

SECTION 02730

SANITARY SEWERAGE SYSTEM

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to:
 - 1. Sanitary sewers and force mains
 - 2. Miscellaneous concrete
 - 3. Pipe bedding and backfill
 - 4. Testing
- B. Related work specified elsewhere includes, but is not limited to:
 - 1. Section 02130, Trench Excavation, Bedding and Backfill.
 - 2. Section 02275, Sediment Control.
 - 3. Section 02607, Manholes and Covers.
 - 4. Section 03300, Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. All submittals shall conform completely to the requirements of the Contract Documents.
- B. Reference Submittals
 - 1. Material Certification: Provide material certification for items listed below:
 - a. Granular backfill material
 - b. Pipe bedding material
 - 2. Test Reports: Provide 2 copies of test reports.
 - 3. As-Built Drawings: Indicate deviations from original Contract Documents and include the following:
 - a. All buried/concealed storm and/or sanitary sewers, dimensioned from a fixed control point, including invert elevations.
 - b. All buried/concealed utility services, gas, water, telephone, electrical ducts, etc., dimensioned from a fixed control point, including depth of bury.

C. Product Data: Provide product data for items listed below:

1. Pipe
2. Fittings
3. Gaskets
4. Manhole base compression fittings

1.04 PRODUCT HANDLING

A. General

1. Handle pipe with care as only sound, undamaged material and fittings will be accepted.
2. Keep pipe interiors completely free of dirt and foreign matter.

1.05 JOB CONDITIONS

A. General

1. Make connections to existing lines and new building services as shown and required.

B. Site Information

1. Test borings have been made on the Site and a complete report on the soil borings is included in this Project Manual.
2. The data on indicated subsurface conditions is not intended as representations or warranties of the continuity of such conditions between soil borings. It is expressly understood that the Owner and/or the Engineer will not be responsible for interpretations or conclusions drawn there from by the Contractor. The data is made available only for the convenience of the Contractor.
3. Additional test borings and other exploratory operations may be made by the Contractor at no additional expense to the Owner.

C. Use of Explosives

1. The use of explosives is not permitted.

1.06 LOCATIONS AND VERIFICATIONS

A. Verify at the Site all locations, elevations, grades, and utility service connections, as indicated on the Drawings and serving the Project.

B. Locations shown on the Drawings shall be followed as closely as possible. However, exact positions shall be subject to, and adjusted to, interferences

with other Work. Should major difficulties prevent the installation of any part of this portion of the Project, such conditions shall be brought to the attention of the Owner, who will determine final locations, and the Contractor shall make the installation accordingly.

PART 2 PRODUCTS

2.01 SANITARY SEWERS

A. Sanitary Sewers

1. General: The Contractor shall provide the following types of pipe materials.
 - a. Type PSM Polyvinyl Chloride Pipe (PVC) for all gravity pipe indicated as SDR 35 on the Contract Drawings.
 - 1) Pipe and fittings: Conform to ASTM D3034, SDR 35.
 - 2) Joints: Flexible elastomeric gasket, conform to ASTM D3212.
 - 3) Fittings: Molded or fabricated of same material as pipe.
 - 4) Gaskets: Conform to ASTM F477.
 - b. Type PSM Polyvinyl Chloride Pipe (PVC) for the building domestic sanitary line.
 - 1) Pipe and fittings: Conform to ASTM D3034, SDR 35.
 - 2) Joints: Flexible elastomeric gasket, conform to ASTM D3212.
 - 3) Fittings: Molded or fabricated of same material as pipe.
 - 4) Gaskets: Conform to ASTM F477.
 - c. Type PSM Polyvinyl Chloride Pipe (PVC) for force mains:
 - 1) Pipe and fittings: Conform to ASTM D2241, SDR 21.
 - 2) Joints: Flexible elastomeric gasket, conform to ASTM D3212.
 - 3) Bedding: Conform ASTM 2321, Type I
 - d. Type High Density Polyethylene (HDPE) for force mains:
 - 1) Pipe and fittings: Conform to ASTM D1248.
 - 2) Joints: Butt Fusion.

B. Miscellaneous Concrete

1. Miscellaneous concrete shall conform to Section 03300, Cast-In-Place Concrete.
2. Concrete shall have a compressive strength of no less than 3,000 psi at 28 days.
3. Miscellaneous concrete shall be provided for the following items:
 - a. Concrete encasement if necessary.

2.02 JOINTS AND FITTINGS

- A. Bell and spigot type joints, including their respective appurtenances shall conform to ASTM D3212. Gaskets shall be in accordance with ASTM F477.

- B. All spigots shall have a "home" mark in order to facilitate joint closure.

2.03 PIPE BEDDING AND BACKFILL

- A. Granular Backfill: State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, Item 304.
- B. Pipe Bedding: ODOT Coarse Aggregate, conform to AASHTO M43, Size No. 8, 57 or 67.
- C. Earth Backfill
 - 1. Fine sand, clayey gravel, sand-clay, silty clay, clay (soil types GM, GC, MH, ML, CH).
 - 2. Excavated materials.
- D. Unsuitable Material
 - 1. Organic soils (soil types OL, OH, PT).
 - 2. Rocks larger than 6" in any dimension.
 - 3. Bricks and building debris.
 - 4. Frozen materials.

2.04 VALVE BOXES

- A. Valve boxes shall be supplied for all buried valves on force mains.
- B. The assembly shall consist of three (3) pieces and a cover. The cover shall be marked "Sewer". The valve box shall be screw-type, cast iron with 5-1/4-inch shaft. A round base that will enclose the valve bonnet shall be furnished with valves 8-inch and smaller. An oval base shall be supplied with valves larger than 8-inches.
- C. The valve box shall be supported at the base on concrete blocking to stabilize the assembly.

2.05 UTILITY MARKING TAPE

- A. Three (3) inch wide detectable utility marking tape bearing the word "CAUTION...BURIED FORCE MAIN" permanently printed on the tape. Tape shall be brown as specified by the APWA color code.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that substrate is ready to receive work and elevations are as indicated on Drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.02 TRENCHING

A. General

1. Trench excavation shall follow lines and grades as indicated on the Drawings. Exact positions shall be subject to and adjusted to interferences with other work.
2. Leave trenches open until work is inspected.
3. Whenever existing items such as sewer pipes, water pipes, gas mains, culverts, or other pipes or structures are encountered in or near the lines of trenches being excavated, use proper care in preserving such items intact, and repair any damage to such items due to failure to exercise sufficient care.
4. Prior to beginning excavation, notify, in writing, all utilities on the project of the intended Work and schedule.
5. Locate all existing utilities or other structures of critical location in advance of excavation.
6. Uncover existing pipes and cables ahead of trenching for new Work.

B. Excavation and Pipe Bedding

1. Trench shall be excavated 6" below invert of pipe.
2. Pipe shall be laid in pipe bedding material which will cradle the bottom third (120 deg) of the pipe.
3. Place appropriate backfill above the pipe and both sides of pipe to a depth of 12" above the top of the pipe and compacted in layers not to exceed 6" in thickness with mechanical tampers.

C. Backfill and Compaction

1. Under and within 5' of roads, walks and other paved areas, trenches and pits shall be backfilled to within 18 inches of sub-grade with original excavated material, compacted in 8-inch lifts. The final 18 inches to sub-grade shall be backfilled with granular material (ODOT 304) compacted in 8" layers.
2. Elsewhere, backfill with earth backfill unless otherwise directed by the Engineer. Top 4" shall be topsoil.
3. Unsuitable backfill shall not be used.
4. Compaction shall be as specified in Section 02130, Trench Excavation, Bedding and Backfill.

3.03 INSTALLATION

A. General

1. Install full lengths of pipe, where practical.
2. Make joints in accordance with Manufacturer's recommendations.
3. Cutting of all pipe shall be done with sharp tools. The ends of each pipe shall be reamed until all burrs or fins are removed. Full tapered threads shall be used throughout and threaded joints shall turn up perfectly tight without the use of filling substances. A standard pipe joint paste shall be used on the male threads only, and none shall be allowed to accumulate on the inside of the pipes.
4. Lay pipe in dry trench. Line may be partially backfilled, leaving joints open until after testing.
5. Plug end of pipe when not being worked.
6. Leave line clean and free of debris when complete.

B. Sanitary Sewers

1. All sewers shall be installed as shown on the Construction Drawings.
2. Install sewers to lines and grades as indicated.
3. Make sewer connections to existing lines or structures as shown and required.
4. Lay sewer pipe with spigot end downstream.

3.04 TESTING

A. General

1. Tests may be conducted on completed pipe line or any completed portion that can be isolated from other sections previously tested or not complete. Contractor shall test the sewer line for leakage in the methods described in Sections 3.04 B, C or D. Deflection testing shall be required for all flexible pipe.

B. Exfiltration Test of Sanitary Sewers

1. As soon as a section of sewer has been constructed, suitable expandable plugs manufactured for that purpose shall be inserted in the sewer at the upstream side of the lower manhole and the section filled with water to a head of at least two (2) feet above the top of the sewer pipe. The drop in head for a section of 300' for the last 30 min of a period of 1 hr, shall not exceed the following:
 - a. 0.5" for 8" sewers
 - b. 0.7" for 10" sewers

- c. 0.8" for 12" sewers
- 2. For sections other than 300' the allowable drop in head as listed above, shall be adjusted in direct proportion to the length.
- 3. Contractor shall make all arrangements and pay all costs to obtain water for the test.
- 4. Any section of sewer showing leakage in excess of the amounts above specified shall be repaired or replaced and retested at the expense of the Contractor.

