM B

CONCRETE SUPPLIER:_____

MATERIAL TRAIL BATCH NUMBER - proportions per cubic yard

1 2 3 4

1.0 Cement Source: _____

Type ____ _____lb _____lb _____lb _____lb

1.1 Other Cementitious Material Sources:_____

Type ____ _____lb _____lb _____lb _____lb

2.0 Aggregate No. 1 Size_____ Source:_____

SSD ____ _____lb _____lb _____lb _____lb

Alternate No. 1 Lightweight Aggregates Type _____ Source: _____

Sp. Gr. Factor _____

Oven Dry _____lb _____lb _____lb _____lb

Wet _____lb _____lb _____lb _____lb

2.1 Aggregate No. 2 Size_____ Source:_____

SSD ____ _____lb _____lb _____lb _____lb

2.2 Aggregate Nos. 3, 4, n) Size_____Source:_____

SSD ____ _____lb _____lb _____lb _____lb

3.0 Water _____lb _____lb _____lb _____lb

4.0 Admixtures Source: _____

_____ Type _____ _____oz _____oz _____oz _____oz

_____ Type _____ _____oz _____oz _____oz _____oz

_____ Type _____ _____oz _____oz _____oz _____oz

EXAMPLE FORM B (CONTINUED)

5.0 Other Materials

_____ Type _____ _____lb _____lb _____lb _____lb

_____

Total Mass: _____lb _____lb _____lb _____lb

Total Mass/cy: _____pcy _____pcy _____pcy _____pcy

Relative Cubic Yard Volume:
_____cy _____cy _____cy _____cy

Water-Cementitious Material Ratio:

Fresh Concrete Properties

TRAIL BATCH NUMBER

	## -1	## -2	## -3	## -4
Slump-inches	_____	_____	_____	_____
Air-Content %	_____	_____	_____	_____
Unit Wt. pcf	_____	_____	_____	_____
Concrete Temp. °F	_____	_____	_____	_____

Compressive Strength Results (ASTM C192, C39) or Other Specified Test Requirements

7 days	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Average (7 day)	_____	_____	_____	_____

EXAMPLE FORM B (CONTINUED)

28 days	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Average (28 day)	_____	_____	_____	_____
Water-Cementitious Material Ratio:				
	_____	_____	_____	_____

Signature: _____ Date:_____

Title:_____

Organization: _____

END OF SECTION 03310CT (1/06)

SECTION 03410AIA - PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plant-precast structural concrete units, including the following:

1. Hollow-core slab units.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for elastomeric joint sealants and sealant backings.
2. Refer to drawings for equipment penetrations through roof slab.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

B. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads:
2. Live Loads: 30 psf + snow drift loads
3. Wind Loads: 90 MPH

1.4 SUBMITTALS

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

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.

1. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
2. Indicate locations and details of anchorage devices to be embedded in other construction.
3. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Concrete materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed precast structural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast structural concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast structural concrete that are similar to those indicated for this Project in material, design, and extent.
3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C2.
4. Has sufficient production capacity to produce required units without delaying the Work.

C. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.7 SEQUENCING

A. Furnish anchorage items to be embedded in other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 FABRICATORS

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

1. Any fabricator meeting the requirements of Section 1.5, Quality Assurance.

2.2 MOLD MATERIALS

A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

2.3 REINFORCING MATERIALS

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

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

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

D. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:

1. For uncoated reinforcement, use all-plastic or CRSI Class 1 plastic-protected bar supports.

2.4 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A 416, Grade 250 or 270, uncoated, 7-wire, low-relaxation strand.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, of same type, brand, and source.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S.

C. Lightweight Aggregates: ASTM C 330.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

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

F. Water-Reducing Admixture: ASTM C 494, Type A.

G. Retarding Admixture: ASTM C 494, Type B.

2.6 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36.

B. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.

C. Welding Electrodes: Comply with AWS standards.

D. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast structural concrete units.

2.7 BEARING PADS

A. Provide bearing pads for precast structural concrete units as follows:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.
4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

C. Epoxy Grout: ASTM C 881, 2-component epoxy resin, of type, grade, and class to suit requirements.

2.9 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

1. Limit use of fly ash and silica fume to not exceed, in aggregate, 25 percent of portland cement by weight.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

D. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows, with a tolerance of plus or minus 1-1/2 percent:

   a. Air Content: 6 percent for 1-inch- nominal maximum aggregate size.

E. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's written instructions.

F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.10 FABRICATION

A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.

1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.
2. Unless forms for precast, prestressed concrete units are stripped before detensioning, design forms so stresses are not induced in precast concrete units because of deformation or movement of concrete during detensioning.

B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless approved by Architect.

C. Cast-in openings larger than 10 inches in diameter or 10 inches square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Architect.

D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Prestress tendons for precast structural concrete units by either pretensioning or posttensioning methods. Comply with PCI MNL 116.

1. Delay detensioning until concrete has reached at least 70 percent of its compressive strength as established by test cylinders cured under the same conditions as concrete.
2. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
3. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

F. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.

G. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.

I. Comply with ACI 306.1 procedures for cold-weather concrete placement.

J. Comply with ACI 305R recommendations for hot-weather concrete placement.

K. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.

L. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

M. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.

N. Finish formed surfaces of precast structural concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.

O. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.

P. Smooth steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

1. Apply scratch finish to precast concrete units that will receive concrete topping after installation. After initial strikeoff, transversely scarify surface to provide ridges approximately 1/4 inch deep.

Q. Recess prestressing tendons a minimum of 1/2 inch, fill recesses with grout, and apply a sack finish to vertical ends of precast concrete units.

2.11 HOLLOW-CORE SLAB UNITS

A. Type: Precast, prestressed concrete units with open, hollow cores running the full length of the slab units.

B. Furnish units free of voids and honeycombs.

C. Provide standard finish to precast concrete units.

D. Reinforce units to resist transportation and erection stresses.

E. Include cast-in weld plates where required.

F. Coordinate with other trades for installation of cast-in items.

G. Provide solid, monolithic, precast concrete slab units forming an integral part of hollow-core slab unit system. Design and fabricate solid units to dimensions and details indicated for hollow-core slab units.

H. Provide headers of cast-in-place concrete or structural-steel shapes for openings larger than one slab width according to hollow-core slab unit fabricator's written recommendations.

2.12 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.

B. Strength of precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements, including the following:

1. Units fail to comply with compressive-strength test requirements.
2. Reinforcement and prestressed tendons of units do not comply with fabrication requirements.
3. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
4. Units are damaged during handling and erecting.

C. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

D. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.

1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.

E. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.

B. Install precast structural concrete. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.

C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.

1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
2. Repair damaged metal surfaces by cleaning and applying a coat of galvanized repair paint to galvanized surfaces.
3. Repair damaged metal surfaces by cleaning and repriming damaged painted surfaces.

D. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless approved by Architect.

E. Erection Tolerances: Install precast concrete units level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete."

F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:

1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.3 CLEANING

A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

1. Wash and rinse according to precast concrete fabricator's written 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.

END OF SECTION 03410AIA 8/98

SECTION 03415CT - PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Under this section, the Contractor shall furnish and construct precast concrete manholes, including drops and manhole stacks of types and at locations shown on the Drawings and/or scheduled.

B. This section includes additional excavation to widen and deepen sewer trenches for manhole construction, furnishing and installing concrete of classes called for, brick, Portland cement mortar, reinforcing steel, precast concrete pipe, integral base sections, bottom riser sections, transition sections, riser sections, eccentric cones, flat slab tops and adjusting rings, flexible manhole connections, pipe for drop connections, plugging lifting holes, pointing joints, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 DEFINITIONS

A. The various types of manholes are as shown on the Drawings or in the Standard Details.

1.5 SUBMITTALS

A. Manufacturer's Shop Drawings, Certificates and Technical Data

1. Precast Concrete Manhole Sections and Specials
2. Flexible Joints
3. Concrete Materials
4. Reinforcing Materials

B. Supplier's Certificates

1. Reinforced Concrete Pipe Manhole Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete Pipe Manhole Sections

1. Precast concrete pipe manhole sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM Specification C 478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.
2. Joints shall be O-ring type conforming to ASTM Specification C 443.
3. The standard length of riser sections shall be 48 in. Lengths of 32 in. or 16 in. shall be used to meet required dimensions and as specified.
4. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
5. Specified manhole steps shall be factory installed to provide a continuous ladder of 16 in. c/c rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with nonshrink mortar to insure a watertight joint. If the outer surface of the pipe wall is pierced, the patch shall be completely covered with a bituminous sealer.
6. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

B. Manhole frames, covers, and steps utilized shall comply with their respective specification.

C. Mortar

1. Mortar used for the structures herein specified shall conform to Specifications for Mortar for Unit Masonry, ASTM Designation C 270 Type S, containing no masonry cement. The mortar shall be composed of one part Portland cement to two parts sand by volume.
2. Materials for nonshrinking grout shall conform to CRD-C "Corps of Engineers Specifications for Non- Shrink Grout". Approved products are "Sauereisen F-100 Grout" by Sauereisen Cements Co.; "Five Star Grout" by U.S. Grout Corporation; "Masterflow 713" by Master Builders; "Euco N-S" by Euclid Chemical Company.

D. All cast-in-place concrete used for forming channels in manhole bottoms shall be Class B as specified in the Section 03310.

E. Reinforcing steel used in cast-in-place concrete shall meet the requirements of Section 03310.

F. Flexible joints for precast manhole pipe openings herein specified shall conform to ASTM designation C 923, "A-Lok" Type as manufactured by A-Lok Products; or an approved equivalent.

G. The pipe and size for manhole drops shall conform to the Standard Details and its respective specification contained herein.

H. Brick used for catch basin and manhole construction shall conform to Specifications for Sewer and Manhole Brick (made from clay or shale), ASTM Designation C 32, and shall be Grade "MS" unless otherwise specified.

PART 3 - EXECUTION

3.1 LOCATION AND CONSTRUCTION

A. Location and type of manhole installed shall be as shown on the Drawings or directed.

B. Construction shall be in conformance with details shown on the Drawings and as specified under this section.

3.2 EXCAVATION

A. Excavation for manhole construction shall be prepared as directed in the applicable paragraphs of Section 02300 Excavation, Bedding & Backfill.

3.3 INSTALLATION OF INTEGRAL BASE SECTIONS

A. Class B concrete shall be poured so as to provide a minimum of 4-in. thick pad under the entire area of the manhole base. Place the manhole on the pad before the concrete is completely set so that final leveling adjustment can be made.

B. 6" Granular backfill bedding can be used in lieu of Class B concrete.

3.4 CHANNELING MANHOLE BOTTOMS

A. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the manhole wall.

B. In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4-in. thick minimum between bricks and between bricks and concrete and 1-in. thick minimum on all exposed surfaces.

3.5 PRECAST CONCRETE RISER SECTIONS

A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the flat slab top.

B. Pipe section joints shall be pointed and lifting holes filled with nonshrinking mortar.

3.6 SPECIAL PROVISIONS

A. The intent of this section is to identify requirements only associated with improvements, or rehabilitation of existing sewerage manholes.

B. The installation of bottom riser sections shall be as follows:

1. The base shall be of Class A concrete as specified in Section 03310, 9 in. thick minimum placed on undisturbed earth.
2. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section.
3. On straight runs the Contractor may carry the sewer pipe through the manhole and break out the top half after the fill concrete has set. In all cases the sewer pipe shall extend through the manhole wall to the inside face.

C. All manholes for sanitary sewers shall have an application of Thoro-Seal or other approved coating (any color but gray).

END OF SECTION 03415CT 1/89

SECTION 03416CT - PRECAST CONCRETE CATCH BASINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Under this section the Contractor shall furnish and construct precast catch basins of designated types at locations shown on the Drawings and/or scheduled.

B. This section includes furnishing and installing concrete of classes called for, reinforcing steel, brick, Portland cement mortar, precast concrete inlet structures, flexible joints where specified, inlet castings, making watertight connections to new and existing sewers, and other incidental work.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 DEFINITIONS

A. Types of catch basins included under this section shall be as designed and detailed on the Drawings.

B. The term catch basins as used herein, refers to nomenclature of standard drawings for specified structures and of details shown on the Drawings.

1.5 SUBMITTALS

A. Manufacturer's Shop Drawings, Certificates and Technical Data

1. Precast Catch Basins
2. Flexible Joints
3. Frames and Covers
4. Concrete Materials
5. Reinforcing

B. Supplier's Certificates

1. Brick

1.6 PROTECTION

A. Adequate precautions shall be taken to prevent concrete and/or mortar from freezing. Brick, having a temperature of 40 degrees F or less shall not be set with mortar until heated for a period sufficient to insure a temperature of 50 degrees F to 80 degrees F throughout the entire mass of material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete Catch Basin Sections

1. Precast concrete catch basin sections, flat slab tops, and adjusting rings shall conform to ASTM C 478.
2. Joints shall be O-ring type conforming to ASTM C 443.
3. The standard length of riser sections shall be 48 in. Lengths of 32 in. or 16 in. shall be used to meet required dimensions and as specified.
4. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
5. Precast integral base sections shall be of monolithic construction. The bottom of the section shall be 6 in. thick minimum and contain 0.32 sq. in. per foot minimum of steel reinforcing each way in top of the slab or as indicated on the details shown on the drawings. Walls shall meet ASTM C 478.

B. Catch Basin Frames and Covers

1. Catch Basin frames and covers shall be as shown on the Drawings.

C. Mortar

1. Mortar used for the structures herein specified shall conform to Specifications for Mortar for Unit Masonry, ASTM C 270 Type S, containing no masonry cement. The mortar shall be composed of one part Portland cement to two parts sand by volume.