C. Infiltration Test of Sanitary Sewer

- 1. An infiltration test shall be performed in lieu of an exfiltration test when the ground water table is two (2) feet or more above the top of the pipe at the upper end of the pipeline section to be tested.
- 2. Infiltration shall be measured using a suitable weir or other measuring device, acceptable to the Engineer, in the lower end of the sewer section to be tested.
- 3. The quantity of ground water infiltration into the sewer shall be measured and shall not exceed the allowable leakage of 100 gallon per day per inch of diameter per mile of pipe.

D. Low Pressure Air Test

- 1. In lieu of exfiltration tests for pipe sizes 8" through 24", the Contractor may perform an air test.
- 2. Approval of Engineer is required.
- 3. Air test procedure:
 - a. Plug all pipe outlets with suitable test plugs in section to be tested.
 - b. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
 - c. After an internal air pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
 - d. After the two minute period, disconnect the air supply.
 - e. When pressure decreases to 3.5 psig, start timing with a stop watch.
 - f. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig.
 - g. Minimum permissible pressure holding times shall be as prescribed in ASTM C828, for clay pipes; ASTM F1417 for plastic pipes; or as recommended by the manufacturer for the type of piping materials being tested.
- 4. All air tests shall be conducted with the utmost safety precautions, including but not limited to:
 - a. Bracing all plugs securely.
 - b. Not allowing personnel in manholes during testing.
 - c. Installing a pressure-relief system operative at 10 psi.

E. Deflection Test (for PVC pipe only)

1. A deflection test shall be made by pulling through the sewer a rigid ball or mandril having a diameter equal to 95% of the inside diameter of the pipe.
2. Deflection tests shall be performed no sooner than 30 days following completion of backfill.
3. All plastic pipe shall be tested for deflection.
4. Maximum ring deflection of pipe when backfilled shall be equal to or less than 5 percent of average inside diameter.
5. A copy of diameter record shall be submitted to the Engineer.
6. Any pipe showing deflections in excess of 5%, thirty (30) days after installation, shall be replaced at no cost to the Owner.

F. Force Main Testing:

1. A hydrostatic test as required in applicable sections of AWWA C600 for Ductile Iron Pipe and AWWA C605 for PVC Pipe shall be applied to the whole or to individually isolated sections of the force main either before or after the trench is backfilled. The pressure during the test shall be maintained at 150 psi or one and a half times the working pressure, whichever is greater, in any section being tested. The duration of each pressure test shall be at least 2 hours. The Contractor shall supply and Site Observer verify gauges for the test. Furthermore, the Contractor shall furnish all materials, make all taps required and furnish a pump, piping, all other equipment and all assistance necessary for conducting the tests. Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Contractor at points of highest elevation or as required. Taps shall be of the sizes as shown on the construction drawings or as directed by the Contract Administrator.
2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. No pipe installation will be accepted until this leakage (evaluated on a pressure basis of 150 psi) is less than 1.99 U.S. gallons per hour per 100 joints of 12 inch nominal diameter pipe and correspondingly varied for other sizes of pipe as provided in the AWWA Specifications.
3. Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the Contract Administrator. If unable to achieve the required test the Contractor shall disconnect from the existing valve, plug the line and retest until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

3.05 UTILITY MARKING TAPE INSTALLATION

- A. Install detectable utility marking tape above all plastic force mains, twelve (12) to eighteen (18) inches below final grade.

END OF SECTION

SECTION 02769

TEMPORARY BYPASS PUMPING SYSTEMS

PART 1 GENERAL

1.01 SCOPE

- A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc., to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project if sufficient flows are present to warrant bypass pumping system.
- B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.02 REQUIREMENTS FOR SUBMITTALS

- A. The Contractor shall prepare a specific, detailed description of the proposed pumping system and submit it to the Engineer after the award of the Contract.
- B. The Contractor shall submit to the Engineer detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flow. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.
- C. The plan shall include but not be limited to details of the following:
 - 1. Staging areas for pumps;
 - 2. Sewer plugging method and types of plugs;
 - 3. Number, size, material, location and method of installation of suction piping;
 - 4. Number, size, material, method of installation and location of installation of discharge piping;
 - 5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
 - 6. Calculations of static lift, friction losses, and flow velocity (pump curves

- showing pump operating range shall be submitted);
7. Standby power generator size, location;
 8. Downstream discharge plan;
 9. Method of protecting discharge manholes or structures from erosion and damage;
 10. Thrust and restraint block sizes and locations;
 11. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
 12. Method of noise control for each pump and/or generator;
 13. Any temporary pipe supports and anchoring required;
 14. Design plans and computation for access to bypass pumping locations indicated on the drawings;
 15. Calculations for selection of bypass pumping pipe size;
 16. Schedule for installation of and maintenance of bypass pumping lines;
 17. Plan indicating selection location of bypass pumping line locations.

1.03 PREPARATION

A. Precautions

1. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
2. During all bypass pumping operation, the Contractor shall protect the Pumping Station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.
- B. The Contractor shall provide the necessary stop/start controls for each pump.
- C. The Contractor shall include one stand-by pump of each size to be

maintained on site Back-up pumps shall be on-line, isolated from the primary system by a valve.

- D. Discharge Piping – Discharge piping system shall be submitted for review and approval by the Owner. Any spillage shall be the responsibility of the Contractor to clean up.

PART 3 EXECUTION

3.01 SYSTEM DESCRIPTION

A. Design Requirements

1. Bypass pumping systems shall have sufficient capacity to pump the peak flow upstream of the pipe being bypassed. Consult with Owner regarding the peak flows of the sanitary system. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours per day.
2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
4. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

B. Performance Requirements

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
2. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system

shall meet the requirements of all codes and regulatory agencies having jurisdiction.

3. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
4. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.
5. The Contractor shall protect water resources, wetlands and other natural resources.

3.02 FIELD QUALITY CONTROL AND MAINTENANCE

A. Test

1. The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer will be given 24 hours notice prior to testing.

B. Inspection

1. Contractor shall inspect bypass pumping system every two hours to ensure that the system is working correctly.

C. Maintenance Service

1. The contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.

D. Extra Materials

1. Spare parts for pumps and piping shall be kept on site as required.
2. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

3.03 INSTALLATION AND REMOVAL

- A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures as may be required to provide adequate suction conduit.
- B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a

manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

- C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.
- D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to preconstruction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the Owner.

END OF SECTION

SECTION 02820

FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, equipment and incidentals required to provide fences, gates and vehicle barrier gates as shown and specified.
- B. The types of fencing and appurtenances include the following:
 - 1. Galvanized steel systems.
 - 2. Swing gates.
 - 3. Accessories and fittings.

1.02 REFERENCES

- A. The specifications in this Section are subject to the administrative and procedural requirements specified in Division 1, as well as the broader requirements of the General Conditions.
- B. ASTM A 120, Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe of Ordinary Uses.
- C. ASTM A 121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
- D. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- F. ASTM C 33, Specification for Concrete Aggregates (Including Tentative Revision).
- G. ASTM C 150, Specification for Portland Cement.
- H. Chain Link Fence Manufacturer's Institute, Galvanized Steel Chain-Link Fence Fabric.
- I. Federal Specification, RR-F-191/1A, Fencing, Wire and Post, Metal (Chain-Link Fence Fabric).

1.03 SUBMITTALS

- A. Submittals shall meet the requirements of Section 01300.
- B. Shop Drawings: Comply with Section 01300.
- C. Product Data: Comply with Section 01300.

1.04 QUALITY ASSURANCE

- A. Erector Qualifications: A firm experienced in the erection of fencing of the type specified and approved by the manufacturer.
- B. Design Criteria: Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and RR-F-191/1A, unless otherwise shown or specified.
- C. Source Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver material in manufacturer's original packaging with all tags and labels intact and legible.
- B. Handling of Materials:
 - 1. Comply with Sections 01600.
 - 2. Handle and store material in such manner as to avoid damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe sizes specified are commercial pipe sizes.
- B. Tube sizes specified are nominal outside dimension.
- C. Roll-formed section sizes are the nominal outside dimensions.
- D. Wire gages are specified using American Steel Wire, Washburn and Moen Standards, or United States Wire Gage Sizes.
- E. Finish for Framework and Appurtenances:

F. Galvanized finish with minimum weights of zinc as follows:

1. Pipe: ASTM A 120, Schedule 40, 1.8 ounce zinc per square foot.
2. Hardware and Accessories: Hardware and Accessories including tension wire, barbed wire, supporting arms, barbed obstacle tape supporting arms, post tops, stretcher bars, stretcher bar bonds, gates gate hardware, and wire ties shall be galvanized per ASTM A 153, zinc weight per Table I, Federal Specification RR-F-191/1A.

2.02 COMPONENTS

A. Fabric: Furnish chain link fabric as follows:

1. One-piece fabric widths, for fence height up to 12 feet.
 - a. No. 9 gage wires.
2. 2-inch mesh.
3. Top selvages twisted and barbed and bottom selvage knuckled for fabric over 60 inches high.
4. Galvanized finish with not less than 1.2 ounces zinc per square foot, complying with ASTM A 392, Class I.
5. Height: Six feet unless otherwise shown on drawings.