D. Flexible joints for precast catch basins pipe openings herein specified shall conform to ASTM C 923, "A-Lok" Type as manufactured by A-Lok Products, "Kor-N-Seal" Type as manufactured by National Pollution Control systems, Inc., or equal.

PART 3 - EXECUTION

3.1 LOCATION AND CONSTRUCTION

A. Location and type of catch basin installed shall be as shown on the Drawings or directed.

B. Construction shall be in conformance with details shown on the Drawings and as specified.

3.2 EXCAVATION

A. Excavation for catch basin construction shall be prepared as directed in applicable paragraphs of Section 02300 Earthwork.

3.3 INSTALLATION OF INTEGRAL BASE SECTIONS

A. Concrete shall be poured so as to provide a minimum of 4-in. thick pad under the entire area of the catch basin. Place the catch basin on the pad before the concrete is completely set so that final leveling adjustment can be made.

B. Six inch (6") granular backfill bedding can be used in lieu of concrete at the direction of the Engineer.

3.4 INSTALLATION OF CAST-IN-PLACE BASES

A. Unless otherwise called for on the Drawings or directed, precast bottom riser sections shall be placed with cast-in-place concrete bases.

B. The base shall be of reinforced concrete 9 in. thick minimum placed on undisturbed earth.

C. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section.

D. On straight runs the Contractor may carry the sewer pipe through the catch basin and break out the top half after the fill concrete has set. In all cases the sewer pipe shall extend through the catch basin wall to the inside face.

3.5 CHANNELING CATCH BASIN BOTTOMS

A. The bottoms of all catch basins shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the catch basin wall.

B. In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4-in. thick minimum between bricks and between bricks and concrete and 1-in. thick minimum on all exposed surfaces.

3.6 PRECAST CONCRETE RISER SECTIONS

A. The shortest length of riser section to be incorporated into the catch basin shall be installed immediately below the flat slab top.

3.7 INSTALLATION OF CATCH BASIN FRAMES

A. Catch basin frames and covers shall be installed to grades shown on the Drawings or as directed.

B. Adjustment of catch basin castings shall be made using specified brick or precast adjusting rings and Portland cement mortar joints. The entire outer surface of adjusting rings and castings shall be plastered with 1 in. minimum Portland cement mortar unless otherwise detailed on the Drawings or directed.

C. The maximum depth of adjustment below any catch basin casting shall be 16 in.

END OF SECTION 03416CT 1/88

DIVISION 4

MASONRY

SECTION 04200 - 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. Concrete building brick.
3. Face brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry cell insulation.

B. Related Sections:

1. Division 03 Section Concrete work.

2. Division 08 Section Doors and Window work.

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 structural 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.

1.5 SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

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

1. Masonry units.

   a. Include data on material properties.
   b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include test report for efflorescence according to ASTM C 67.
   d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing per ASTM C 67.
   e. 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.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. 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.

1.6 QUALITY ASSURANCE

A. 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.

B. 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.

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

1.7 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.

1.8 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.

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. Regional Materials: Provide CMUs that have been manufactured within 500 miles (800 km) of Project site from aggregate and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

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

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa.
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Faces: Provide color and texture matching the range represented by Architect's sample.

D. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.31 MPa).
2. Density Classification: Normal weight.
3. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 7-5/8 inches (194 mm) long.

2.3 BRICK

A. Regional Materials: Provide brick that has been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).

1. Products: Face Brick
2. Grade: SW.
3. Type: FBX or HBX.
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m)
8. Provide face brick matching color range, texture, and size of existing adjacent brickwork.

D. Building (Common) Brick: ASTM C 62, Grade SW.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1700 psi (11.72 MPa).

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. 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.

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

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

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Capital Materials Corporation; Flamingo Color Masonry Cement.
b. CEMEX S.A.B. de C.V.; Brikset Type N Citadel Type S Dixie Type S Kosmortar Type N Richmortar Victor Plastic Cement.
c. Essroc, Italcementi Group; Brixment or Velvet.
d. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.

e. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Trinity White Masonry Cement.
f. Lehigh Cement Company; Lehigh Masonry Cement Lehigh White Masonry Cement.
g. National Cement Company, Inc.; Coosa Masonry Cement.

F. Mortar Cement: ASTM C 1329.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

G. 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, available products that may be incorporated into the Work include, but are not limited to, the following:

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

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

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Colored Portland Cement-Lime Mix:

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

b. Colored Masonry Cement:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
3) Essroc, Italcementi Group; Brixment-in-Color.
4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.

5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
7) National Cement Company, Inc.; Coosa Masonry 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.
4. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

I. 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.

J. Aggregate for Grout: ASTM C 404.

K. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

L. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.

M. 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, available products that may be incorporated into the Work include, but are not limited to, 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.

N. Water: Potable.

2.5 REINFORCEMENT

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. All Walls: Hot-dip galvanized, carbon steel.
   2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
   3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   4. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
   5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   6. Provide in lengths of not less than 10 feet (3 m).

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. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus 1 side rod at each wythe of masonry 4 inches (100 mm) wide or less.
   2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
   3. 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.

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

2.6 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.
   3. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.

2.7 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed 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.

2.8 EMBEDDED FLASHING MATERIALS

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

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) Advanced Building Products Inc.; Peel-N-Seal.
      2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
      4) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      6) Hohmann & Barnard, Inc.; Textroflash.

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

2.9 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 urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

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

D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
4) Heckmann Building Products Inc.; No. 85 Cell Vent.
5) Hohmann & Barnard, Inc.; Quadro-Vent.
6) Wire-Bond; Cell Vent.

2.10 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

2.11 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 or mortar cement mortar unless otherwise indicated.

B. 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.

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

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Face brick.

D. 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 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

2.12 INSULATION

A. Loose-Granular Perlite Insulation: ASTM C 549, Type II or IV; r-value of 3.3-2.8 BTUH.

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.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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 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.

C. Joints:

1. For all 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).

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 at High School. Match bond pattern at Elementary School.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 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. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMU's 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.

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.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 8 inches (203 mm) o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

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). Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.

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 at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 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.

C. Form expansion joints in brick as follows:

1. Build in compressible joint fillers where indicated.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete lintels where shown.

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

3.10 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.

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 through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

3.11 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) 12.67 ft. (3.86 m).

3.12 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.13 REPAIRING, POINTING, AND CLEANING

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 stone and nonmasonry 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 brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.14 MASONRY CELL INSULATION

A. Poor granular insulation into cavity to fill void spaces completely. Limit fall of insulation to eight-feet height.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units.

C. 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 04200

DIVISION 5

METALS

SECTION 05012CT - ALUMINUM LADDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. The Contractor, under this section, shall provide and install aluminum ladders as shown on the Drawings or as directed.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 PROTECTION

A. All material shall be kept clean and protected from the weather.

1.5 SUBMITTALS

A. Submit manufacturer's certificates indicating the meeting of all OSHA requirements.

B. The Contractor shall furnish for approval complete shop drawings showing all framed work and all connections to concrete or masonry.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, except as otherwise required, shall be aluminum alloy equivalent to specification 6063, rivets and screws shall be 2017 alloy, aluminum plate and structural shapes shall be 6061-T6 aluminum, and extruded shapes shall be 6063-T5, all as manufactured by the Aluminum Company of America; or approved equal.

2.2 FABRICATION

A. Aluminum ladders shall be provided as shown on the Drawings and/or Specifications and shall meet OSHA requirements.

B. Ladders shall be of aluminum alloy 6061-T6 or 6063- T5.

C. All components of a ladder shall be designed for a minimum concentrated live load of 300 lbs.

D. Ladders shall be welded assemblies, except as shown otherwise on the Drawings.

E. All fasteners needed for mounting the ladders shall be Type 304 stainless steel.

2.3 PAINTING

A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.

B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting exposed aluminum surfaces with bituminous paint or water white methacrylate lacquer.

C. Mechanical finishing shall be in accordance with NAAMM Finishes Manual. Electro-chemical, chemical, organic finishes on metal shall conform to industry standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work performed shall be in accordance with the manufacturer's recommendations for installation.

B. All work shall be free from defects of any type which affect durability, strength, or appearance.

C. Support brackets shall be securely anchored into the wall by anchor bolts or wedge type expansion bolts.

END OF SECTION 05012CT 1/89

SECTION 05014CT - ALUMINUM FLOOR GRATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. This section includes the furnishing and the installing of all aluminum floor gratings as shown on the Drawings and necessary to complete the work of this contract. Gratings include all clips, spacers, frames, supports, fasteners, and other incidental materials needed for a complete installation.

B. Floor grating and frames shall be as detailed on Drawings.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. Samples of each type of floor gratings proposed shall be submitted for approval prior to placement of purchase orders.

B. Manufacturer's catalog data showing:

1. Dimensions, spacing, and construction of grating.
2. Design tables showings limits for span length and deflection under various uniform and concentrated loads.
3. Materials of construction.

C. Detail shop drawings showing:

1. Dimensions of each grating.
2. Sectional assembly.
3. Location and identification mark.
4. Size and type of supporting frames required.

PART 2 - PRODUCTS

2.1 ALUMINUM FLOOR GRATING

A. Material for aluminum floor gratings shall be aluminum alloy 6061-T6 and 6063-T5 for structural supports and frames in accordance with the latest ASTM Specification B221.

B. Gratings shall be furnished with a standard mill finish.

C. Aluminum bar gratings shall be designed for a live load of 300 lbs./sq. ft., except that when located in a roadway it shall be designed to carry a truck rear axle load of 24,000 lbs. Maximum deflection under 100 lbs./sq. ft. load shall not exceed 1/4-in. or 1/180th of the span, whichever is least. Gratings shall be 1-1/2 in. deep with spacer bars spaced not more than 4 in. unless otherwise shown, specified or required.

D. Banding of the ends of bearing bars and around openings through the panels shall be provided by 1/4-in. aluminum bars of the same depth as the panels.

E. Grating shall be fabricated from field dimensions taken after facilities requiring passage through the gratings are in place.

F. Individual grating panels shall not exceed a total weight of 125 lbs. unless otherwise shown or specified.

G. Grating frames shall conform to details on the Drawings. Frames shall be shop welded with full strength welds and all exposed welds ground flush.

H. In a case where frames would be large and bending could occur, field jointing shall be allowed using mechanical joints. All frames shall be adequately braced and strapped to wood blocking during shipment and installation to prevent damage.

2.2 PAINTING

A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.

B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting aluminum contact surfaces with bituminous paint or water white methacrylate lacquer.

C. Provide mill finish as fabricated in accordance with NAAMM Finishes Manual.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The gratings shall be installed in angle frames set in the floor or fastened thereto to support the gratings. The tops of the gratings shall be set flush with the surface of the floor in which it is installed. No panel shall rock when any part of it is stepped on.

B. A maximum spacing of 1/4 in. shall be maintained between the grating and adjacent surfaces.

C. Type 304 stainless steel fasteners shall be installed where indicated on the Drawings or required.

END OF SECTION 05014CT 12/05

SECTION 05015CT - ALUMINUM FLOOR PLATES AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor, under this section, shall furnish and properly install all aluminum checkered cover plates and frames as shown on the Drawings or as directed.

B. It is the intent of this Contract that the final installation shall be complete in all respects and the Contractor will be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and structural analysis data signed and sealed by and Ohio Professional Engineer.

B. Shop Drawings: Include plans, elevations, sections, details and attachments to other work.

PART 2 - PRODUCTS

2.1 ALUMINUM CHECKERED COVER PLATES

A. Aluminum checkered cover plates shall be raised pattern and 1/4-in. thick, unless otherwise indicated.

B. Material for aluminum cover plates and supports shall be aluminum alloy 6061-T6 in accordance with the latest ASTM Specification B221.

C. Cover plates shall be furnished with a standard mill finish.

D. The cover plates shall be designed for three times a normal load of 100 lbs./sq. ft. Maximum deflection under a 100 lbs./sq. ft. load shall not exceed 1/4-in. or 1/180th of the span, whichever is least. Stiffeners shall be supplied when necessary.

E. Individual plates shall not exceed a total weight of 100 lbs., unless otherwise directed by the Engineer.

F. Plates not requiring hinges shall be bolted in place and shall be made airtight with a neoprene gasket.

G. Cover plate frames shall conform to details on the Drawings. Frames shall be shop welded with full strength welds and all exposed welds ground flush.

H. In a case where frames would be large and bending could occur, field jointing shall be allowed using mechanical joints. All frames shall be adequately braced and strapped to wood blocking during shipment and installation to prevent damage.

I. Required hinges shall be stainless steel butt hinges or piano hinges.

J. Required lifting handle shall be aluminum alloy 6061-T6.

K. All required fasteners shall be Type 304 stainless steel.

2.2 PAINTING

A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.

B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting aluminum contact surfaces with bituminous paint or water white methacrylate lacquer.

C. Mechanical finishing shall be in accordance with NAAMM Finishes Manual. Electro-chemical, chemical, organic finishes on metal shall conform to industry standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The cover plates shall be installed in the frames set in the concrete surface to support the cover plates. The cover plates shall be set flush with the surrounding surface.

B. No plate shall rock when any part of it is stepped on.

END OF SECTION 05015CT 11/03

SECTION 05016CT - ALUMINUM HANDRAILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor, under this section, shall provide and install all aluminum handrailing as shown on the Drawings or as directed. Unless otherwise shown on the Drawings, all handrailings shall be aluminum.

B. It is the intent of this Contract that the final installation shall be complete in all respects, and the Contractor will be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

A. Submit manufacturer's certificates and calculations indicating the compliance of all OSHA requirements and loadings.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing number, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

   a. Show method of connecting members at intersections.