B. Posts, Rails and Braces

1. End, Corner and Pull Posts: 2.875 inch OD pipe weighing 5.79 pounds per linear foot.
2. Line Posts:
 - a. Spacing: Ten feet on center maximum, unless otherwise shown.
 - b. Materials: 2.375 inch OD pipe, weighing 3.65 pounds per linear foot.
3. Gate Posts:
 - a. Function: Supporting single gate leaf or one leaf of a double gate installation.
 - b. Sizing Table:

<u>Gate Opening (ft.)</u>	<u>OD Pipe (in.)</u>	<u>Weight (lbs/L.F.)</u>
Under 6	2.875	5.79
6 - 13	4	9.10
13 - 18	6.625	18.97
Over 18	8.625	24.70

4. Top Rail:
 - a. Furnish in manufacturer's longest lengths.
 - b. Provide a means for attaching securely to each gate, corner, pull and end post.

- c. Materials: 1.660 inch OD pipe weighing 2.27 pounds per linear foot.
- d. Couplings:
 - 1) Furnish outside sleeve type at least six inches long.
 - 2) Furnish a minimum of 20 percent of the couplings with an internal heavy spring for expansion and contraction.
- 5. Post Brace Assembly:
 - a. Placement: At end and gate posts, at both sides of corner and pull posts, with horizontal brace at mid-height of the fabric.
 - b. Materials:
 - 1) 1.660 inch OD pipe weighing 2.27 pounds per linear foot for horizontal brace.
 - 2) 3/8 inch diameter rod with wrought or cast iron turnbuckle for diagonal truss.
- 6. Tension Wire:
 - a. Galvanized seven gage coiled spring wire.
 - b. Locate at bottom of fabric only.
- 7. Barbed Wire Supporting Arms:
 - a. Materials: Pressed steel, wrought iron, or malleable iron.
 - b. Construction:
 - 1) An integral part of post top weather cap.
 - 2) Complete with provisions for anchorage to posts.
 - 3) Attach three rows of barbed wire to each arm.
 - 4) Angle 45 degree arm, one for each post where shown.
- 8. Barbed Wire:
 - a. Two twisted strand, 12 gage wire with 14 gage, four point aluminum barbs spaced five inches on center.
 - b. Finish: Galvanized, complying with ASTM A 121, Class 3.
- 9. Post Tops:
 - a. Material: Pressed steel, cast iron, wrought iron, or malleable iron.
 - b. Designed as a watertight closure cap, for tubular posts.
 - c. Furnish one cap for each post unless equal protection is provided by combination post top cap and barbed wire supporting arm.
 - d. Provide a means of attaching securely cap to post.
 - e. Furnish caps with openings to permit through passage of the top rail.
- 10. Stretcher Bars:
 - a. Number: One for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into the post.
 - b. One piece lengths equal to full height of fabric, with a minimum cross-section of 3/16 inch by 3/4 inch.
- 11. Stretcher Bar Bands:
 - a. Material: Steel, wrought iron, or malleable iron.
 - b. Spaced not over 15 inches on center to secure stretcher bars to end, corner, pull and gate posts.
 - c. May also be used with special fittings for securing rails to end,

corner, pull and gate posts.

12. Gates

a. Frame:

- 1) Fabricate of tubular member, 1.90 inch OD pipe weighing 2.72 pounds per linear foot.
- 2) Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories.
- 3) Assemble by welding or with special malleable or pressed steel fittings and rivets for rigid watertight connections.
- 4) Space so members are not more than eight feet apart.
- 5) Install diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity.
- 6) Where barbed wire is above gates, extend the end members one foot above top member and prepare to receive three strands of wire. Provide necessary clips for securing wire to extensions.

b. Fabric:

- 1) Comply with Article 2.02 of this Section.
- 2) Install with stretcher bars at vertical edges, bars may also be at top and bottom edges.
- 3) Attach stretchers to gate frame at no more than 15 inches on center.

c. Gate Hardware:

- 1) Furnish latches, stops, keepers, hinges, hardware and accessories for each gate.
- 2) Attach hardware with rivets or by other means which will provide security against removal or breakage.
- 3) Hinges:
 - a) Material: Pressed or forged steel or malleable iron to suit gate size.
 - b) Offset to permit 180 degrees gate opening.
 - c) Provide three hinges for each leaf six feet and over nominal height.
- 4) Latch:
 - a) Material: Galvanized malleable iron except plunger bar may be galvanized tubular or bar steel in compliance to 6.2 of AASHTO M 181.
 - b) Type:
 - i. Forked or plunger bar to permit operation from either side of gate.
 - ii. Forked may be used for a single gate less than 10 feet wide.
 - c) Plunger bar shall be full gate height located in a manner that will engage the gate stop.

- d) Padlock eye as an integral part of latch.
- 5) Keeper:
 - a) Material: Galvanized malleable iron.
 - b) Provide for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
- 6) Stops:
 - a) Material: Galvanized malleable iron.
 - b) Mushroom type or flush plate with anchors.
 - c) Other approved stops may be used for single gates less than 10 feet wide.
- d. Double Gates: Include locking device using one padlock to lock both gates.

2.03 ACCESSORIES

A. Wire Ties:

1. Materials:
 - a. Galvanized Steel Wire: Not less than 0.8 ounces of zinc per square foot.
 - b. Aluminum Wire: Conforming to ASTM B 211 alloy H 18 temper.
2. Spacing:
 - a. For tying fabric to rails and braces, 24 inches on center.
 - b. For tying fabric to line posts, 12 inches on center.
3. Tension Wire: For tying fabric use 11 gage hog rings, spaced 24 inches on center.
4. Finish: To match fabric.

B. Concrete: Design the mix to produce concrete having properties of compressive strength, slump range and air content as specified in Division 3.

C. Vehicle Barrier Gates

1. Manufacturer:
 - a. Security Fabricators, Inc.
 - b. Or equal.
2. Materials:
 - a. Shoe base: 356 Aluminum alloy.
 - b. Stud post: 6 inch I.D. Schedule 40 aluminum pipe.
 - c. Sleeve: 7.5 inch O.D. Schedule 40 aluminum pipe.
 - d. Framing: Schedule 40 alloy 6063 T6, ASTM B-429.
 - e. Anchor bolts: 1 inch diameter x 30 inch long with 4 inch leg, hot dip galvanized carbon steel.
3. Features:

- a. First panel to be filled with aluminum plate.
- b. Furnish stud post with circular locking plate.
- c. Size: As shown on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the conditions under which the fence and gates are to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02 PREPARATION

- A. Do not begin fence installation and erection before the final grading is completed, with finish elevations established.

3.03 INSTALLATION

- A. Comply with the details shown on the drawings.
- B. The Contractor shall reuse insomuch as is possible the existing stockpiled fence with new posts.
- C. Excavation:
 - 1. Post footings in firm undisturbed or compacted soils as shown on the drawings. If not designated comply with following:
 - a. Hole diameter:
 - 1) 12-inch diameter for line posts.
 - 2) 16-inch diameter for end, corner, gate, and pull posts.
 - b. Hole depth:
 - 1) 39 inches deep.
 - 2. Remove soil from excavations unless otherwise indicated by the Owner's Representative to uniformly spread adjacent to fence line or on adjacent areas of the site.
 - 3. When solid rock is encountered near the surface, drill into rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill hole at least 1-inch greater diameter than the largest dimensions of the post to be placed.
 - 4. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed the minimum depths specified above.

D. Setting Posts:

1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
2. Center and align posts in holes 3 inches above bottom of excavation.
3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
4. Trowel finish tops of footings, and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.
5. Keep exposed concrete surfaces moist for at least 7 days after placement, or cure with membrane curing materials, or other acceptable curing method.

E. Concrete Strength:

1. Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed.
2. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.

F. Top Rails:

1. Run rail continuously through post caps or extension arms, bending to radius for curved runs.
2. Provide expansion couplings as recommended by fencing manufacturer.

G. Install internal pull posts at all angle points greater than 5 degrees or on straight runs exceeding 500 feet.

H. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

I. Tension Wire: Install tension wires by weaving through the fabric and tying each post with not less than 6 gage galvanized wire, or be securing the wire to the fabric.

J. Fabric:

1. Leave approximately 2 inches, plus or minus 1 inch, between finish

grade and bottom salvage, except where bottom of fabric extends into concrete.

2. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric opposite security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

K. Repair coatings damaged in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's direction.

L. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.

M. Barbed Wire:

1. Install three parallel wires on each extension arm; opposite security side of fence, unless otherwise indicated.
2. Pull wire taut and fasten securely to each extension arm.

N. Gates:

1. Install gates plumb, level, and secure for full opening without interference.
2. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer.
3. Adjust hardware for smooth operation and lubricate where necessary.

O. Tie Wires:

1. Use U-shaped wire conforming to diameter of pipe.
2. Clasp pipe and fabric firmly with ends twisted at least two full turns.
3. Bend ends of wire to minimize hazard to persons or clothing.

P. Fasteners:

1. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
2. Peen ends of bolts or score threads to prevent removal of nuts.
3. Bolts have anodic coating at least 0.00002-inch in thickness, chromate sealed.

3.04 ADJUSTING

A. Comply with Section 01700.

B. Adjust all fencing and gates and leave in good working condition.

- C. Repair or replace any broken or bent components as directed by the Engineer.
- D. Protect gates and fencing from construction traffic until acceptance of the Work.

END OF SECTION

SECTION 02936

SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Placing topsoil.
- B. Hydro seeding, mulching and fertilizing.

1.02 RELATED SECTIONS

- A. Section 02130 - Backfilling: Rough grading of site.
- B. Section 02130 - Trenching: Rough grading over cut.

1.03 MEASUREMENT AND PAYMENT

- A. Lump sum to be included in bid price.

1.04 REFERENCES

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.05 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quack grass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambs quarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nut grass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.06 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01700 - Contract Closeout: Procedures for submittals.

1.07 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.08 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.09 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

- A. Section 01730 - Operation and Maintenance Data.
- B. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.
- C. Any dead grass or bare spots larger than 3 inches in diameter shall be immediately replaced or resprayed at Contractor's expense.

PART 2 PRODUCTS

2.01 SEED MIXTURE

- A. Seed Mixture:
 - 1. ODOT Mix Type Classes 1, 2, 3A, 3B, 3C, or 7

2.02 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.03 ACCESSORIES

- A. Mulching Material:
 - 1. Oat or wheat straw, free from weeds, foreign matter detrimental to

plant life, and dry. Hay or chopped cornstalks are not acceptable.

2. Hemlock species wood cellulose fiber, dust or chip form, free of growth or germination inhibiting ingredients.

B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.

C. Water: Clean, fresh and free of substances or matter, which could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Herbicide.

F. Stakes: Softwood lumber, chisel pointed.

G. String: Inorganic fiber.

2.04 Method Statement

A. Method Statement of Hydroseeding shall be provided to the Engineer at least 10 working days in advance for approval prior to execution. The method statement shall contain, but not limited to, the following items:

1. Seed Mixtures
 - a. Application rate.
 - b. See combination(s) and properties.
2. Fertilizers and Soil Amenders
 - a. Type of fertilizers/soil amenders
 - b. Mix proportions
 - c. Application rate
3. Mulch fibers
 - a. Type of much fibers
 - b. Application rate
4. Binder
 - a. Binder type
 - b. Mix proportions
5. Mixing procedures
6. Spraying equipment
 - a. Equipment for short range application
 - b. Equipment for long range application
 - c. Agitator
 - d. Pressure pump
7. Biodegradable Mat
 - a. Installation procedure

- b. Mat anchor type
- c. Size, length and spacing of mat anchor

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 3 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen sub grade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Topsoil shall be uniform and shall conform with the finished grade shown on the plans or as otherwise designated.
- F. Slopes that have been exposed for a long time must be trimmed and scaled to remove any oxidized layer prior to hydroseeding.

3.03 APPLICATION

- A. Hydroseeding shall be carried out as soon as practicable on slopes and other areas as shown in the Drawings or directed by Engineer within 14 days after the area is cut or filled.
- B. Seeding shall be carried out by means of a proper hydroseeder where approved slurry of seeds, mulch, fertilizers, binders and organic matter are sprayed onto the prepared soil surface.

3.04 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery.
- B. Cover seeded slopes where grade is 1:3 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
 - 1. Lay fabric smoothly on surface, bury top end of each section in 6-inch

(150 mm) deep excavated topsoil trench. Provide 12-inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

2. Secure outside edges and overlaps at 36-inch (900 mm) intervals with stakes.
3. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
4. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Design and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.02 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

- A. Plywood: Solid one side grade; sound, undamaged sheets with clean, true edges.
- B. Lumber: No. 2 or better grade; with grade stamp clearly visible.

2.02 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than 1-1/4 inches diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or affect bond of subsequent surface finish, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners and other justifications: Wood strips, sizes and configurations as detailed.
- D. Formed Construction Joints: Galvanized steel, tongue and groove type, knock-out holes spaced at 6 inches on center, with anchors.

PART 3 EXECUTION

3.01 EARTH FORMS

- A. Earth forms not permitted, except for footings where soil is conducive and approval is received from authorities having jurisdiction and structural engineer.

3.02 ERECTION

- A. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- B. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- C. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.
- D. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- E. Provide chamfer strips on external corners of beams, and columns where they will be exposed to view after completion of construction.
- F. Do not displace or damage vapor barrier.
- G. Construct formwork to maintain tolerances in accordance with ACI 301.
- H. Construct form full depth of concrete to be placed.

3.03 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- D. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

- E. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.05 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Camber slabs and beams as indicated in Drawings and in accordance with ACI 301.

3.06 FORM REMOVAL

- A. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.
- B. Do not damage concrete surfaces during form removal.
- C. Do not place wood forms which cannot be retrieved after concrete placement. Use steel forms.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65.
- B. Conform to ACI 301 and 318.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: ASTM A 615, grade billet-steel deformed bars, uncoated, 60 KSI yield grade; ASTM A 706, grade 40 weldable for bars welded to steel members.
- B. Welded Steel Wire Fabric: ANSI/ASTM A 185 plain type; in flat sheets; uncoated finish.

2.02 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

2.03 FABRICATION

- A. Fabricate in accordance with ACI SP-66
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. Weld reinforcing bars in accordance with ANSI/AWS D1.4.
- D. Provide sufficient lap of splicing of reinforcement, where required, to permit transfer of stress in accordance with requirements of this specification. Splice wall vertical reinforcement at location of horizontal construction joints.
- E. Unless otherwise noted on the drawings to be more, lap reinforcement 36 bar diameters (class "A" lap) at splices or have dowels of same bar section

and spacing as the bars to be spliced. Lap bars at least 36 diameters (class "A" lap) at corners and at abrupt changes in direction of walls. Stagger splices in adjacent bars.

PART 3 EXECUTION

3.01 PREPARATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.

3.02 PLACING

- A. Place reinforcement in accordance with CRSI "Placing Reinforcing Bars" and ACI 318, with provisions of ACI 318 governing.
- B. Move bars as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
- C. If bars are moved more than one bar diameter or enough to exceed tolerances, submit resulting arrangement of bars to Owner's Representative for review.
- D. Place, support and secure reinforcement against displacement. Do not deviate from alignment or measurement. Place in accordance with approved shop drawings and CRSI recommendations. Do not heat, cut or bend bars without Owner's Representative's approval.
- E. Do not displace or damage vapor barrier.
- F. Place reinforcement, at time of concrete placing, free of mud, oil, or other materials that adversely affect or reduce bond.
- G. Reinforcement with Rust, Mill Scale, or Both: Considered satisfactory, provided minimum dimensions, including height of deformation, and weight of hand-wire-brushed test specimen are not less than ASTM A 615 requirements.
- H. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete. Use No. 16 gage black annealed wire at joints and crosses to accurately position reinforcing in place.
- I. Over formwork, use metal or plastic bar chairs and spacers to support reinforcement.

- J. Where concrete surface will be exposed to weather in finished structure, use non-corrosive or corrosion protected accessories within 1/2 inch of concrete surface.
- K. Bars having splices not shown on shop drawings will be subject to rejection.
- L. Do not bend reinforcement after being embedded in hardened concrete.
- M. Do not allow bars to be in contact with dissimilar materials.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Furnishing, forming, placing, finishing, curing and other related work of cast-in-place concrete for water line thrust blocking and other structures as required.

1.02 REFERENCES

- A. ACI 301 – Structural Concrete for Buildings.
- B. ACI 305 - Hot Weather Concreting.
- C. ACI 306 - Cold Weather Concreting.
- D. ACI 308 - Standard Practice for Curing Concrete.
- E. ACI 318 – Building Code Requirements for Reinforced Concrete.
- F. ACI 347 - Recommended Practice for Concrete Formwork.
- G. ASTM C31 – Making and Curing Concrete Test Specimens in the Field.
- H. ASTM C33 - Concrete Aggregates.
- I. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C143 – Slump of Portland Cement Concrete.
- L. ASTM C150 - Portland Cement.
- M. ASTM C156 – Test for Water Retention by Concrete Curing Materials.
- N. ASTM C231 – Air Content of Freshly Mixed Concrete by Pressure Method.
- O. ASTM C260 - Air-Entraining Admixtures for Concrete.
- P. ASTM C309 – Liquid Membrane Forming Compounds for Curing Concrete.

- Q. ASTM C494 - Chemical Admixtures for Concrete.
- R. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- S. ASTM D994 – Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- T. ASTM D1752 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.03 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301 and 318.
- B. Obtain materials from same source throughout the Work.
- C. Conform to ACI 305 when concreting during hot weather.
- D. Conform to ACI 306 when concreting during cold weather.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under Provisions of Section 01700.
- B. Accurately record actual locations of all embedded utilities and components which are concealed from view.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Submit the following information:
 - 1. Gradation of fine and course aggregates – ASTM C33
 - 2. Specific gravity and dry-rodded density of each aggregate.
 - 3. Test of deleterious substances in fine and course aggregate – ASTM C33.
 - 4. Design mix of each individual concrete mix to be used.
 - 5. Previous test results or trial batch results with 7-day and 28-day compressive strengths for each concrete mix proposed.
 - 6. Certified mill test results for cement; identifying brand, type and chemistry of cement to be used.
 - 7. Brand, type, principal ingredient and amount of each admixture to be used.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: Portland type, ASTM C150, Type I, or Type III. Type III shall be used only when permitted by the Engineer. All cement shall be the product of one manufacturer or mill. No industrial slag will be allowed to be used in any concrete mix design.
- B. Fly Ash: All fly ash used as an admixture in Portland cement concrete shall be Class C or F conforming to the requirements of ASTM C618.
- C. Fine Aggregate: ASTM C33.
- D. Coarse Aggregate: ASTM C33, Size 57.
- E. Water: ASTM C94, Clean and not detrimental to concrete.