PART 2 - PRODUCTS

2.1 HANDRAILING

A. Aluminum pipe rails and posts shall be 1-1/2 in. nominal diameter pipe made of alloy 6063-T6. Aluminum handrail shall be anodized. The color shall be selected by the Engineer. Railing components, fastenings, and complete structure shall meet all requirements of OSHA. All rails and posts shall be a minimum of Schedule 40.

B. All handrails, unless otherwise shown on the Drawings, shall be as follows:

1. All bottom mounted rails should be 3 ft.-6 in. high, measured from the floor to the top of the rail, with intermediate rail on the posts. Posts shall be placed at a maximum of 6 ft. and at each change in direction. Posts shall be attached to the top of the walkway or curb as shown on the Drawings. The mounting plate shall be made of alloy 6061-T6.
2. Bends, where called for, shall be shop formed and present pleasing appearance.
3. The top surface of the top railing shall be smooth and shall not be interrupted by a projecting fitting.
4. All openings in the railing shall be spanned with a 1/4 in. type 304 stainless steel chain with snap hook at one end and fixed to post at other end. Hooks and eyes shall be stainless steel.
5. Toe plates shall conform to OSHA Standards. Toe plates shall not be pop-riveted to posts.

6. Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 PAINTING

A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.

B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting exposed aluminum surfaces with bituminous paint or water white methacrylate lacquer.

C. Finishing shall be in accordance with Aluminum Association M10C22 A41 Clear Anodized. The handrail system shall be plastic wrapped and not removed until after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work performed shall be in accordance with the manufacturer's recommendation for installation.

B. All work shall be free from defects of any type which affect durability, strength, or appearance.

C. Support brackets shall be securely anchored into the wall by anchor bolts or wedge type expansion bolts.

D. Posts shall be set on mounting plates attached to the floor or curb by stainless steel concrete anchor bolts in concrete.

E. All erection shall meet OSHA requirements and the manufacturer's recommendations.

F. Upon completion of railing installation all work shall be cleaned to make it acceptable for final inspection.

G. For protection from temperature induced stresses an expansion joint and gap shall be provided in every top rail on a maximum of 24 feet. Top rails only shall have expansion joints between the fixed points. Use 1/8 inch gap between bottom rail and each fitting.

END OF SECTION 05016CT 5/12

SECTION 05310AIA - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Acoustical roof deck.
3. Cellular roof deck.
4. Acoustical cellular roof deck.
5. Composite floor deck.
6. Electrified cellular floor deck.
7. Non-composite form deck.
8. Non-composite vented form deck.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from same manufacturer.

C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Steel Deck:

    a. ASC Profiles, Inc.
    b. Canam Steel Corp.; The Canam Manac Group.
    c. Consolidated Systems, Inc.
    d. DACS, Inc.
    e. D-Mac Industries Inc.
    f. Epic Metals Corporation.
    g. Marlyn Steel Decks, Inc.
    h. New Millennium Building Systems, LLC.
    i. Nucor Corp.; Vulcraft Division.
    j. Roof Deck, Inc.
    k. United Steel Deck, Inc.
    l. Valley Joist; Division of EBSCO Industries, Inc.
    m. Verco Manufacturing Co.
    n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653Grade G60 zinc coating.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653 G90 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.

2.4 NON-COMPOSITE FORM DECK

A. Non-composite Steel Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653 Grade G60 zinc coating.

2. Profile Depth: 1-1/2 inches.

3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

K. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

   1. Weld Diameter: 5/8 inch.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310AIA 05/03

SECTION 05500CT - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following metal fabrications:

1. Rough hardware.
2. Ladders
3. Loose bearing and leveling plates.
4. Loose steel lintels.
5. Shelf and relieving angles.
6. Miscellaneous framing and supports for the following:

a. Overhead doors.
b. Suspended toilet partitions.
c. Applications where framing and supports are not specified in other sections.

7. Miscellaneous steel trim, including the following:

a. Edgings.

8. Pipe bollards.
9. Steel Pipe Railings

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 5 Section "Alternating Tread Steel Stairs".

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for nonslip aggregates and nonslip aggregate surface finishes, paint products, and grout.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Handrails: Capable of withstanding the following loads applied as indicated:

1. Concentrated load of 200 lbf applied at any point nonconcurrently, vertically downward or horizontally.
2. Uniform load of 50 lbf per linear foot applied nonconcurrently, vertically downward or horizontally.
3. Concentrated and uniform loads above need not be assumed to act concurrently.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

C. Rolled Steel Floor Plates: ASTM A 786 (ASTM A 786M).

D. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.

1. Black finish, unless otherwise indicated.

E. Gray-Iron Castings: ASTM A 48, Class 30.

F. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

G. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27 (ASTM A 27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

H. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of Division 9 Special Coatings, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).

G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

2.4 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless higher strengths are indicated.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F (55.5 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.7 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per m) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

    a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

2.11 STRUCTURAL STEEL DOOR FRAMES

A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together. Plug-weld built-up members and continuously weld exposed joints.

B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8-by-2-inch (3-by-50-mm) straps of the length required for a minimum 8-inch (200-mm) embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches (300 mm) from both bottom and head of frame and space anchors not more than 30 inches (750 mm) apart.

C. Galvanize frames and anchors in the following locations:

1. Exterior locations.

2.12 STEEL PIPE AND HANDRAILS

A. General: Fabricate pipe handrails to comply with requirements indicated for design, dimensions, details, finish and member sizes, including wall thickness of pipe, and anchorage, but not less than that required to support structural loads.

B. Interconnect handrail members by butt-welding or welinding with internal connectors, at fabricator's option, unless otherwise indicated.

C. For changes in direction of railing members as follows:

1. By radius bends.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails.

F. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings.

G. Brackets, flanges, fittings, and Anchors: Provide wall brackets, end closurers, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of rails and handrails to other work. Furnish inserts and other anchorage devices for connecting rails and handrails to masonry work.

H. For interior steel handrails formed from steel pipe with black finish, provide nongalvanized ferrous metal fittings, brackets, fasteners and sleeves.

2.13 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4-inch (6.4-mm) minimum steel plate.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve.

2.14 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. fusion without undercut or overlap.
3. welding flux immediately.
4. exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

3.3 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use nonshrink, metallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

B. Fill bollards solidly with concrete, mounding top surface.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting."

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500CT 5/93

SECTION 05537CT – MISCELLANEOUS FIBERGLASS REINFORCED PLASTIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Under this section, the Contractor shall furnish and install fiberglass reinforced plastic baffles, troughs, weirs and structural members along with all support brackets, fasteners, anchors, and other incidental work.

B. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

C. Structural members shall be designed to support all applied loads. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the loads.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work. Materials shall be furnished by an ISO-9001:2008 Certified Manufacturer

1.4 SUBMITTALS

A. Product Data: Shop drawings of all fabricated pultruded structural shapes and plate, and appurtenances as shown in the plans shall be submitted to the Engineer for approval.

B. Detailed shop drawings showing:
   1. Dimensions
   2. Sectional Assembly
   3. Location and Identification mark
   4. Size and type of supporting framing required

C. Samples of each type of product shall be submitted for approval along with shop drawing submittals.

PART 2 - PRODUCTS

2.1 BAFFLES

A. Baffles shall be constructed of fiberglass reinforced polyester resin with a thermoplastic surfacing mat to prevent ultraviolet deterioration. A minimum static differential head of water of 12 inches shall be utilized in the design of the walls with a panel deflection limited to L/150.

B. Physical Properties

1. All laminates shall meet the following minimum physical properties:

		ASTM Test Method	Minimum Properties
a.	Tensile Strength(psi)	D 638	42,000
b.	Flexural Strength (psi)	D 790	32,000
c.	Flexural Modulus (psi)	D 790	$1.5x10^6$
d.	Compressive Strength (psi)	D 695	50,000
e.	Izod Notched Impact (ft-lbs./inch)	D 756	25
f.	Water Absorption (24 hrs.)	D 570	0.2% max.

C. Fabrication:

1. Baffles shall be minimum 12 in. wide.
2. The baffles and holding brackets shall have slotted holes if required so that vertical and horizontal adjustments can be made. Slots shall be cut in such a way as to prevent leakage through the baffles with bolts in place. If leakage occurs, a neoprene gasket shall be installed.
3. All support brackets shall be of the same material as that of the baffle or stainless steel.
4. All fasteners shall be stainless steel to resist corrosion.
5. The complete system shall be rigid and free of sway that would work anchors loose or cause undue wear.
6. All baffles with cut edges shall receive two protective coats of a compatible resin. Such a coating shall prevent premature fraying.
7. Baffles shall be easily removable for cleaning.

2.2 FRP WEIRS & SCUM BAFFLES

A. Troughs, weir plates, scum baffles and washers shall be constructed of 1/4 in. fiberglass reinforced polyester (FRP) resin with a thermoplastic surfacing mat to prevent ultraviolet deterioration. All fiberglass troughs and plates shall be of the same color as selected by the Owner. There shall be included all necessary butt plates, cover plates, anchors, nuts, washers, etc., of the material as shown or required for a complete installation.

B. Physical Properties

1. All laminates shall meet the following minimum physical properties:

		ASTM Test Method	Minimum Properties
a.	Tensile Strength (ksi)	D 638	12.0
b.	Flexural Strength (ksi)	D 790	19.0
c.	Flexural Modulus (ksi)	D 790	900
d.	Barcol Hardness	D 2583	35 min.
e.	Izod Notched Impact (ft-lbs./inch)	D 256	13
f.	Water Absorption (24 hrs.)	D 570	0.2% max.
g.	Laminate Thickness (1/4 inch)		

C. Fabrication

1. Weirs shall be fabricated to exact dimensions as shown on the Drawings or as called for in this section with modifications based on field measurements. Possible types of weirs include the V-notch, sawtoothed, or straight edge.

2. Unless otherwise specified, the weir and its supports shall be fabricated to provide minor adjustments horizontally and vertically. To provide for this adjustment each weir plate shall be provided with 2 in. diameter holes spaced as detailed on the Drawings.

3. All weir supports shall be of the same material as the weir or stainless steel.

4. Baffles shall be 12 in. deep with countersunk fastener holes so that no fastener extends beyond the baffle's inside face.

5. The baffles and holding brackets shall have slotted holes as shown on the Drawings so that vertical and horizontal adjustments can be made. Slots shall be cut in such a way as to prevent leakage through the baffles with bolts in place. If leaking occurs, a neoprene gasket shall be installed.

6. All fasteners and anchors shall be stainless steel and at spacings not exceeding 18" unless shown otherwise.

7. All bolt holes and cut edges shall receive two coats of a resin compatible to the original resin. Such coatings shall prevent premature fraying.

2.3 FRP STRUCTURAL MEMBERS

A. Structural FRP members composition shall consist of a glass fiber reinforced vinyl ester resin matrix, approximately 50% resin to glass ratio by weight.

B. The glass reinforcement shall be of three varieties:

1. A surface mat on all exterior surfaces for maximum chemical resistance.
2. Continuous glass strand rovings shall be used internally for longitudinal strength.
3. Continuous strand glass mates shall be used for internally for transverse strength.

C. The resin shall be a halongenated polyester, possessing inherent fire and chemical resistance. Resin shall have flammability rating as per ASTM E 84 and ASTM D 635.

D. Physical Properties

1. The following minimum mechanical properties shall apply:

a. Ultimate tensile strength (longitudinal coupon) - 30,000 psi.
b. Ultimate compressive strength (longitudinal coupon) - 30,000 psi.
c. Ultimate shear strength - 4,500 psi
d. Ultimate bearing strength - 30,000 psi
e. Modulus of elasticity - 2.6×10^6 psi
f. Barcol hardness - 45

E. Manufacturer

A. The FRP Structural Members shall be "Extren" as manufactured by Strongwell-Bristol Division, Bristol, VA. or approved equal.

PART 3 - EXECUTION

3.1 BAFFLES INSTALLATION

A. The baffle shall be supported by structural fiberglass support brackets and posts which are anchored to the in-place construction.

B. All baffles shall be leveled.

C. All field cut or drilled edges shall receive two protective coats of a compatible resin. Such a coating shall prevent premature fraying.

D. Handling and Storage:

1. Products shall be suitably packaged to avoid damage during handling and shipping.
2. Products shall be stored on a flat level place and adequately supported on wood members to evenly distribute weight of product.

3.2 WEIR INSTALLATION

A. Weirs and scum baffles shall be installed as shown on the Drawings and according to manufacturer’s instructions.

B. All weirs and scum baffles shall be leveled. Edges on straight edge weir plates shall be leveled within 1/32 in. in length of individual weir plates.

C. The scum baffle shall be supported by support brackets which are anchored to the tank's wall, to the weir pans, or to the effluent trough as shown on the Drawings.

D. All field cut or drilled edges shall receive two protective coats of a compatible resin. Such a coating shall prevent premature fraying.

E. Contractor shall provide supports as recommended by the manufacturer to prevent uplift.

3.3 STRUCTURAL MEMBERS INSTALLATION

A. All field cut and drilled edges shall be sealed with a catalyzed resin compatible with the original resin and recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges. Two coats shall be applied.

END OF SECTION 05537CT 2/12

DIVISION 6

WOOD AND PLASTICS

SECTION 06100CT - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking and nailers.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

   1. Metal Framing Anchors:
      a. Cleveland Steel Specialty Co.
      b. Simpson Strong-Tie Company, Inc.
      c. United Steel Products Company, Inc.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

   1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
6. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.

3. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat all rough carpentry, unless otherwise indicated.

2.5 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.
6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.

E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; pre-drill as required.

F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

END OF SECTION 06100CT 8/12

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 071326AIA - SELF-ADHERING SHEET 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. This Section includes the following:

1. Modified bituminous sheet waterproofing.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Samples: For the following products:

1. 12-by-12-inch (300-by-300-mm) square of waterproofing and flashing sheet.

C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project.

B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels] through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

1.7 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.

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

2. Warranty includes removing and reinstalling protection board.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Not less than 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Meadows, W. R., Inc.; SealTight Mel-Rol.
b. Grace, W. R. & Co.; Bituthene 3000.
c. Tamko Roofing Products, Inc.; TW-60.

2. Physical Properties:

a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
f. Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.

h. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches (114 mm) wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
2. Detail Strips: 62.5-mil- (1.58-mm-) thick, felt-reinforced self-adhesive strip, 9 inches (229 mm) wide, with release film on adhesive side.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

I. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths to provide a minimum of 2 thicknesses of sheet membrane over areas to receive waterproofing.

E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.

G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

I. Install protection course with butted joints over waterproofing membrane immediately.

J. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION AND CLEANING

A. Protect installed from damage due to UV light, harmful weather exposures, physical abuse, and other causes.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 07552CT - SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING; HEAT WELDED/TORCHED APPLIED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. SBS-modified bituminous membrane roofing.
2. Roof insulation.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-90.

1.5 SUBMITTALS

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

B. Samples for Verification: For the following products:
   1. 12-by-12-inch square of mineral-granule-surfaced roofing membrane cap sheet.
   2. 12-by-12-inch (300-by-300-mm) square of roof insulation.

C. Maintenance Data: For roofing system to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

E. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. 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 warranty.

B. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

1.7 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, and directions for storage.

B. 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.

C. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT 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.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Warranty Period: 20-years from date of Substantial Completion; No Dollar Limit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. SBS-Modified Bituminous Membrane Roofing:
   a. Firestone Building Products Company.
   b. Johns Manville International, Inc.
   c. GAF Materials Corporation.

2.2 HEAT APPLIED ROOFING SYSTEM

A. Heat Applied SBS Roofing Membrane System: The work shall involve providing a two-ply SBS membrane system that is adhered to an approved substrate using torch or hot-air. Work shall include flashing and accessories necessary to complete the system, qualifying for the specified manufacturer's warranty.

2.3 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. Roofing Membrane Sheet: ASTM D 6164, Grade G, Type I or II, polyester-reinforced SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:

1. Granule Color: Black.

2. Thickness: 120 Mil.

2.4 BASE-SHEET MATERIALS

A. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

B. Base Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

2.5 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 4601, Type I, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

2.6. AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing membrane.

C. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.7 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers:
   a. Celotex Corporation
   b. Firestone Building Products Company.
   c. GAF Materials Corporation.
   d. Johns Manville International, Inc.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

D. Tapered Insulation: Provide factory tapered insulation board fabricated to slope ¼-inch per foot.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Insulation Cant Strips: ASTM C 728, perlite insulation board.

C. Tapered Edge Strips: ASTM C 728, perlite insulation board.

D. Cover board: Minimum 3/4-inch thick Duraboard.

E. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

F. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one-component or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.9 WALKWAYS

A. Walkway Pads: Mineral granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, ½-inch thick, minimum.

PART 3 - EXECUTION

3.1 REMOVAL OF ASBESTOS CONTAINING ROOF MATERIALS

A. Notification of ACRM Removal Operations

1. Notification to regulatory agencies of roof removal activities is required, at a minimum of ten (10) business days prior to the start of the project. The agencies to be notified are as follows:

a. Ohio Department of Health (ODH).

b. Ohio Environmental Protection Agency (OEPA).

c. Any applicable local agency such as county air pollution control.

d. The Architect administrating this contract.

2. All applicable governmental regulations and guidelines will be followed at all times.

3. All records, procedures, licenses, and methods, including required posters, signs, and log books required by governmental agencies and/or this contract will be maintained on-site during the project.

B. Disposal Requirements

1. Prior to the start of work, the Contractor will submit to the Architect copies of the state or local license for the waste hauler, as well as the name and address of the disposal facility where the ACRM are to be deposited. Include contact person and telephone number.

2. All ACRM debris will be transported in a closed covered container in accordance with local, state, regional, and federal regulations.

3. At the end of the project, the Contractor will submit copies of all manifests and disposal site receipts to the Architect.

3.2 REMOVAL OF EXISTING ROOFS

A. Remove existing roofing, roof insulation and base flashing from existing deck.

B. Clean roof deck and other surfaces to which new roofing and insulation are to be applied. Surfaces must be clean, dry and free from all defects that might affect the application.

C. Except as otherwise noted, all material removed as a result of the Contract becomes the property of the Contractor, who is responsible for disposal of the property of the premises.

D. Schedule demolition and removal work with the Owner in advance in order to permit normal operations to continue within the unaffected areas of the building.

E. Take all responsible precautions to protect the premises from damage during demolition operations.

F. Remove rubble and debris from the sites promptly and in an orderly manner.

G. Repair or replace any damage occurring to the buildings, equipment or grounds during demolition and removal work and as a result of such work, at no additional cost to the Owner.

3.3 INSULATION INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roof insulation.

B. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. 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.

E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2-inches or more, 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.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.

2. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
3. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.4 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application Modified Bitumen Roofing".

1. Install roofing system according to specification-plate classifications in NRCA's "The NRCA Roofing and Waterproofing Manual" and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 3/4 inch per 12 inches (1:18) install roofing membrane sheets parallel with slope.

D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane. Apply only as much as insulation to the roof as can be covered the same day with roofing membrane. At the conclusion of each day's work, seal exposed edges of the insulation, cut and remove seal upon continuation of the work.

3.5 BASE-SHEET INSTALLATION

A. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:

1. Install base sheets dry and in parallel courses. Adhere the base sheet in accordance with the manufacturing recommendations. Seal all joints by heat welding.

3.6 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Weld cap sheet onto base sheet with torch.

2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing membrane sheets so side and end laps shed water.

3.7 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Flashing Sheet Application: Heat Weld/Torch.
2. Flashing Sheet Application: Heat Weld/Torch

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches (100 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

3.8 WALKWAY INSTALLATION

A. Walk-way Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturers standard size according to walkway pad manufacturers written instructions.
1. Set walkway pads in cold-applied adhesive.

3.9 PROTECTING AND CLEANING

A. 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.

3.10 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

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

3.11 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.

3.12 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.13 PROTECTING AND CLEANING

A. 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.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07552CT 10/12

SECTION 07620CT - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Coping/Gravel Stop
2. Metal Flashing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed sheet metal flashing and trim work similar in material, design and extent to that indicated for this project and with a record of successful performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

1) Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Manufacturers:
   a. Fry Reglet Corporation.
   b. Heckmann Building Products Inc.
   c. Hickman, W. P. Company.

2. Material: Aluminum, 0.024 inch (0.6 mm) thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
6. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
7. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide joint cover plates.

1. Joint Style: Butt, with 12-inch- (300-mm-) wide concealed backup plates.
2. Fabricate scuppers of dimensions required with 4-inch- (100-mm-) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate scuppers from the following material:

a. Aluminum: 0.050 inch (1.2 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch- (300-mm-) wide concealed backup plate.
2. Fabricate copings from the following material:

    a. Aluminum: 0.050 inch (1.2 mm) thick.

C. Counterflashing: Fabricate from the following material:

1. Aluminum: 0.0320 inch (0.8 mm) thick.

D. Flashing Receivers: Fabricate from the following material:

1. Aluminum: 0.0320 inch (0.8 mm) thick.

E. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick) hard tempered.

2.8 FINISHES

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

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

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

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
1. Aluminum: Use aluminum or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch (400-mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch (400-mm) centers.
2. Anchor interior leg of coping with screw fasteners and washers at 24-inch (600-mm centers.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

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

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620CT 11/12

SECTION 07901CT - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

a. Control and expansion joints in unit masonry.
b. Perimeter joints between materials listed above and frames of doors and windows.
c. Other joints as indicated.

2. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
e. Perimeter joints of toilet fixtures.
f. Other joints as indicated.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.

1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

F. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

G. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
3. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

B. Products: Subject to compliance with requirements, provide one of the products specified in each Elastomeric Joint Sealant Data Sheet.

2.3 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

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

1. Acrylic-Emulsion Sealant:

a. "AC-20," Pecora Corp.
b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
c. "Tremco Acrylic Latex 834," Tremco, Inc.

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

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

1. Acoustical Sealant:

a. "SHEETROCK Acoustical Sealant," United States Gypsum Co.
b. "AC-20 FTR Acoustical and Insulation Sealant," Pecora Corp.

2. Acoustical Sealant for Concealed Joints:

a. "BA-98," Pecora Corp.
b. "Tremco Acoustical Sealant," Tremco, Inc.

2.5 PREFORMED FOAM SEALANTS

A. Preformed Foam Sealants: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:

1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
2. Impregnating Agent: Manufacturer's standard.
3. Density: Manufacturer's standard.
4. Backing: None.
5. Products: Subject to compliance with requirements, provide one of the following:

   a. "Emseal," Emseal Corp.
   b. "Wil-Seal 150," Wil-Seal Construction Foams Div., Illbruck.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu. m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
3. Any material indicated above.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    a. Do not leave gaps between ends of joint fillers.
    b. Do not stretch, twist, puncture, or tear joint fillers.
    c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
2. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING

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

3.5 PROTECTION

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

PRODUCT DATA SHEET 1 - ELASTOMERIC JOINT SEALANT

A. Elastomeric Joint Sealant Designation: ES# 1

B. Base Polymer: Urethane.

C. Type: S (single component).

D. Grade: NS (nonsag).

E. Use Related to Exposure: NT (nontraffic).

F. Available Products:

1. "Chem-Calk 900"; Bostik Construction Products Div.
2. "Chem-Calk 2639"; Bostik Construction Products Div.
3. "Vulkem 116"; Mameco International, Inc.
4. "Vulkem 921"; Mameco International, Inc.
5. "Dynatrol I"; Pecora Corp.
6. "Permapol RC-1"; Products Research & Chemical Corp.
7. "Sikaflex-1a"; Sika Corp.
8. "Sikaflex-15LM"; Sika Corp.
9. "Sonolastic NP 1"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
10. "Dymonic"; Tremco Inc.

END OF SECTION 07901CT 5/91

DIVISION 8

DOORS AND WINDOWS

SECTION 08100 - FLUSH ALUMINUM DOOR/ALUMINUM FRAME

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Extent of standard doors and frames is indicated and scheduled on drawings.

B. Finish hardware is specified elsewhere in Division 8.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcement and details of joints and connections. Show anchorage and accessory items.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver doors and frames cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Engineer; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum door/aluminum frame openings by field measurement before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide doors and frames by the following:

1. Capital Aluminum and Glass Corporation
   1276 West Main Street
   Bellevue, Ohio 44811
   (419)483-7050

2. Special Lite Inc.
   P.O. Box 6
   Decantur, MI 49045
   (800)821-6531

2.2 FABRICATION, GENERAL

A. Fabricate door and frame units to be rigid, neat in appearance and free from defects, wrap or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.

1. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

B. Aluminum Doors

1. Rails - Extruded 6063 T5 aluminum alloy with a minimum well thickness of 1/8 inch. Top and bottom rails extruded with legs for interlocking "rigidity weather bar". Lock in face sheets with extruded interlocking edges. No snap-on trim will be accepted.
2. Stiles - Tubular shape to accept hardware as specified.
3. Joinery to be 3/8 inch tie rods, top and bottom, bolted through an extruded spline and 3/16 inch riveted reinforcing angles.
4. Face Sheets: Aluminum 0.062-inch thick with pebble like embossed finish.
5. Core: Mineral with minimum 30 lbs per s.f. with 1-1/2-inch perimeter blocking.
6. Pre-machine all doors in accordance with appropriate templates. For surface applied hardware, doors shall have necessary reinforcement including the attachment of Rivnut blind fasteners for bolting.
7. Class I finish, Anodized.
8. Vision Lites shall be 1/4-inch thick tempered/glass.

2.3 ALUMINUM FRAMES

A. Aluminum Frames

1. Continuous hinge type.
2. Framing members to be accurately milled with flush hairline joints. Reinforce corner members with channel type corner guests fastened with concealed stainless steel screws (12-24 screws required).
3. Reinforce frames in areas to receive locks, hinges and door closers.
4. Class I finish, Anodized.
5. Hardware by others.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door and frame in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Door Installation:

1. Fit doors accurately in frames within clearances specified in SDI-100 and manufacturer's recommendations.

3.2 ADJUST AND CLEAN

A. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving doors and frames undamaged and in a complete and proper operating condition.

C. Clean aluminum surfaces and remove protective coverings and excess sealants.

END OF SECTION 08100 10/12

SECTION 08331 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of electric-motor operated overhead coiling doors:

1. Insulated service doors.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 8 Section "Door Hardware" for lock cylinders and keying.
3. Division 16 Sections for electrical service and connections for powered operators and accessories.

1.3 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.

a. Level of Protection: Basic Protection.
b. Wind Zone One: 110 mph (176 km/h), pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1. Include tamperproof cycle counter.

1.5 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Summary of forces and loads on walls and jambs.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.

1. Curtain Slats: 12 inches long.
2. Bottom Bar: 6 inches long.
3. Guides: 6 inches long.
4. Brackets: 6 inches square.
5. Hood: 6 inches square.
6. Laminate-Clad Counter Panel Product: 6 inches square; for each type, color, pattern, and surface finish; laminated to core.