2.02 ADMIXTURES

- A. Air Entrainment: ASTM C260. MB AE 90 Standard by Master Builders, Darex by Grace Construction Products or equal.
- B. Water Reducing Admixture: ASTM C494, Type A. Pozzolith 220N by Master Builders, WRDA 15 by Grace Construction Products or equal. Water reducing admixture shall not decrease durability, shall increase strength a minimum of 10% and shall not affect bleeding characteristics over referenced mix.
- C. Waterproofing Admixture: antimicrobial crystalline additive by Xypex Bio-San C-500 by Xypex Chemical Corp., or equal. Admixture shall be added at a 1% dosing rate.
- D. Use of calcium chloride is prohibited.

2.03 ACCESSORIES

- A. Bonding Agent: Thorobond by Harris Specialty Chemicals, Inc., Sonocrete by Sonneborn Contech Co., Sonoprep by Sonneborn Contech Co., or equal.
- B. Joint Filler: Expansion joints shall have standard ½-inch thick cork expansion filler; Grace, W.R. Meadows, or equal; meeting ASTM D1752 – Type II. Expansion joints in exterior concrete walks and between concrete walks and other structures shall be ASTM D994 asphalt expansion joint filler, ½-inch thick; Grace, W.R. Meadows, or equal.

- C. Non-shrink grout: Dayton Superior, Master Builders or equal. Minimum compressive strength shall be 5,000 psi at 7 days and 7,500 psi at 28 days.
- D. Patching Additive: ACRYL 60 by Harris Specialty Chemicals, Inc., Sonocrete by Sonneborn Contech Co., or equal.

2.04 WATERSTOPS

- A. PVC waterstops shall be as manufactured by Greenstreak, Inc., W.R. Meadows, Grace Construction Products, or equal. Provide center-bulb type, non-tapered 3/8-inch minimum thickness waterstops manufactured from virgin polyvinyl chloride with no reclaimed/scrapped material or pigment in conformance with Army Corps of Engineers CRD-C-572. The waterstops shall have an integral fastening system consisting of hogrings or grommets.
- B. For non-expansion joints where 6-inch waterstops are required, use Greenstreak, Inc. Profile No 732, W.R. Meadows Catalog #6380, or equal.
- C. For non-expansion joints where 4-inch expansion joints are required, use Greenstreak, Inc. Profile No. 702, W.R. Meadows Catalog #4316, or equal.
- D. For expansion joints where waterstops are required, use Greenstreak, Inc. Profile No. 735, W.R. Meadows Catalog #9380, or equal.
- E. Bentonite waterstop shall be a flexible strip of bentonite waterproofing compound equal to Waterstop-RX as manufactured by the Colloid Environmental Technologies Company (CETCO), Swellstop by Greenstreak, Inc., or equal. The strip shall be 1-inch by 3/4-inch for walls with a double mat of reinforcing and 3/4-inch by 3/8-inch for walls with a single mat of reinforcing.

2.05 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.
- B. All concrete, unless otherwise specified, shall have the following characteristics:
 - 1. Minimum Compressive Strength at 28 days
 - a. Unexposed foundation work: 4000 PSI
 - b. All exposed concrete work (including floors, walls, columns, walks): 4000 PSI
 - 2. Maximum Water Cement Ratio: 0.45

3. Minimum Cement Content
 - a. 4000 PSI mix: 564 LB/CY (6 sacks)
4. Slump – Minimum: 2"
5. Maximum: 4"
6. Air Entrainment: 6 ± 1 percent (all concrete exposed to weather)

C. All concrete designated as "Fill Concrete" shall have the following characteristics:

1. Minimum Compressive Strength at 28 days: 3000 PSI
2. Minimum Cement Content: 376 lb (4 sacks) per cubic yard
3. Slump – Minimum: 1"
4. Maximum: 6"

D. Add an air entraining agent to the mix for concrete exposed to the exterior or subject to freeze-thaw cycling.

E. Use waterproofing admixture in any mix that will come in contact with water or wastewater including but not limited to walls, floors, channels and/or building floors. Mix, apply, and cure per Manufacturer's instruction.

F. Use set retarding admixtures during hot weather only when approved by Engineer. Use set accelerating admixtures during cold weather only when approved by Engineer. Only non-chloride accelerators will be considered.

G. No admixture shall be used unless approved in writing by the Engineer.

H. Water shall not be added to the mix at the job site without specific approval by the Engineer.

I. Slump tests shall be taken prior to the addition of any approved water reducing or plasticizing agents.

2.06 FORMS

A. Conform to ACI 301.

B. Forms for exposed surfaces shall produce a smooth surface unless noted otherwise on the drawings.

PART 3 EXECUTION

3.01 CONCRETE FORMWORK

A. Construct and erect concrete formwork in accordance with ACI 301 and ACI 347.

- B. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.
- C. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- D. Arrange and assemble formwork to permit stripping so that concrete is not damaged during its removal.
- E. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.
- F. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- G. Camber slabs and beams to achieve ACI 301 tolerances.
- H. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.
- I. Construct formwork to maintain tolerances in accordance with ACI 301.
- J. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices and embedded items.
- K. Do not apply form release agent where concrete surfaces are scheduled to receive special finishes or applied coverings, which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete

3.02 FORM REMOVAL

- A. Do not remove forms and shoring until concrete has sufficient strength to support its own weight and construction and design loads which may be imposed upon it.
- B. Reshore structural members due to design requirements or construction conditions to permit successive construction.
- C. Do not damage concrete surfaces during form removal.

3.03 JOINTS

- A. Provide keyways in all construction joints. The width of the keyway shall be 1/3 of the wall or slab thickness (3 1/2 inch minimum) by 1 1/2 inch deep, unless otherwise shown on the drawings.
- B. Provide control joints in sidewalks spaced approximately 5 feet on center and expansion joints at approximately 20 feet on center. Expansion joints shall also occur adjacent to all construction items in place when walks are poured.
- C. Control joints may be saw cut using a 3/16 inch thick blade, cutting 1/3 into the depth of the slab thickness. Saw cut control joints shall be made no sooner than 4 hours and no later than 24 hours after finishing is completed.

3.04 PREPARATION

- A. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, held securely and will not cause hardship in placing concrete. Reinforcing bars shall clear embedded items by a minimum of 2 inches.
- B. Prepare previously placed or existing concrete by cleaning with a steel brush and removing all foreign matter and laitance. Existing concrete is defined as concrete more than six months old.
 - 1. Saturate surface with water 24 hours before pouring new concrete.
 - 2. Immediately before placing new concrete, remove any standing water and apply bonding agent. Bonding agent shall be applied in accordance with manufacturer's recommendations.
- C. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- D. When patching existing concrete, remove poor concrete until firm, hard concrete is exposed, roughen and clean surface of the existing concrete and clean any exposed reinforcing bars and pour new concrete. Concrete finish to match existing concrete. New concrete shall be 4,000 psi, 28-day strength mixed with patching additive, mixed according to the manufacturer's recommendations. Concrete shall not be air entrained.

3.05 PLACING CONCRETE

- A. Before placing concrete, all equipment, forms, ground, reinforcements, and other surfaces with which the concrete will come into contact are to be

thoroughly cleaned of all debris, ice and water. Ground shall be wetted prior to placement of concrete on it.

- B. After reinforcement is placed and before it is covered with concrete, the Engineer shall be allowed sufficient time to observe the reinforcing.
- C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.
- D. Place concrete in accordance with ACI 301.
- E. Hot Weather Placement: ACI 301 and ACI 305.
- F. Cold Weather Placement: ACI 301 and ACI 306.
- G. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- H. The method of placing the concrete shall be such to insure against separation of materials.
- I. Place concrete continuously between predetermined construction and control joints in layers not exceeding 18 inches in depth. Do not break or interrupt successive pours such that cold joints occur.
- J. Placement of concrete shall be completed within one hour after the introduction of mixing water.
- K. All concrete shall be consolidated by vibrating. A spare vibrator shall be kept on the job during all concrete placing operations.
- L. Care shall be taken to avoid an excess of water on the concrete surface. Excess water shall be drained or otherwise removed from the surface. Dry cement or a mixture of cement and sand shall not be sprinkled directly on the surface to absorb water.
- M. Concrete is not to be placed under water. A suitable means shall be provided for lowering the water level below the surfaces upon which concrete is to be placed. This may require excavating approximately 12 inches below the bottom of the concrete surface and refilling with gravel and compacting. The ground water shall not be allowed to rise to the bottom of the concrete until 24 hours after the concrete pour has been completed. Water shall not be allowed to fall upon or run across the concrete during this period.

- N. No extra payment will be allowed for dewatering, undercutting and gravel fill.

3.06 CURING

- A. Concrete curing shall be in accordance with ACI 301 and ACI 308.
- B. Beginning immediately after placement, concrete shall be protected from premature drying, excessive hot or cold temperatures and mechanical injury.
- C. For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing.
 - 1. Ponding.
 - 2. Application of absorptive mats or fabric kept continuously wet.
 - 3. Application of waterproof sheet materials conforming to ASTM C171.
 - a. Seal all edges and joints.
 - 4. Application of liquid membrane-forming curing compound conforming to ASTM C309. Curing compound shall not be used on surfaces to which additional concrete or other material (hardeners, weatherproofing, paint, adhered floor coverings, etc.) is to be bonded.
- D. For concrete surfaces in contact with forms the following procedures shall be followed:
 - 1. Moisture loss from surfaces placed against forms exposed to the sun shall be minimized by keeping the forms wet.
 - 2. After the concrete has hardened and while the forms are still in place, form ties shall be loosened and water applied to run down the inside of the form to keep the concrete wet.
 - 3. Immediately following form removal, surfaces shall be kept wet by a water spray or water saturated fabric. Liquid membrane-forming curing compound conforming to ASTM C309 may be used with the previous restrictions still applying.
 - 4. Curing procedures shall be continued for at least 7 days. One procedure may be replaced by another any time after the concrete is one day old.