E. Qualification Data: For Installer.

F. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. Atlas Door; Div. of Clopay Building Products Company, Inc.
2. Dynamic Closures Corporation.
3. Metro Door.
4. Overhead Door Corp.
5. Pacific Rolling Doors Co.
6. Raynor.
7. Wayne-Dalton Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B 209 or ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

   a. Aluminum Extrusion Thickness: Not less than 0.051 inch.
   b. Curved profile slats.
   c. Perforated slats, 25 percent of total door opening.
   d. Fenestrated slats, 17 percent of total door opening.
   e. Vision windows, 10 by 1-5/8 inches, spaced 2 inches apart and 12 inches from end guides; in 2 rows of slats.

2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.

3. Inside Curtain Slat Face: To match material of outside metal curtain slat.

B. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch-thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate hoods for steel doors of minimum 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
2. Fabricate hoods for stainless-steel doors of minimum 0.025-inch-thick stainless-steel sheet, Type 304, complying with ASTM A 666.
3. Include automatic drop baffle to guard against passage of smoke or flame.
4. Fabricate hoods for aluminum doors, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; 0.032-inch minimum thickness, complying with ASTM B 209.
5. Shape: Round.

B. Integral Frame, Hood, and Fascia: Provide welded assemblies of the following sheet metal:

1. Fabricate from minimum 0.064-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
2. Fabricate from minimum 0.0625-inch-thick stainless-steel sheet, Type 304, complying with ASTM A 240/A 240M or ASTM A 666.

C. Integral Sills: Fabricate sills as integral part of frame assembly of same sheet metal; 0.078-inch minimum thickness.

D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

E. Chain Lock Keeper: Suitable for padlock.

F. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

G. Provide automatic-closing device that is inoperative during normal door operations, with oscillating governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by the following:

1. Replaceable fusible links with temperature rise and melting point of 165 deg F; interconnected and mounted on both sides of door opening.
2. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
3. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
4. Building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in/ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.5 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, enclosed gear-head-reduction drive and chain and sprocket secondary drive.

1. Through-wall-mounted motor operator.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
5. Provide totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
2. Provide exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide electrically actuated automatic bottom bar.

1) Self-Monitoring Type: Four-wire configured device.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

L. Radio Control: Provide radio control system consisting of the following:

1. Three-channel universal coaxial receiver to open, close, and stop door, one per operator.
2. Multifunction remote control.
3. Remote antenna mounting kit.

2.6 FINISHES, GENERAL

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in 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 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Manufacturer's standard mill finish.

C. Class I, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.010 mm or thicker) complying with AAMA 611.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

    a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 08331 10/12

SECTION 08340CT - ROLL-UP BUG SHIELD

PART 1 - GENERAL

1.1 Drawing and general provisions of the contract, including general and supplemental conditions and Division 1 specifications apply to this section.

1.2 Submit shop drawings showing overall dimensions (width, height).

1.3 Submit three (3) copies of manufacturer's owner's manual, maintenance manual and master service manual to the architect and/or engineer.

1.4 Warranty: Proposal submitted without the following written warranties will be considered non-responsive.

A. Door manufacturer shall provide with his bid a written minimum 1-year limited warranty on parts and labor, including 90m days on electrical.

B. In addition to all other warranties, the manufacturer shall warrant that the equipment will perform in a manner satisfactory to the Owner for a period of 12 months after the date of installation. If the Owner is not satisfied with the performance of the equipment, the Owner may notify the manufacturer and the manufacturer shall remove the equipment and refund the equipment purchase price to the Owner. This warranty shall be provided by the manufacturer in writing at time of bid.

PART 2 - PRODUCTS

2.1 Doors shall be manufactured by Rite-Hite Doors or an approved equal. Doors shall be sized by manufacturer to meet specific applications requirements.

2.2 Doors shall be made for sizes indicated.

2.3 Standard operation on doors over 10'3" wide x 10'3" high shall be a integral tubular motor with gear head, free-fall break protection, and rotary limit switches in an adjustable roller.

A. Powered doors shall open and close at a speed of 8" per second.

B. Powered doors shall have a remote mounted junction box and a constant contact rotary cam switch within a NEMA 4x enclosure.

2.4 Door shall have a water resistant Hypalon bottom seal for added protection.

A. Door shall have a centrifugal top seal.

2.5. Track shall be made of extruded PVC.

A. Track shall have a polyethylene insert guide for smooth, wind-resistant rolling action.

2.6 Curtain material shall be made of heavy-duty vinyl-coated mesh, 17x11 weave, .025" thread diameter (standard colors: safety yellow, red, blue and gray). Color selection by Owner.

2.7 Curtain shall be attached to roller with touch and hold material for ease of adjustment and cleaning.

2.8 Doors shall have sewn-in wind bars to maintain curtain shape and stability.

2.9 Manual models shall include pull-down handles to assist in operation.

2.10 Manual models shall include a bumper stop to prevent curtain overtravel.

2.11 Power operated doors shall comply with ANSI/UL325 safety standard.

2.12 Door shall provide a visual barrier at the opening.

2.13 Powered doors shall have a constant contact switch for operator control during operation.

2.14 Door shall not operate with any other external activation.

PART 3 - EXECTUTION

3.1 Installer shall examine the substrate and conditions under which door is to be installed and notify the architect and/or engineer and contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 Door manufacturer's representative shall install door in accordance with approved shop drawings and manufacturers recommendations. Location of door shall be indicated on drawings. Exact location of control box for door shall be approved by the architect and/or engineer.

3.3 Adjust units to operate smoothly.

3.4 After installation is completed, a representative of the manufacturer shall examine the installation and require that all connections and adjustments necessary to assure proper operation of power door has been made. Before acceptance, a demonstration shall be conducted in the presence of the Owner's representative that all doors operate properly in every aspect. In addition, a detailed user/operator training session shall be conducted at time and place agreed upon by Owner's representative.

END OF SECTION 08620AIA 8/00

SECTION 08520CT - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of aluminum-framed windows:

1. Projected windows.

1.3 DEFINITIONS

A. AW: Architectural.

B. C: Commercial.

C. HC: Heavy Commercial.

D. LC: Light Commercial.

E. R: Residential.

F. Performance grade number, included as part of the AAMA/NWWDA product designation code, is actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.

G. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

H. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

2. Minimum size required by gateway performance requirements for determining compliance with AAMA/NWWDA 101/I.S.2 for both gateway performance requirements and optional performance grades.
3. Size indicated.

B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: HC

C. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

D. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa).

E. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.

F. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to NFRC 100.

1. U-Value: .55 Btu/sq. ft. x h x deg F (W/sq. m x K).

G. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum of .29 determined according to NFRC 200 procedures.

H. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/NWWDA 101/I.S.2.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.

5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of down-sized test units will not be accepted.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

C. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Warranty Period: Five years from date of Substantial Completion.

B. Warranty Period for Metal Finishes: Five years from date of Substantial Completion.

C. Warranty Period for Glass: Five 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. Projected Windows:

a. EFCO Corporation.
b. Kawneer Company, Inc.
c. Wausau Window and Wall Systems.
d. YKK AP America Inc.

2.2 MATERIALS, GENERAL

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Retain subparagraph below except for least-expensive workmanship.

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/NWWDA 101/I.S.2.

F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

A. Glazing System**:** Manufacturer's standard factory-glazing system that produces weathertight seal

2.4 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze.

B. Counterbalancing Mechanism: Comply with AAMA 902.

C. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

D. Roller Assemblies: Low-friction design.

E. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.

F. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.

1. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.

G. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.

1. Locking mechanism and handles for manual operation.
2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.

H. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.

1. Safety Devices: Limit clear opening to 6 inches for ventilation; with custodial key release.

I. Projected Windows: Provide the following operating hardware:

1. Operator: Underscreen push-bar.
2. Hinge: Concealed four- or six-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
3. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper.
4. Limit Device: Concealed friction adjustor, adjustable stay bar limit device; located on jamb of each ventilator.

2.5 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on **inside** of window and provide for each operable exterior sash or ventilator.

1. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
2. Finish: Manufacturer's standard.

2.6 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/NWWDA 101/I.S.2 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.

1. Projected Windows: HC.

B. All aluminum frames shall have a minimum wall thickness of .125 inches.

C. Depth of frame shall not be greater than 2-7/16 inch.

D. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

2.7 FINISHES

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

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances and other conditions affecting performance of work.

1. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08520CT 11/99

SECTION 08620CT - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes factory-assembled unit skylights for installation in flat roof areas.

1. Type: Mounted on site-built curb.
2. Glazing: Polycarbonate insulating panels.

B. Related Sections include the following:

1. Division 6 Section Rough Carpentry for wood framing and blocking at unit skylights.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing at unit skylights.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Loads: Provide unit skylights, including glazing and anchorage, capable of withstanding the effects of the following design loads:

1. Snow Load: As indicated.

1.4 SUBMITTALS

A. Product Data: For unit skylights. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For unit skylights. Include plans, elevations, sections, details, and attachments to other Work.

1.5 QUALITY ASSURANCE

A. Fire-Test Response Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Self-Ignition Temperature: 650 deg F (343 deg C) or greater for plastic sheets in thickness indicated when tested per ASTM D 1929.
2. Smoke Production Characteristics: Comply with either requirement below:

    a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
    b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.

3. Relative-Burning Characteristics: Tested per ASTM D 635.

    a. Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Uncontrolled water leakage.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
3. Breakage of polycarbonate glazing.

B. Warranty Period: Five-years from Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

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

1. American Skylites Inc.
2. Auburn Skylights, Major Industries, Inc.
3. Bristolite Skylights
4. Wasco Products, Inc.

2.2 UNIT SKYLIGHTS

A. General: Factory-assembled units that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding design loads indicated.

B. Unit Shape and Size: As indicated on drawings.

C. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar resistance rated per UL 972, and with average impact strength of 12 to 16 ft-lb/in. (638 to 850 J/m) of width when tested per ASTM D 256, Test Method A (Izod).

1. Double-Glazing Profile: Dome, 25 percent rise.

a. Inner Glazing Color: As selected by Architect from manufacturer's full range.
b. Outer Glazing Color: As selected by Architect from manufacturer's full range.

D. Glazing Gaskets: Manufacturer's standard.

E. Aluminum Components:

1. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad alloy 3005-H25.
2. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of alloy 6063-T52.
3. Anodic Coating: Class I, color anodic coating complying with AAMA 611.

a. Color: As selected by Architect from manufacturer's full range.

F. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

G. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

H. Thermal Break: Fabricate unit skylights with thermal barrier separating interior metal framing from materials exposed to outside temperature.

I. Protective Screens: Manufacturer's standard to protect against hail.

2.3 INSTALLATION MATERIALS

A. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil (0.4-mm) dry film thickness per coating.

B. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

C. Elastomeric Sealant: ASTM C 920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O; recommended by unit skylight manufacturer and compatible with joint surfaces.

D. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate unit skylight installation with installation of substrates, vapor retarders, roof insulation, roofing, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

1. Unless otherwise indicated, install unit skylights according to construction details of NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Where metal surfaces of units will contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

C. Anchor unit skylights securely to supporting substrates.

D. Set unit skylight flanges in thick bed of roofing cement to form a seal, unless otherwise indicated.

E. Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

3.2 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

1. Operating Units: Clean and lubricate joints and hardware. Adjust for proper operation.

END OF SECTION 08620CT 9/12

SECTION 08810CT - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:

1. Lock and latch sets.
2. Exit devices.
3. Closers.
4. Overhead holders.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

C. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

D. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.

e. Explanation of all abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

1.5 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site)

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.6 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Base manufacturer is identified by *. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Locks:
   a. Best Access Systems, Stanley Security Solutions
   b. Sargent Manufacturing Company.
   c. Von Duprin, Div. Ingersoll-Rand Door Hardware Group.*

2. Exit/Panic Devices:
   a. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
   b. Sargent Manufacturing Company.
   c. Von Duprin, Div. Ingersoll-Rand Door Hardware Group.*

3. Overhead Holders/Closers:
   a. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
   b. Dorma Door Controls International.
   c. International Door Closers, Inc.
   d. Sargent Manufacturing Company.*

4. Cylinders:
   a. Best Access Systems, Stanley Security Solutions*

5. Hinges/Removal Post:
   a. Hagar Hinges
   b. Von Duprin, Div. Ingersoll-Rand Door Hardware Group.*

6. Threshold
   a. NGP*
   b. Zero

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.3 MATERIALS AND FABRICATION

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.4 LOCK CYLINDERS AND KEYING

A. Existing System: Grandmaster key the locks to the Owner's existing system using Best/Best compatible cylinders. Owner to self key all cylinders.

2.5 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.

B. Lock Throw: Provide 5/8-inch (16-mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

1. Provide 1/2-inch (13-mm) minimum throw of latch for other bored and preassembled types of locks and 3/4-inch (19-mm) minimum throw of latch for mortise locks. Provide 1-inch (25-mm) minimum throw for all dead bolts.

C. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (300-mm-) long rod for doors up to 84 inches (2100 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2100 mm) in height.

2.6 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.

1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
2. Provide parallel arms for all overhead closers, except as otherwise indicated.

B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.

2.7 HARDWARE FINISHES

A. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

B. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

D. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.3 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

1. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable.