3.07 FINISHING

- A. Flat Work:
 - 1. Floated Finish – Place, consolidate, strike off, and level concrete, eliminating high spots and low spots. Do not work concrete further until it is ready for floating. Begin floating with a hand float, a bladed power

float equipped with float shoes, or a power disk float when bleed water sheen has disappeared and the surface has stiffened sufficiently to permit the operation. Immediately refloat the slab to a uniform texture.

2. Light Troweled Finish – Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks.
3. Hard Troweled Surface – Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled.
4. Tolerance for all concrete floors shall be 1/4-inch within 10 feet in any direction. Straight edge shall be furnished by the Contractor.
5. Broom or Belt Finish – Immediately after concrete has received a floated finish, give the concrete a course transverse scored texture by drawing a broom or burlap belt across the surface.
6. The above finishes shall be used in the following locations:
 - a. Float Finish – Surface to receive roofing, waterproofing or sand bed terrazzo.
 - b. Light Troweled Finish – Submerged tank slabs.
 - c. Hard Troweled Finish – Building floors.
 - d. Broom or Belt Finish – Exterior slabs, sidewalks, tops of walls, and tank slabs to receive grout topping.

B. Formed Surfaces:

1. Within two days after removing forms, and prior to the application of a curing compound, all concrete surfaces shall be observed and any poor joints, voids, stone pockets or other defective areas shall be patched at once before the concrete is thoroughly dry. Defective areas shall be chipped away to remove all loose and partially bonded aggregate. The area shall be thoroughly wetted and filled with as dry as practical mortar mix placed to slightly overfill the recess. Mortar shall include a bonding agent. After a partial set has taken place, the excess mortar shall be removed flush with the surface on the concrete using a wood float. All cracks, leaks or moist spots which appear shall be repaired to the satisfaction of the Engineer. No extra compensation shall be allowed the Contractor for such work.
2. The exterior or removal portion of non-removable form ties shall be removed with the use of a special tool designed for this purpose. Cutting or chipping of concrete to permit removal of the exterior portion will not be permitted.
3. For non-removable ties, tie rod holes left by the removal of the exterior portion of the tie and cone shall be thoroughly wetted and filled by ramming with as dry as practical mortar mix in such a manner as to insure complete filling of the hole. Mortar shall include a bonding agent. All patching shall be cured, protected and covered as specified for

concrete. The holes are to be filled immediately after removal of the exterior portion of the tie.

4. Holes left by removable ties shall be filled by installing a neoprene plug near the center of the wall. The balance of the hole shall be filled with mortar as specified to within 1-inch of the face of the wall. The remainder of the hole shall be filled with a waterproofing compound.
5. All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown or prescribed by the Engineer. All surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness. All sharp angles, where required, shall be rounded or beveled. Any formed surface to be painted shall be free from any material that will be detrimental to the paint. The surface of the concrete shall be given one of the following finishes immediately after form stripping:
 - a. Finish 1 shall be referred to as a sack finish. Surfaces shall be free of contaminants prior to sacking. After wetting the surface, a grout shall be rubbed in using a rubber float or burlap. After the grout hardens sufficiently, it shall be scrapped from the surface with the edge of a steel trowel without disturbing the grout in the air holes. After further drying, the surface shall be rubbed with burlap to remove all surface grout. The entire surface shall be finished to secure a continuous, hard, dust-free and uniform texture surface free from pinholes and other minor imperfections. Where steel faced forms are used to form walls, the portion of the wall to receive the sack finish shall first be roughed by brush blasting or other approved method to achieve a texture similar to 40-60 grit sandpaper.
 - b. Finish 2 shall be the same as Finish 1, except that the final burlap rubbing may be omitted, providing the steel trowel scraping removes the loose buildup from the surface.
 - c. Finish 3 shall be referred to as a finish which has surface imperfections less than 3/8-inch in any direction. Surface imperfections greater than 3/8-inch shall be repaired or removed and the affected areas neatly patched.
 - d. Finish 4 shall be the finish for surfaces which may be left as they come from the forms, except that tie holes shall be plugged and defects greater than 1/2-inch in any dimension shall be repaired.
 - e. The above finishes shall be used in the following locations:
 - 1) Finish 1 – Provided for all surfaces to be painted, interior surfaces of equipment rooms, operation areas, and permanently exposed vertical surfaces.
 - 2) Finish 2 – Provided for waterproof and moisture proof coated surfaces.
 - 3) Finish 3 – Provided for interior surfaces of wet wells, tanks and channels from 1 foot below the minimum water surface and down and otherwise unfinished interior surfaces.

- 4) Finish 4 – Provided for surfaces to be buried or covered by other construction such as masonry veneer.

- C. All precautions shall be taken to protect concrete from stains or abrasions and any such damage shall be removed or repaired under this Contract.

3.08 LOADING OF CONCRETE STRUCTURES

- A. No concrete structure or portion thereof shall be loaded with its design load until the concrete has obtained its specified 28-day compressive strength. This shall include but not be limited to vertical live load, equipment loading, water loading, groundwater loading, and backfill load. Concrete strength at the time of loading shall be determined by testing field cured concrete cylinders.
- B. Extreme care shall be taken to assure that construction loads do not exceed design loading of the structure.

3.09 WATER TEST

- A. When requested by the Engineer, liquid retaining structures shall be water tested by the Contractor before being faced with masonry or backfilled. Generally, concrete structures separating liquid from occupied spaces, above grade tanks with veneer cladding or tank structures exposed to weather shall be tested. The Engineer reserved the right to request the Contractor to water test any liquid retaining structure. The structure shall be filled with water, kept full for a minimum of 24 hours, leaks or moist areas marked and the structure or surrounding area drained.
- B. Prior to testing, the structures shall be thoroughly cleaned and washed down. All shrinkage cracks shall be repaired from the inside by grooving the concrete and applying primer and caulk. Caulk shall be one part polyurethane as specified in Section 07900 – Caulking and Sealants. Honeycombs and other imperfections shall also be repaired to provide a leakage free structure. Where the tank is scheduled to retain potable water, the repairs and materials utilized shall be suitable for this application.
- C. Repairs shall be made from the face of the concrete which is subjected to water pressure. Method of repair shall be reviewed by the Engineer.
- D. Testing of the structure shall not take place until the last of the concrete placed in the structure has developed 28-day design strength as determined by testing field cured concrete cylinders.
- E. After repair, the structure shall again be tested as above. Testing and repair shall continue until all leaks or moist spots have disappeared to the

satisfaction of the Engineer. Unless otherwise stated, water for testing shall be supplied by the Contractor.

3.10 NON-SHRINK GROUT

- A. Non-shrink, nonmetallic grout shall be used for filling recesses and pockets left for equipment installation and for setting of base plates. The material used shall be approved by the Engineer. Store, mix and place the non-shrinking compound as recommended by the manufacturer.

3.11 CONCRETE TESTING AND SAMPLING

- A. The following tests of fresh concrete shall be performed by the Contractor at his expense. The Contractor shall prepare, protect, transport and have tested all cylinders at his expense.

1. Cylinders:

- a. Three test cylinders shall be made for each pour less than 25 cubic yards, 4 test cylinders shall be made for each pour between 25 and 100 cubic yards and 8 cylinders shall be made for each pour in excess of 100 cubic yards. Each concrete mix shall be represented by at least 4 cylinders for the entire job. Concrete for cylinders shall be collected near the middle of the load and/or as requested by the Engineer.
 - b. Cylinders shall be made and tested in accordance with ASTM C31 and ASTM C39, respectively. The cylinders shall be kept moist and at temperatures between 60°F and 80°F, and shall remain undisturbed and stored in a location free from vibration. In hot weather, the cylinders shall be covered with wet burlap and stored in a shaded area. It is the Contractor's responsibility to provide a suitable protected location for storing the cylinders on the job site.
 - c. After 24 hours, the cylinders shall be transferred to an independent testing laboratory acceptable to the Owner. The cylinders shall be packed in sawdust or other cushioning material for transit to avoid any bumping or jarring during transport.
 - d. Cylinders shall be broken at 7 days and 28 days or as requested by the Engineer. Test results shall be mailed immediately following compression testing and shall be directed to the Engineer unless otherwise directed in writing by the Owner. The documentation of the test data shall include the date and location of the the pour from which the sample was obtained and the concrete mix utilized.
2. Slump Test: The Contractor shall make one slump test at the beginning of all pours with two test being made for pours in excess of 25 cubic yards or as requested by the Engineer. Slump tests shall conform to ASTM C143. The Contractor shall furnish the Engineer with a slump cone and rod to use in performing extra tests if requested.

3. Air Test:

- a. When air-entrained concrete is used, the air content shall be checked by the Contractor at the beginning of all pours with at least two checks being made for all pours in excess of 25 cubic yards.
- b. The air content shall be checked using the pressure method (ASTM C231). Pocket-sized alcohol air indicators shall not be used unless they are first checked in conjunction with the pressure method test.
- c. The Contractor shall furnish, and make available to the Engineer, all equipment necessary for making extra tests of air content.

B. All costs of additional testing and sampling of fresh or hardened concrete needed because of suspected or actual violation of the specifications shall be at the expense of the Contractor.