Heading #1

Removable Post	KR 4954	SP28
Exit Device	99 EO	32D
Closer	351 CPSH	EN
Overhead Stops	690 (concealed)	26D
Kick Plates	190 S 8”x2” LDW	32D
Threshold	612 SS	SS
Continuous Hinges	780-224 HD	AN
Pull	997550	32D
Door Cylinder matching existing system		
Weather-Stripping by Door Manufacturer		

Heading #2

Exit Device	99 EO	32D
Closer	351 CPSH	EN
Overhead Stops	690 (concealed)	26D
Kick Plates	190 S 8”x2” LDW	32D
Threshold	612 SS	SS
Continuous Hinges	780-224 HD	AN
Pull	9975 EO	32D
Flushbolt (Top and Bottom)	845	26D
Weather-Stripping by Door Manufacturer		
Door Cylinder matching existing system		

END OF SECTION 08810CT 2/11

SECTION 08900CT - INSULATED TRANSLUCENT PANEL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. All requirements of the contract documents form an integral part of the work specified herein; in particular, refer to the conditions (general or otherwise), and Division I of the specifications, including all subdivisions thereof.

B. Translucent panels shall consist of 2-3/4" thick (flat) factory prefabricated sandwich panels and system (including installation).

C. All systems must meet all minimum criteria of following specification.

D. Work included: Supply all (labor and) materials required to deliver (and install) the insulated translucent panel unit system. The following major items included are:

1. Prefabricated insulated translucent sandwich panel units
2. Installation system

1.2 QUALITY ASSURANCE

A. Manufacturer's and Erector's Qualifications

1. Sandwich panel unit system manufacturer must be listed by a recognized building code authority, including the International Conference of Building Officials, which requires quality control inspections by an approved agency for sandwich panel construction.
2. Quality control inspections and testing conducted at least once each year, shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with "Acceptance Criteria for Sandwich Panels" as regulated by the ICBO-ES or equivalent.
3. Materials and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified material for a period of at least ten (10) consecutive years and which can show evidence of these materials being satisfactorily used on at least six (6) projects of similar size, scope and type within such a period. At least three (3) of the projects shall have been in successful use for ten (10) years or longer.
4. Erection shall be by installer which has been in the business of erecting specified materials for a least five (5) consecutive years; and can show evidence of satisfactory completion of projects of similar size and scope.

B. Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel unit system.

1.3 SUBMITTALS

A. Submit shop drawings and color samples in accordance with Division I, Submittals.

B. Test reports to be furnished by sandwich panel system manufacturer in accordance with Division I, Submittals. The manufacturer shall submit certified test reports made by an independent testing organization for each type and class of panel system. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if current and indicative of products used on this project. Test reports required are:

1. Flame Spread and Smoke Development (ASTM E-84)
2. Burn Extent (ASTM D-635)
3. Color Difference (ASTM D-2244)
4. Impact Strength (Free Falling Ball Method)
5. Tensile Bond Strength (ASTM C-297) after aging by ASTM D-1037
6. Shear Bond Strength (ASTM D-1002) after 5 different aging conditions
7. Beam Bending Strength (ASTM E-72)
8. Insulation "U" Factor (by NFRC-100)

C. Proof of regular, independent quality control monitoring under a building code review and listing program shall be submitted.

D. Complete energy calculations and all above data must be submitted with any request to be included as an approved product to bid this section.

1.4 PRODUCT HANDLING

A. Store translucent panel units on the long edge, several inches above the ground, blocked and under cover to prevent warping. In accordance with manufacturer's storage and handling instructions.

PART 2 - MATERIALS

2.1 TRANSLUCENT FACING:

A. Translucent faces shall be manufactured from glass fiber reinforced thermoset resins by insulated panel unit system fabricator specially for architectural use. Thermoplastic (eg. polycarbonate, acrylic) faces are not acceptable.

B. Flammability - The interior face sheet shall be U.L. listed and have a flamespread rating no greater than 45 and smoke developed no greater than 350 when tested in accordance with ASTM E-84. Burn extent by ASTM D-635 shall be no greater than 1". Faces shall not deform, deflect or drip when subjected to fire or flame; or delaminate when exposed to 300°F for one (1) hour.

C. Weatherability

1. The full thickness of the exterior face shall not change color more than 3.0 Hunter or CIE Units DELTA E by ASTM D-2244 after five (5) years outdoor South Florida weathering at 7 degrees facing south, determined by the average of at least three (3) white samples without a protective film or coating to insure maximum, long term color stability.
2. The exterior face shall have a permanent glass veil erosion barrier to provide maximum long term resistance to reinforcing fiber exposure and shall be warranted against same for 25 years by face manufacturer. (Note: for white and crystal). Plastic surface films are not acceptable.

D. Appearance

1. The faces shall be uniform in color to prevent splotchy appearance. Faces shall be completely free of ridges and wrinkles which prevent proper surface contact in bonding to the aluminum grid core. Clusters of air bubbles/pinholes which collect moisture and dirt are not acceptable.
2. Exterior face sheets shall be smooth, .070" thick and crystal in color. Interior face sheets shall be .045" thick and white in color. Faces shall not vary more than + 10% in thickness.

E. Strength - The exterior face sheet shall be uniform in strength and repel an impact equal to (60) ft. lbs. <u>without</u> fracture or tear when impacted by a 3-1/2" diameter, 6.37 lb. free falling ball, and be resistant to penetration by pencil point or other small, sharp objects.

2.2 GRID CORE

A. The (aluminum) I-beams shall be 6063-T6 or 6005-T5 with provisions for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface to contact with face material. Width of I-beam shall be no less than 7/16". Aluminum I-beam grid shall be machined to tolerances of not greater than + .002". Panels shall withstand 1200°F fire for minimum one (1) hour without collapse or exterior flaming.

2.3 ADHESIVE

A. The laminate adhesive shall be heat and pressure type engineered for structural sandwich panel use. Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive". Minimum strength shall be:

B. 750 PSI tensile strength by ASTM C-297 after two (2) exposures to six (6) cycles each of the aging conditions prescribed by ASTM D-1037.

C. Shear strength by ASTM D-1002 minimum after exposure to five (5) separate conditions:
   1. 50% Relative Humidity at 73°F: 540 PSI
   2. 182°F: 100 PSI
   3. Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI
   4. Accelerated Aging by ASTM D-1037 at 182°FL 250 PSI
   5. 500 Hour Oxygen Bomb by ASTM D-572: 1400 PSI

2.4 PANEL CONSTRUCTION

A. Panels shall have a thickness of 2-3/4" with a "U" factor of 29, light transmission of 20% and shading coefficient of .22 .

B. Translucent panels shall be a true sandwich panel of flat fiberglass sheets bonded to a grid core of mechanically interlocking aluminum I-beams and shall be laminated under a controlled process of heat and pressure, and deflect no more than 1.9" at 30 psf in 10' by ASTM E-72.

C. Grid pattern shall be 12" x 24" nominal Shoji and be symmetrical about the horizontal center line of each panel, for flat panels.

D. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge. In order to insure bonding strength, white spots at intersections of muntins and mullions shall not exceed 4 for each 40 square feet of panel, nor shall they be more than 3/64" in width.

2.5 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system shall be extruded 6063-T6 and 6063-T5 aluminum clamp-tite screw type. (Thermal break options: Perimeter system with urethane bridge; or Factory Prefabricated Superbreak "U" = .50 or less.)

B. All battens and perimeter closures to be supplied with 300 series stainless steel screws (excluding final fasteners to the building).

C. All exposed aluminum to be (architectural corrosion resistant finish which meets the performance requirements of ANSI/AAMA 605.2-85 with color to be selected from manufacturer's standards).

2.6 FLEXIBLE SEALING TAPE

A. Sealing tape shall be manufacturer's standard pre-applied to closure system at the factory under controlled conditions.

PART 3 - EXECUTION

3.1 PREPARATION

A. The general contractor shall prepare openings including isolating dissimilar materials from aluminum system which may cause damage by electrolysis, and shall provide temporary enclosures if required.

3.2 ERECTION

A. The erector shall erect translucent panel unit system in strict accordance with approved shop drawings as supplied by manufacturer. Fastening and sealing shall be in strict accordance with manufacturer's shop drawings and installation instructions. All aluminum shall be cleaned before sealants are applied.

B. After other trades have completed work on adjacent material, carefully inspect translucent panel installation and make adjustments necessary to insure proper installation and weather-tight conditions.

C. All staging, lifts and hoists required for the complete insulated panel unit system installation, including staging, etc., necessary for field measuring, shall be provided by, set up and maintained by the general contractor.

END OF SECTION 08900CT 1/12

DIVISION 9

FINISHES

SECTION 09255CT - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Nonload-bearing steel framing members for gypsum board assemblies.
2. Gypsum board assemblies attached to steel framing.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Steel Framing and Furring:

    a. Dietrich Industries, Inc.
    b. Marino/Ware (formerly Marino Industries Corp.).
    c. National Gypsum Co.; Gold Bond Building Products Division.
    d. USG Industries

2. Gypsum Board and Related Products:

    a. Georgia-Pacific Corp.
    b. National Gypsum Co.; Gold Bond Building Products Division.
    c. United States Gypsum Co.

2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:

1. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating.
2. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating for framing members attached to and within 10 feet (3 m) of exterior walls.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0179 inch (0.45 mm), unless otherwise indicated.

   a. For head runner, sill runner, jamb, and cripple studs at door and other openings.

2. Depth: 3-5/8 inches (92.1 mm), unless otherwise indicated.
3. Depth: 1-5/8 inch (41.3 mm) where indicated.

C. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.3 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Edges: Tapered.
3. Thickness: 5/8 inch (15.9 mm) unless otherwise indicated.

2.4 TRIM ACCESSORIES

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal or plastic, with metal complying with the following requirement:

a. Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.
b. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.

2.5 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

1. Ready-Mixed Formulation: Factory-mixed product.

a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

2.6 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Steel drill screws complying with ASTM C 1002 for the following applications:

1. Fastening gypsum board to steel members less than 0.033 inch (0.84 mm) thick.

C. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

1. Mineral-Fiber Type: Fibers manufactured from slag wool or rock wool.

D. Polyethylene Vapor Retarder: ASTM D 4397, thickness and maximum permeance rating as follows:

1. 6 mils (0.15 mm), 0.13 perms (7.5 ng/Pa x s x sq. m).

E. Vapor Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."

C. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.

C. Install steel studs in sizes and at spacings indicated.

1. Single-Layer Construction: Space studs 16-inches, unless otherwise indicated.

D. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

E. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install 2 studs at each jamb, unless otherwise indicated.

F. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

G. Install polyethylene vapor retarder where indicated to comply with the following requirements:

1. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with mechanical fasteners or adhesives. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose mineral-fiber insulation.
2. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches (400 mm) o.c.
3. Seal joints in vapor retarders caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor retarder tape.
4. Repair any tears or punctures in vapor retarder immediately before concealing it with the installation of gypsum board or other construction.

3.5 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.

E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.6 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.

3.7 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 4 for gypsum board surfaces, unless otherwise indicated.

E. Use the following joint compound combination as applicable to the finish levels specified:

1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.

F. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.

3.9 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255CT 2/95

SECTION 09510CT - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch square Samples of each type, color, pattern, and texture.

2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-(300-mm-) long Samples of each type, finish, and color.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels 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.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

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

1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 1, Modular.
2. Pattern: CD (perforated, small holes and fissured).

C. Color: White.

D. LR: Not less than 0.65.

E. NRC: Not less than 0.35.

F. CAC: Not less than 25.

G. AC: Not less than 180.

H. Edge/Joint Detail: Square.

I. Thickness: 5/8 inch (15 mm).

J. Modular Size: 24 by 24 inches (610 by 610 mm)

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five (5) times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

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

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. USG Interiors, Inc.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Structural Classification: Intermediate duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Aluminum cold-rolled sheet.
5. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.
b. Install panels with pattern running in one direction parallel to long axis of space.
c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09510CT 10/12

SECTION 09651AIA - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Vinyl composition tile (VCT).
2. Resilient wall base and accessories.

1.3 SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

1. Resilient Wall Base: Manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long, of each resilient product color and pattern required.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C)or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic for 48 hours after floor covering installation.

D. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.
1. Armstrong World Industries, Inc.
2. Azrock Commercial Flooring, DOMCO;
3. Mannington Mills, Inc.

B. Class: 2 (through-pattern tile).

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm)

E. Size: 12 by 12 inches (305 by 305 mm).

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
1. Armstrong World Industries, Inc.
2. Azrock Commercial Flooring, DOMCO.
3. Johnsonite.
4. Roppe Corporation.

B. Type (Material Requirement): TS (rubber, vulcanized thermoset).

C. Group (Manufacturing Method): I (solid, homogeneous).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch (3.2 mm).

F. Height: 4 inches (102 mm).

G. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

H. Outside Corners: Premolded.

I. Inside Corners: Premolded.

J. Surface: Smooth.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to manufacturer.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09651AIA 5/00 (R 11/03)

SECTION 09801CT - SPECIAL COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work covered by this Section includes the furnishing and application of paints, stains, primers, varnishes and other finish, decorative and protective coatings.

B. Shop priming and factory prefinishing are required on some, but not necessarily all, of the items described in other sections.

C. Extent of work:
   1. All new process equipment and process piping.
   2. All building and room surfaces as indicated on the plans or as scheduled.
   3. All conduits, ducts, drains, etc of other trades unless such product is deemed having an acceptable factory pre-finish, under the following conditions:
      a. When exposed items are related to room surfaces scheduled to painting.
      b. When specifically called out as requiring special coating protection.

1.3 DEFINITIONS

A. Special coating systems are defined as those types of materials and methods of application requiring more than normal skills and techniques for mixing, handling and application, as specified in the "Painting" section.
   1. The term "special coating systems" as used in this section includes applied materials used in prime, intermediate and finish coats.
   2. The word "paint", as applied in this and or other Sections shall apply to all special coatings required herein for the protection of materials from corrosive environment, weathering processes, or for aesthetic or other reasons.
   3. The term "exposed surfaces" is defined to include areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place in areas to be coated. Extend special coatings in these areas as required to maintain the coating system integrity and provide desired protection.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.