C. Core tests:

1. Provide only when specifically so directed by the Owner because of low cylinder test results.
2. Cut from locations directed by the Owner, securing in accordance with ASTM C42, and prepare and test in accordance with ASTM C39.

3.12 RECORDS

A. A record is to be kept of all concrete work. The record shall include the date, location of pour, concrete mix, slump, air content, test cylinder identification, concrete temperature and ambient air temperature. In addition, for cold weather concreting the record shall include the daily maximum-minimum thermometer readings of all thermometers during the curing period for all concrete pours. The project representative will keep this record and the Contractor shall assist in obtaining the needed information.

3.13 SIDEWALKS AND EXTERIOR SLABS

- A. Sidewalks shall be constructed where shown on the drawings. They shall be a minimum of 4 inches thick and shall slope away from buildings or structures at a rate of ¼-inch per foot. Concrete shall be as previously specified.
- B. Sidewalks shall be constructed on a minimum of 4 inches of compacted granular fill. They shall have tooled joints of 1-inch minimum depth at approximately 5-foot centers with ½-inch preformed expansion joint filler at approximately 25-foot centers with one at all corners, and located anywhere sidewalks abut structures and buildings.

3.14 CONCRETE REINFORCEMENT INSPECTING AND TESTING

A. Prior to use, test all reinforcement steel bars for compliance with the specified standards.

1. Material identified by mill test reports, and certified by the testing laboratory, does not require additional testing. Require the supplier to furnish mill test reports to the testing laboratory for certification.
2. Tag identified steel at the supplier's shop. When steel arrives at the job site without such tags, test it as unidentified steel.

B. Unidentified steel:

1. Have testing laboratory select samples consisting of two (2) pieces of each size, each 18" long.
2. Have the testing laboratory make one tensile test and one bend test for each 2-1/2 tons of fraction thereof of each size of unidentified steel.

C. Provide continuous inspection for all welding of reinforcement steel.

3.15 DEFECTIVE CONCRETE

A. Concrete not conforming to required lines, details, dimensions, finishes tolerances or specified strength requirements shall be defined as defective concrete.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

D. If, according to the Engineer, the defects in the concrete can not be patched successfully or if the patch is unsatisfactory from the standpoint of appearance or structural integrity, the entire section of concrete shall be removed and replaced at the Contractor's expense.

3.16 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

- D. The area to be patched shall be cleaned and all defective concrete removed down to sound concrete. The area and an area at least 6 inches wide surrounding it shall be saturated with water.
- E. A bonding agent shall be applied prior to placing the patching mortar.
- F. The patching mortar shall be made of the same materials and proportions as used for the concrete, except the coarse aggregate shall be omitted.
- G. On all exposed concrete, sufficient white Portland cement shall be substituted for the regular cement to produce a color matching finish.

3.17 DISINFECTION AND TESTING

- A. All concrete tanks designated to retain potable water shall be disinfected and tested prior to being placed into service.
- B. Disinfection procedures shall be implemented only after a satisfactory water retaining test has been completed.
- C. Disinfection procedures applied shall be in accordance with AWWA C652.
- D. Upon completion of the disinfection procedures, the Contractor shall obtain the necessary samples and coordinate testing of the facility. Two consecutive satisfactory samples shall be obtained, a minimum of 24 hours apart, prior to placing the tank into service.

3.18 CONCRETE SEALANT

- A. Apply one coat of sealer as soon as practicable after finishing. If a curing compound is used, the Contractor shall verify compatibility with the sealer.
- B. At completion of the project, clean surface thoroughly with detergent and rinse. Apply a second coat of sealer in accordance with the manufacturer's instructions.
- C. If detergent and rinse does not remove all dirt and staining, acid etch or shot blast surface to obtain clean, uniform surface. Apply two coats of sealer following manufacturer's directions.
- D. The Contractor is responsible for protection of floor slabs from staining or other damage during the construction period.

END OF SECTION

SECTION 03355

CONCRETE FLOOR FINISHING AND CURING

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Conform to ACI 301.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature during curing period above 70 degrees F for 3 days or above 50 degrees F for 5 days.
- B. Protect from rain or running water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. Sonneborn Building Products
 - 2. L & M Construction Chemicals
 - 3. Secure, Inc.
 - 4. Dayton Superior
 - 5. Burke
 - 6. Or approved equal
- B. Substitutions: Refer to Section 01600.

2.02 MATERIALS

- A. Sodium Silicate Compounds: Zero-VOC water-based sodium silicate compound in solution. Clear. Non-membrane forming. Compounds in suspension not permitted.
 - 1. Compatible with subsequent coatings and toppings without stripping.
 - 2. Acceptable Products:
 - a. Sinak S-102, Sinak Corp., San Diego, CA
 - b. L&M Cure, L&M Construction Chemicals, Omaha, NE.
 - c. Eucosil, Euclid Chemical Company, Cleveland, OH.
 - d. Ashford Formula, Crecrete Distribution Inc.
 - e. Or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify floor surfaces are acceptable for application of this work.
- B. Ensure floor surfaces are depressed to accommodate finish materials.
- C. Beginning of installation means acceptance of surfaces.

3.02 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration.
- C. Manually float surfaces which will receive ceramic tile with full bed setting system.
- D. Steel trowel surfaces to receive carpeting, resilient flooring, seamless flooring, thin set ceramic tile, and surfaces to be left exposed.
- E. Apply hardener/sealer in accordance with manufacturer's instructions on scheduled floor surfaces.

3.03 TOLERANCES

- A. Maintain surface flatness to ACI 302 of Ff30 and levelness of FI25 for floors to receive carpet, resilient surfaces, thin set tile, and surfaces to be left exposed; maintain flatness to Ff15 and levelness to FI13 for recessed sub-slabs. Test flatness and levelness in accordance with ASTM E 1155.
- B. In areas of floor drains, maintain floor level at walls and slope surface uniformly to drains at 1/8 to 1/4 inch per foot.

3.04 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screening and bull floating, but before power floating and troweling.

- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, or by moisture-retaining cover curing, and by combinations thereof, as herein specified.
 - 1. Provide moisture curing by the following Method 1:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.
 - 2. Provide moisture-cover curing by the following Method 2:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Provide curing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
 - a. Apply specified curing 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 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
 - c. Apply in accordance with manufacturer's instructions and ACI 301.
 - d. Do not apply curing compound on surfaces to receive applied coatings and finishes. Use other methods specified herein.

END OF SECTION

SECTION 03410

PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The Contractor shall provide all labor, materials, tools, and equipment required to furnish and install precast structures, as shown on the drawings and specified herein, including all miscellaneous or incidental items required, but not listed.
- B. Related work specified elsewhere includes, but is not limited to:
 - 1. Section 02200, Earthwork and Site Preparation
 - 2. Section 02240, Dewatering
 - 3. Section 02275, Erosion and Sediment Control
 - 4. Section 03300, Cast-In-Place Concrete

1.02 SUMMARY

- A. This section includes precast structural concrete units, including the following:
 - 1. Pumping Station Vaults
 - 2. Valve & Meter Vaults

1.03 SUBMITTALS

- A. Product data: For each type of product indicated.
- B. Design mixes: for each concrete mix.
- C. Shop Drawings: detail fabrication 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. Contractor shall provide copies of certificates for welding procedures and personnel.
 - 2. Indicate locations and details of anchorage devices to be embedded in other construction.
 - 3. Comprehensive engineering analysis certified by qualified professional engineer responsible for its preparation.

D. Materials:

1. Contractor shall provide test report from a qualified testing agency indicating and interpreting test results.
2. Contractor shall provide materials certificates, signed by manufacturers certifying.

1.04 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. Manufacturer 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 and be responsible for the structural integrity and design of the unit according to the soil conditions and loads. This responsibility includes preparation of shop drawings and comprehensive engineering analysis by a registered structural professional engineer.
 2. The manufacturer of the work of this Section shall provide a qualified field personal at the Site.
 3. The manufacturer of the precast structures shall be responsible for the structural integrity and design of the unit according to the soil conditions.
 4. The structure shall be as manufactured by United Precast, Inc., Mack Industries or Engineer approved equivalent.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide all labor, materials, tools, and equipment required to furnish and install the precast structures, as shown on the drawings and specified herein.

2.02 MATERIALS

- A. The structure shall be constructed of reinforced concrete with a minimum 5,000 PSI at 28-day compressive strength. Concrete reinforcing bars shall meet the requirements of ASTM A615 or A617 and shall be grade 60 reinforcing steel. Cement shall be type I or type III Portland cement.

- B. The thickness of the precast wall panels shall be the result of a structural design and shall be tongue and groove interlocking. All walls and joints shall be watertight. Joints between wall panels shall be made watertight by caulking with Sikaflex 1-A. After the caulking has dried the interior joints shall be sealed with a single coat of Sikagard-62.

2.03 VAULTS

- A. Materials: Precast concrete per ASTM C478.
- B. Joint Seals: Watertight rubber gasket per ASTM C443.
- C. Precast concrete supplier shall consider all possible loads and load combinations per ASTM Standards in the precast concrete design calculations, including any buoyant forces resulting from the elevated water tables.
- D. Precast concrete supplier shall coordinate with the Contractor to obtain the location of mounting plates, where required.
- E. All concrete structures shown in scope of work may be precast concrete provided the structure meets all requirements listed in the Drawings and Specifications. No additional compensation shall be provided for substitution of precast structures.