1. List each material and cross-reference to the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
2. In the event that the submittal requests a substitution then the following ASTM test results from an independent testing laboratory for the referenced products shall be included: Performance Criteria:
3. ASTM B 117 Salt Fog
4. ASTM D 3359 (Method A and B) Adhesion Test
5. ASTM G8, Method A Cathodic Disbondment
6. ASTM D 4541 (Elcometer)
7. ASTM D 4060 Taber Abrasion
8. ASTM D 522 (Conical Mandrel)
9. ASTM D 3363 Pencil Hardness
10. ASTM D 2794 Impact
11. ASTM G 53 QUV Exposure
12. ASTM D 2240 Durometer, Shore D
13. ASTM D 870 Immersion (Potable Water)
14. ASTM E 96 Moisture Vapor Transmission
15. ASTM D 2370 Tensile Strength and Elongation
16. ASTM D 638 Tear Strength

B. Manufacturer's representative color and texture sample cards shall be submitted to the Engineer at least 30 days prior to paint application. Contractor shall coordinate work so as to allow sufficient time for paint to be delivered to the job site.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer, and only within recommended limits.

B. Coordination of Work: Review other sections of these specifications in which other coatings are to be provided to ensure compatibility of the total coatings systems for various substrates.
1. Upon request, furnish information on the characteristics of pre-primed materials, to ensure that provisions for specified finish coats can be appropriately applied.
2. Notify the Engineer of any anticipated problems involved in using the coatings systems as specified.

C. Job Mock-up:
1. Minimum 50 sq.ft. application of each specified coating system on each type of substrate. At Engineer's discretion.
2. Mock-ups will serve as standard for acceptance of work.
3. Leave approved mock-ups in place as part of completed project.
4. Manufacturer's representative shall be available to advise applicator on proper application techniques and procedures.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Name or title of material.
   2. Federal Specification number, if applicable.
   3. Manufacturer's stock number and date of manufacture.
   4. Manufacturer's name.
   5. Contents by volume, for major pigment and vehicle constituents.
   6. Thinning instructions.
   7. Application instructions.
   8. Color name and number.
   9. Handling instructions and precautions.

B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg. F (7 deg. C) in a well ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
   1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all necessary precautionary measures to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of stains.

1.7 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg. F (7 deg. C), unless otherwise permitted by manufacturer's printed instructions.

B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85%, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing with the coating operation.
   1. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and the temperature within the area can be maintained within limits specified by the manufacturer during application and drying periods.

C. Report to responsible person such as safety personnel, General Trades Superintendent, etc., any condition which may pose a threat to the health and welfare of employees.

D. Keep working area clean and safe.

E. Obey all job site rules and regulations.

F. Surfaces not to be painted; unless specifically stated otherwise:
   1. Face brick
   2. Pre-finished wall panels, partitions and ceiling tile
   3. Items with acceptable factory-applied final finish
   4. Concealed ducts, pipes and conduit.
   5. Glass, Aluminum, Copper, Bronze, Stainless Steel

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   1. Tnemec Company, Inc., North Kansas City, Missouri
   2. Carboline Company, At. Louis, Missouri
   3. Sherwin Williams Company, Cleveland, Ohio

B. Material Quality: Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

C. Proprietary names to designate colors or materials are not intended to imply that products of named manufacturers are required to the exclusion of equivalent products of other manufacturers.

D. Request for substitution shall include manufacturer's literature for each product giving the name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified test reports showing results to equal the performance criteria of the products listed herein.

2.2 COATING SYSTEMS

A. Ferrous Metal:
   1. Submerged, Non-Potable

Surface Preparation:	SSPC-SP10 Near White Blast
First Coat:	Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
	Carboline Carboguard 890 @ 3.0 - 5.0 DFT
	Sherwin Williams Dura-Plate 235 at 3.0-5.0 mils DFT
Second Coat:	Tnemec Series N69 Hi-Build Epoxoline II @ 6.0-8.0 mils dry
	Carboline Carboguard 890 @ 4.0 - 6.0 DFT
	Sherwin Williams Dura-Plate 235 at 5.0-8.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series 161 @ 3-5 mils dry or Carboline Carboguard 890 @ 3.0 - 5.0 DFT or Sherwin Williams Dura-Plate 235 @3.0-5.0 mils DFT.

   2. Submerged, Potable

Surface Preparation:	SSPC-SP10 Near White Blast
First Coat:	Tnemec Series N140-1255 Pota-Pox Plus @ 4.0-6.0 mils dry
	Carboline Carboguard 891 @ 4.0 - 6.0 DFT
	Sherwin Williams Macropoxy 646 PW at 4.0-6.0 mils DFT

Second Coat: Tnemec Series N140-15BL Pota-Pox Plus @ 6.0-8.0 mils dry
Carboline Carboguard 891 @ 6.0 - 10.0 DFT
Sherwin Williams Macropoxy 646 PW at 6.0-8.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series N140 @ 3-5 mils dry or Sherwin Williams Macropoxy 646 PW at 3.0-5.0 mils DFT.

3. Non-Submerged, Interior Exposure
Surface Preparation: SSPC-SP6 Commercial Blast
First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
Carboline Carboguard 60 @ 3.0 - 5.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT
Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 4.0-6.0 mils dry
Carboline Carboguard 60 @ 4.0 - 6.0 DFT
Sherwin Williams Macropoxy 646 at 4.0-6.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series N69 @ 3-5 mils dry or Carboline Carboguard 60 @ 3.0 - 5.0 DFT or Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT.

4. Non-Submerged, Exterior Exposure
Surface Preparation: SSPC-SP6 Commercial Blast
First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
Carboline Carboguard 60 @ 3.0 - 5.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT
Second Coat: Tnemec Series 1075 Endura-Shield II @ 2.0-4.0 mils dry
Carboline Carbothane 133 LH @ 3.0 - 5.0 DFT
Sherwin Williams Acrolon 218 HS or Hi-Solids Polyurethane at 3.0-5.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-6 and spot prime with Series N69 @ 3-5 mils dry or Carboline Carboguard 60 @ 3.0 - 5.0 DFT or Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT.

5. Galvanized Steel (including Bar Joist and Galvanized Steel)
Surface Preparation: SSPC-SPI Solvent Clean on galvanized surfaces.
SSPC-SP7 Brush-Off blast to lightly profile surface.
First Coat: N69 Hi-Build Epoxoline II @ 2.0-4.0 mils dry
Carboline Carboguard 888 @ 3.0 - 4.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-4.0 mils DFT

B. Non-Ferrous Metals:

1. Interior Exposure

Surface Preparation: SSPC-SP1 Solvent Clean and Scarify per SSPC-SP 3

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 2.0-3.0 mils dry
Carboline Carboguard 60 @ 3.0 - 5.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
Carboline Carboguard 60 @ 3.0 - 5.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT

2. Exterior Exposure

Surface Preparation: SSPC-SP1 Solvent Clean and Scarify per SSPC-SP 3

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 2.0-3.0 mils dry
Carboline Carboguard 60 @ 3.0 - 5.0 DFT
Sherwin Williams Macropoxy 646 at 3.0-5.0 mils DFT

Second Coat: Tnemec Series 1075 Endura-Shield @ 2.0-4.0 mils dry
Carboline Carbothane 133 LH @ 3.0 - 5.0 DFT
Sherwin Williams Acrolon 218 HS or Hi-Solids Polyurethane at 3.0-5.0 mils DFT

C. Concrete

1. Submerged, Non-Potable

Surface Preparation: SSPC-SP 13/NACE#6 "Surface Preparation of Concrete"

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft. per gal.
Carboline Carboguard 890 @ 150 sq. Ft. per gal
Sherwin Williams Dura-Plate 235 at 150 sqft per gal

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft. per gal.
Carboline Carboguard 890 @ 150 sq. Ft. per gal
Sherwin Williams Dura-Plate 235 at 150 sqft per gal

2. Waterproofing - See Specification Section 09880

3. Non-submerged, poured in place or precast, Interior Exposure

Surface Preparation: Clean and dry

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq. ft/gal.
Carboline Carboguard 60 @ 150 sq. Ft. per gal
Sherwin Williams Macropoxy 646 at 150 sqft per gal

Second Coat: Series N69 Hi-Build Epoxoline II @ 150 sq. ft./gal.
Carboline Carboguard 60 @ 150 sq. Ft. per gal
Sherwin Williams Macropoxy 646 at 150 sqft per gal

4. Non-submerged, poured in place or precast, Exterior Exposure

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 156 Envirocrete @ 150 sq.ft. per gal. Carboline Flexxide Elastomer @ 150 sq. Ft. per gal Sherwin Williams Loxon XP at 6.0-8.0 mils dft
Second Coat:	Tnemec Series 156 Envirocrete @ 150 sq.ft. per gal. Carboline Flexxide Elastomer @ 150 sq. Ft. per gal Sherwin Williams Loxon XP at 6.0-8.0 mils DFT

5. Concrete block walls, Interior Exposure

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 130-6601 Envirofill @ 75 sq.ft. per gal Carboline Sanitile 600 @ 75 sq. Ft. per gal. Sherwin Williams Cement Plex 875

NOTE: Material should be rolled, or sprayed and back rolled, then squeegeed to provide a smoother surface.

Second Coat:	Tnemec Series N69 Hi-Build Epoxoline II @150 sq. ft./gal. Carboline Carboguard 60 @ 150 Sq. Ft. per gal. Sherwin Williams Macropoxy 646 at 150 sqft per gal
Third Coat:	Tnemec Series N69 Hi-Build Epoxoline II @150 sq. ft/gal. Carboline Carboguard 60 @ 150 Sq. Ft. per gal. Sherwin Williams Macropoxy 646 at 150 sqft per gal

6. Concrete block walls, Exterior Exposure

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 156 Envirocrete @ 100 sq.ft. per gal. Carboline Flexxide Elastomer @ 100 sq. Ft. per gal. Sherwin Williams Loxon XP at 6.0-8.0 mils DFT
Second Coat:	Tnemec Series 156 Envirocrete @ 100 sq.ft. per gal. Carboline Flexxide Elastomer @ 100 sq. Ft. per gal. Sherwin Williams Loxon XP at 6.0-8.0 mils DFT

7. Floors

Surface Preparation:	SSPC-SP 13/NACE#6 "Surface Preparation of Concrete"
First Coat:	Tnemec Series 201 Epoxoprime @ 250 sq.ft. per gal. Carboline Carbotguard 1340 @ 3.0 - 4.0 DFT Sherwin Williams GP 3579 at 6.0-8.0 mils DFT
Second Coat:	Tnemec Series 280 Tneme-Glaze @ 150 sq.ft. per gal. If non-skid is desired then randomly broadcast with 30/50 mesh silica sand into wet epoxy intermediate Carboline Santile 944HB @ 6.0 - 8.0 DFT Sherwin Williams GP 3745 at 6.0-8.0 mils DFT
Third Coat:	Tnemec Series 291 CRU @ 250 sq. ft per gal. Carboline Sanitile 934 @ 2.0 - 3.0 DFT Sherwin Williams GP 4638 at 3.0-4.5 mils DFT

8. Foundations

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 46H-413 80 sq.ft. per gal. Carboline Bitumastic 300 M @ 80 sq. Ft. per gal. Sherwin Williams Hi-Mil Sher-Tar at 80- sqft per gal

D. Plaster and Gypsum Wallboard

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 51-792 PVA Sealer @ 275 sq.ft. per gal. Carboline Carbocrylic 120 @ 1.0 - 2.0 DFT Sherwin Williams Pro Mar 200 Laztex Primer at 1.0-2.0 mils DFT
Second Coat:	Tnemec Series 113 Tneme-Tufcoat @ 200 sq.ft. per gal. Carboline Sanitile 255 @ 200 sq. ft. per gal Sherwin Williams Pro Industrial Hi-Bild Waterbased Catalyzed Epoxy at 4.0-6.0 mils DFT
Third Coat	Tnemec Series 113 Tneme-Tufcoat @ 200 sq.ft. per gal. Carboline Sanitile 255 @ 200 sq. ft. per gal Sherwin Williams Pro Industrial Hi-Bild Waterbased Catalyzed Epoxy at 4.0-6.0 mils DFT

E. Wood

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 36-603 Undercoater @ 300 sq.ft. per gal. Carboline Carbocrylic 120 @ 1.0 - 2.0 DFT Sherwin Williams Multi Purpose Primer at 1.0-2.0 mils DFT
Second Coat:	Tnemec Series 23 Enduratone @ 400 sq.ft. per gal. Carboline Carbocoat 8215 @ 400 sq. ft. per gal. Sherwin Williams Pro Mar 200 Alkyd at 400 sqft per gal
Third Coat	Tnemec Series 23 Enduratone @ 400 sq.ft. per gal. Carboline Carbocoat 8215 @ 400 sq. ft. per gal. Sherwin Williams Pro Mar 200 Alkyd at 400 sqft per gal

F. PVC Pipe

Surface Preparation:	Lightly sand
First Coat:	Tnemec Series N69 Hi-Build Epoxoline II @ 200 sq.ft. per gal. Carboline Carboguard 60 @ 200 sq. ft. per gal. Sherwin Williams Macropoxy 646 at 200 sqft per gal

G. Insulated Pipe

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 1029 Enduratone @ 300 sq.ft. per gal. Carboline Carbocrylic 3359 @ 300 sq. ft. per gal. Sherwin Williams DTM Acrylic at 2.5-4.0 mils DFT

Second Coat:	Tnemec Series 1029 Enduratone @ 300 sq.ft. per gal. Carboline Carbocrylic 3359 @ 300 sq. ft. per gal. Sherwin Williams DTM Acrylic at 2.5-4.0 mils DFT

H. Insulated Pipe

Surface Preparation:	Clean and dry
First Coat:	Tnemec Series 27 F.C. Typoxy @ 400 sq.ft. per gal. Carboline Santile 120 @ 400 sq. ft. per gal Sherwin Williams Pro Industrial Pro Cryl Primer @ 400 sq. ft. per gal
Second Coat:	Tnemec Series 113 Tneme-Tufcoat @ 325 sq.ft. per gal. Carboline Carboguard 60 @ 325 sq. ft. per gal Sherwin Williams Pro Industrial Hi-Bild Waterbased Catalyzed Epoxy at 4.0-6.0 mils DFT

2.3 COLOR CODING AND PROCESS SYSTEM IDENTIFICATION

A. Color coding for processing piping, equipment and appurtenances is a suggested system unless otherwise specified or requested by owner. Final coding to be determined in the field:

1. Equipment - light gray with O.S.H.A. orange coupling guards and O.S.H.A. yellow belt guards.
2. Pipe Supports - hangers to be same color as piping applied, floor post to be same as adjacent wall color, and fabricated racks to be manufacturer's standard protective finish or paint same as adjacent wall color if not having a suitable protective finish.
3. Process piping-exposed interior or exterior:
   a. Submerged Pipe or Supports - Black
   b. Intermittently Submerged Metals - Black (unless piping as defined otherwise)
   c. Natural Gas - OSHA Red*
   d. Process/L.P. Gas - OSHA Orange
   e. Potable (City) water - OSHA Blue*
   f. Well or Non-Potable Water — Aqua
   g. Seal water, wash water — white plant effluent
   h. Raw wastewater - Medium Grey*
   i. Equipment drains - Black
   j. Sanitary drains - Black with tags
   k. Chemical feed - Aqua
   l. Vents Ivory
   m. Compressed air - Green
   n. Chlorine - OSHA Yellow w/Red Stripes*
   o. Raw Sewage - Light Gray
   p. Grit Light Gray w/Yellow Stripes
   q. Primary Sludge - Dark Brown
   r. Return Sludge - Black w/Brown Stripes
   s. Waste Sludge or Liquor - Dark Green*

t. Supernatant - OSHA Green
u. Fuel Oil - Dark Gray
v. Sample Lines - Light Blue
w. Fire Protection System - OSHA Red Sprinkler Piping
x. Hoist and Trolleys - OSHA Yellow

* These colors are recommended as standard by WPCF.

4. Miscellaneous, non-process related items such as electrical conduit, duct work, roof drains, etc. are to be properly prepped and finished to match adjacent wall or ceiling color in rooms scheduled for finish wall and/or ceiling paint.

B. Signs and Labels

1. There shall be stenciled on each pipeline in each room a minimum of two legends describing the function of the pipeline, such as "natural gas", on each side of the pipe. It is intended that all pipelines shall bear legend at the most visible point and meet ANSI A13.1 Scheme for the identification of piping system for size, type and vantage point of legends.
2. Signs shall be furnished and securely fastened to each pipeline showing its destination such as "Aeration Tank No. 1".
3. Where the flow of a pipeline is in one direction only, then a flow arrow shall be stenciled in front of each legend on the pipe.
4. For pipes smaller than 1 in. in outside diameter, a white plastic tag with black lettering shall be used.
5. The legends and flow arrows shall be stenciled with approved stencil paint. Following the completion of other work under this Item, all stencils used shall remain the property of the Owner.
6. Each hydrant, hose bib, sillcock, and yard hydrant connected to plant water shall be stenciled with the words "Unsafe Water - Do Not Drink". The size of the stenciled letters shall be 1 inch. Stencil on the hydrants is to be on the nozzle section. The hose bibs shall have a 15" x 5" x 1/2" thick plaque made of marine plywood, where the stenciled letters are to be applied. The Plaque shall be fastened to the structure directly above the hose bib connection, (Plaques to have white letters with aqua background).
7. Preprinted plastic-coated adhesive labels may be used in lieu of stencils, on interior piping only.
8. All rooms in which equipment is operated automatically shall have signs mounted on the walls which are visible at entrances. The Contractor shall furnish twenty 14 in. x 20 in. black or yellow porcelain signs meeting OSHA requirements. Signs shall include mounting accessories. Each sign shall read:

   Warning: The equipment in this room operates automatically and may start or stop at any time.

PART 3 – EXECUTION

3.1 PRE-WORK INSPECTION

A. Examine surfaces to be coated and report conditions that would adversely affect appearance or performance of coating systems and which cannot be put into an acceptable condition by preparatory work specified in Paragraph 3.02.

B. Do not proceed with surface preparation and application until surface is acceptable or authorization to proceed is given by the Owner's representative.

3.2 SURFACE PREPARATION

A. General:
1. Dislodge dirt, rust, plaster nibs, mortar spatter and other dry material by scraping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming or blowing with high-pressure air.
2. Remove oil, wax and grease by scraping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a water rinse.
3. Verify that surfaces to be coated are dry, clean and free of dust, dirt, oil, wax grease or other contaminants.

B. Non-Submerged Concrete, Masonry and Cement Stucco:
1. Allow new concrete and masonry to cure 28 days
2. Scrape and grind fins and protrusions flush with surface.
3. Patch holes and cracks flush with surface.
4. Rake mortar joints clean.

C. Plaster:
1. Allow to cure for 28 days.
2. Remove nibs and other protrusions by scraping flush with surface.
3. Patch voids and cracks with spackling compound to match texture or surface.

D. Gypsum Board:
1. Sand joint compound smooth and flush with surface using fine grit sand paper.
2. Fill nicks, scratches, holes and uneven spots with spackling compound and after dry, sand flush with surface.

E. Non-Ferrous Metal:
1. SSPC-SPI solvent cleaning to remove all contaminants.

F. Ferrous Metal:
1. Enclosed: Remove loose rust, mill scale and other foreign matter by hand (SSPC-SP2) or power tool (SSPC-SP3) cleaning and apply specified coating before rusting occurs.
2. Non-Submerged, Architecturally Exposed: Society of Protective Coatings, SSPC-SP6 Commercial Blast.

3. Submerged Steel: Society of Protective Coatings, SSPC-SP10 Near White Blast.

G. Galvanized Metal:
1. Remove contaminants and protective mill coating by SSPC-SP1 Solvent Cleaning or steam cleaning. All surfaces shall be prepared by light brush blasting to achieve a minimum 1.0 mil abrasive blast profile

H. Wood:
1. Remove surface deposits of sap and pitch by scraping and cleaning with mineral spirits.
2. Seal knots and pitch pockets with a product manufactured for this specific purpose.
3. Sand rough spots of smooth siding and finish woodwork.
4. After prime coat is dry, fill cracks, holes and scratches with suitable wood filler or spackling compound and when dry, sand flush with surface.
5. Sand lightly between coats.

I. Concrete Floors:
1. Prepare concrete floors in accordance with SSPC-SP 13/NACE #6 "Surface Preparation of Concrete".

J. Submerged Concrete:
1. Prepare in accordance with SSPC-SP 13/NACE #6 "Surface Preparation of Concrete" to remove laitance and expose all cavities and honeycombs. If immersion service condition will have an exposure outside of neutral pH (6-9) then all cavities shall be filled using Tnemec Series 218 Mortarclad or Sherwin Williams Corobond 300. Product is trowel applied to all vertical walls with exposed cavities.

3.3 APPLICATION

A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators in accordance with the manufacturer's directions. brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
1. Coating colors, surfaces treatments and finishes are indicated in the "Schedules" of the contract documents.
2. Provide finish coats that are compatible with the primers used.
3. The number of coats and coating film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the coating manufacturer. Sand between coating applications where sanding is required to produce an even smooth surface in accordance with the coating manufacturer's directions.
4. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
5. Coat the back sides of access panels, removable or hinged covers, and similar hinged items, to match exposed surfaces.

B. Minimum Coating Thickness: Apply each material at not thinner than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire coating system as recommended by the manufacturer.

C. Prime Coats: Before the application of finish coats, apply a prime coat, as recommended by the coating manufacturer, to material that is required to be painted or finished, and which has not been prime coated by others.
   1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

D. Brush Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
   1. Apply primers and first coats by brush unless the manufacturer's instructions permit use of mechanical applicators.

E. Mechanical Applications: Use mechanical methods for coating application when permitted by the coating manufacturer's recommendations, governing ordinances, and trade union regulations.
   1. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by the coating manufacturer.

F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or recoat work not in compliance with specified requirements.

G. Spray application will not be permitted for the Primary Clarifier Painting bid item.

3.4 INSPECTION

A. Request acceptance of each coat before applying succeeding coats.

B. The Contractor shall furnish the Engineer a suitable thickness detector of a type recommended by the paint manufacturer.

C. Any field painting found to be defective shall be removed and the surfaces repainted as the Engineer may direct at no additional cost to the Owner.

D. Before final approval of the work, all damaged surfaces of paint (field or factory applied) shall be cleaned and repainted or touched up as directed.

3.5 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following material testing procedure at any time, and at any number of times during the period when coating operations are being conducted.

1. The Owner will engage the services of an independent testing laboratory to sample the coating being used. Samples of material delivered to project site will be taken, identified and sealed, and certified in the presence of the Contractor.
2. The testing laboratory will perform appropriate tests for any or all of the following characteristics as required by the Owner:
   a. Quantitative materials analysis.
   b. Absorption.
   c. Accelerated weathering.

3.6 CLEANING

A. Clean-Up: At the end of each work day during progress of work, remove rubbish, empty cans, rags and other discarded materials from the site.
   1. Upon completion of the work, clean window glass and other spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or otherwise damage adjacent finished surfaces.

3.7 PROTECTION

A. Protect work of other trades, whether to be coated or not, against damage from coating operations. Correct damage by cleaning, repairing or replacing, and recoating as acceptable to the Architect. Leave the work in an undamaged condition.

B. Provide "Wet Paint" signs as required to protect newly-coated finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.
   1. At completion of the work of other trades, touch-up and restore damaged or defaced coated surfaces.

END OF SECTION 09801 CT 12/03

SECTION 09880CT - CONCRETE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Under this section the Contractor shall furnish and apply the waterproofing materials necessary for the protection of concrete surfaces.

B. These materials shall be designed to protect the concrete surfaces against the penetration of moisture and the disintegrating influences of alkalis, acids, and frost.

C. Other finishes for concrete surfaces are included in Painting.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall comply with manufacturer's recommendations as to environmental conditions under which waterproofing systems can be applied and to all applicable OSHA requirements.

B. Face masks shall be used when applying toxic material in enclosed rooms or chambers, regardless of the amount of ventilation provided.

C. Exterior waterproofing shall not be done during or immediately following rainy or frosty weather or when the temperature is below 50 degrees F or likely to drop below freezing during drying period. The application of treatment while surfaces are exposed to the hot sun, or when the temperature is above 90 degrees F, or likely to be during the drying period, shall be avoided.

D. Waterproofing material shall not be applied in areas where dust is being generated.

1.5 SUBMITTALS

A. The Contractor shall submit complete descriptive literature from the manufacturer for each type of special waterproofing material he proposes to use. If requested by the Engineer, the Contractor shall submit the manufacturer's complete formula for the special material if different from those mentioned in the specifications, in order that the Engineer may determine that the proposed materials are equal to those specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type A Waterproofing

1. Type A shall be a bituminous material in a liquid form that is suitable for cold application.
2. It shall be of such a nature as to bond firmly to the concrete surface without the use of primers and to maintain sufficient elasticity to perform its protective function permanently in spite of cracks which develop.

    a. Concrete surfaces shall be sand blasted in accordance with SSPC-SP7 Brush-off Blast Cleaning.
    b. Concrete surfaces shall be clean and dry in accordance with ACI 515.

3. In a nonpotable water situation, Type A shall be "Bitumastic Super Service Black" by Kop-Coat Division of Carboline System, "Series 46H-413 Hi-Build Tneme-Tar" by Tnemec, or Coal Cat 97-640 Series by PPG Industries.

PART 3 - EXECUTION

3.1 PREPARATION

A. All surfaces which are to be treated shall be thoroughly cleaned and dried in conformance with manufacturer's recommendations.

3.2 APPLICATION

A. Type A

1. Type A shall be applied to all concrete bottom slabs, walls, and columns in contact with water from bottom to one foot above high water level unless noted otherwise.
2. Type A shall be applied in two coats. Each coat shall have a coverage rate of 60 to 80 sq. ft. per gallon.

END OF SECTION 09880CT (1/06)

DIVISION 10

SPECIALTIES

SECTION 10520AIA – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.

2. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each mounting bracket indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

C. Pressurized, FFFP-Foam Type: UL-rated 299, 3-A:20-B, 2.5-gal. nominal capacity, with FFFP foam in stainless-steel container; with pressure-indicating gage.

D. Regular Dry-Chemical Type in Steel Container: UL-rated 299, 10-B:C**,** 5-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.

E. Carbon Dioxide Type: UL-rated 154 10-B:C**,** 15-lb nominal capacity, with carbon dioxide in enameled-steel container.

2.2 MOUNTING BRACKETS

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1. Color: Red.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

    a. Orientation: Horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

2. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

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

3.2 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights as indicated below or as acceptable to authorities having jurisdiction:

1. Mounting Brackets: 54-inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Identification: Apply vinyl lettering at locations indicated.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 10520 02/01 (R 05/03)