2.04 APPURTENANCES

- A. All appurtenances, excluding valve vaults, as shown on the construction drawings (i.e., hatches, baffles, vents, piping, fittings, railings, and brackets) shall be provided by the General Contractor to create a complete, operational and functional structure.
- B. Steps in accordance with ASTM C-478 and installed with a uniform vertical spacing of 12 to 16 inches.

2.05 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 PCL MNL 116 requirements, including the following:
 - 1. Units fail to comply with compressive strength test requirement.
 - 2. Reinforcement and pre-stressed tendons of units do not comply with fabrication requirement.
 - 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. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 116 requirements, Contractor shall employ an independent testing agency, chosen by Owner, to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according with ASTM C42.
1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer.
 2. Cores shall be tested, after immersion in water, in a wet condition per ACI 301 if unit will be wet under service conditions.
 3. Cores shall be tested in an air-dry condition per ACI 301 if unit will be dry under service conditions.
 4. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
 5. Test results will be made in writing on the same day that test are performed, with copies to Engineer, Contractor, and precast fabricator. Test report shall include:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name and type of precast concrete unit(s) represented by core test; design compressive strength, type of break, compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
 6. 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.
 7. Costs of all tests shall be the sole responsibility of the Contractor or Prefabricator.

D. MANUFACTURER

1. The structure shall be as manufactured by E.C. Babbert Corp., United Precast, Inc., Mack Industries, or Engineer approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The structure shall consist of a poured in place base slab with cast in sumps if necessary and precast concrete wall panels. All precast items are to be manufactured in a P.C.I. certified facility. Proof of such

certification is required as a part of the pre-approval process.

- B. The excavation shall be free of any water, mud, rocks or other debris. The bottom excavation shall be made level with a mat foundation as shown on plans.
- C. Due to the loaded weight of delivery trucks a firm level access way to site shall be provided.
- D. The excavation shall be clear and accessible.
- E. The structure shall be bedded and backfilled with ODOT Item 304, granular material.
- F. The compaction of granular material shall be performed with hand compaction equipment. Use of heavy compaction equipment next to the structures could cause possible damage including leakage and is not acceptable.

END OF SECTION

SECTION 03415

PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured unit including accessory/inserts and reinforcements.
- B. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to design and provide a complete and operational system installed where noted on the drawings and as specified within these specifications.
- C. Coordinate all work with this plank system and any other associated equipment, with inserts and openings required for other equipment.
- D. Floor and roof planks.
- E. Connection plates, brackets and hangers.
- F. Grouting plank joint keys.
- G. Pipe sleeves and reinforcing for items/equipment that pass through.

1.02 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Supporting steel lintels and headers.
- B. Section 07900 - Joint Sealers: Caulking of butt joints of precast units at exposed underside of floor members.
- C. Section 09900: Interior applied finish.

1.03 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ASTM A36 - Structural Steel.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A416 - Uncoated Seven-Wire Stress-Relieved Steel Strand for

Prestressed Concrete.

- F. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- G. ASTM A666 - Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications.
- H. ASTM C150 - Portland Cement.
- I. AWS D1.1 - Structural Welding Code.
- J. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- K. PCI - Manual For The Design of Hollow Core Slabs.
- L. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
- M. PCI MNL-120 - Design Handbook - Precast and Prestressed Concrete.
- N. PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.
- O. PCI MNL-124 - PCI Design for Fire Resistance of Precast Prestressed Concrete.
- P. PCI - Design Handbook - Precast and Prestressed Concrete.
- Q. PCI - Tolerances for Precast and Prestressed Concrete.
- R. UL - Underwriters' Laboratories Inc., Fire Resistance Directory.

1.04 DESIGN REQUIREMENTS

- A. Size components to withstand design loads in a restrained and/or unrestrained condition as follows:
 - 1. Roof Assembly: 40 psf live loads.
- B. Maximum Allowable Deflection of Roof Planks: $1/180$ span, cambered to achieve slope to drain.
- C. Maximum Allowable Deflection of Floor Planks: $1/240$ span, cambered to achieve flat surface under dead load.
- D. Design components to accommodate construction tolerances, deflection of

other building structural members and clearances of intended openings.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, factory poured openings, openings intended to be field cut, and relationship to adjacent materials. Drawing to be sealed by a Registered Professional Engineer of the State of Ohio.
- C. Product Data: Indicate standard component configuration, design loads, deflections, and cambers.
- D. Design calculations and sketches generated by a Registered Professional Engineer of the State of Ohio, reflecting design parameters used, size selection and reinforcing of openings and supports.
- E. Fabricator's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with the requirements of PCI MNL-116, PCI MNL-123, and PCI MNL-120.
- B. Maintain plant records and quality control program during production of precast planks. Make records available upon request.
- C. Maintain one copy of shop drawings on site.
- D. All units shall have a two (2) hour unrestrained UL fire rating label.

1.07 QUALIFICATIONS

- A. Fabricator: Company specializing in manufacturing the work of this section with five years' experience.
- B. Erector: Company specializing in erecting the work of this Section with five years' experience approved by fabricator.
- C. Design precast concrete members in accordance with PCI Manual For The Design of Hollow Core Slabs, and state/local codes, under direct supervision of a Registered Professional Structural Engineer experienced in design of this work and licensed in the State of Ohio.

- D. Welder: Qualified within previous 12 months in accordance with AWS D1.1.

1.08 REGULATORY REQUIREMENTS

- A. Conform to ACI 318 and applicable state/local codes for design load and on-site construction requirements.
- B. Conform to UL Assembly No. J-919, to achieve two hour rating.

1.09 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this section, under provisions of Section 01039.
- B. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection. Provide contractor with proper lifting/handling locations.
- C. Mark each member with date of production and final position in structure.

1.11 COORDINATION

- A. Coordinate work under provisions of Section 01039.
- B. Coordinate the Work of framing components associated with the Work of this section.
- C. Coordinate field cut openings with affected section. All field cut openings must be approved by the Registered Professional Engineer, in advance, by the Engineer sealing the shop drawings.
- D. Coordinate location of hanger tabs and devices for mechanical and electrical work.

PART 2 PRODUCTS

2.01 FABRICATORS

- A. Flexicore Systems, Inc.
- B. StresCore Company
- C. Or equal.

2.02 MATERIALS

- A. Materials: ACI 318.
- B. Tensioning Steel Tendons: ASTM A416 Grade 250 K, of sufficient strength commensurate with member design.
- C. Reinforcing Steel: ASTM A615, Grade 40 or 60 deformed steel bars.
- D. Non-shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi (69 MPa) at 28 days.
- E. Concrete - Minimum compressive strength 3500 psi at initial prestress and 5000 psi at 28 days tested in accordance with ASTM C-39.
- F. Portland Cement ASTM C150 – Type I or III.
- G. Admixtures: water reducing, retarding, accelerating, ASTM C494.
- H. Aggregates: ASTM C33 or C330.

2.03 ACCESSORIES

- A. Connecting and Supporting Devices: ASTM A36 carbon steel.
- B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.
- C. Hanger Tabs: Galvanized steel, designed to fit into grouted key joints, capable of supporting 500 lbs (225 Kg) dead load, predrilled to receive hanger.
- D. Bearing Pads: High density plastic, 1/8 inch (3 mm) thick, smooth on one side.
- E. Sill Seal: Compressible glass fiber strips.

2.04 FABRICATION

- A. Conform to AWS D1.4.
- B. Embed anchors, inserts, plates, angles, and other items at locations

indicated.

- C. Provide openings required by other sections. Exact location shall be responsibility of the Contractor.
- D. Cut exposed ends flush.
- E. Frame Opening: Wider than $\frac{2}{3}$ of slab width with structural steel headers designed and supplied by the manufacturer.

2.05 FINISHES

- A. Plant Finish: Finish members to PCI MNL-116 Standard Grade.
- B. Connecting and Supporting Steel Devices: Hot dip galvanized in accordance with ASTM A153.

2.06 FABRICATION TOLERANCES

- A. Maximum Variation From Intended Camber: $\frac{1}{4}$ inch in 10 feet (6 mm per 3 m).
- B. Maximum Out of Square: $\frac{1}{8}$ inch/10 feet (3 mm/3 m), non-cumulative.
- C. Maximum Misalignment of Anchors, Inserts, Openings: $\frac{1}{8}$ inch (3 mm).
- D. Maximum Bowing of Members: $\frac{1}{4}$ inch in 10 feet to a maximum of $\frac{3}{8}$ inch.

2.07 SOURCE QUALITY CONTROL AND TESTS

- A. Provide testing and analysis of site placed concrete and grout under provisions of Section 01400.
- B. Provide shop inspection and testing for stressing tendons.
- C. Test samples in accordance with specified ASTM and ACI standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 01039.
- B. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

- C. Verify supporting structure is ready to receive work.

3.02 PREPARATION

- A. Prepare support devices for the erection procedure and temporary bracing.

3.03 ERECTION

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Align and maintain uniform horizontal and end joints, as erection progresses.
- C. Maintain temporary bracing in place until final connection is made. Protect members from staining.
- D. Install bearing pads at bearing ends of planks.
- E. Adjust differential camber between precast members to tolerance before final attachment and grouting.
- F. Adjust differential elevation between precast members to tolerance before final attachment.
- G. Grout plank joints, trowel smooth.
- H. Tape seal underside of plank joints to prevent grout leakage.
- I. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.
- J. Secure units in place. Perform welding in accordance with AWS D1.1.
- K. Set bearing strips smooth side up.
- L. Set slabs square keeping units tightened at right angles to bearing walls and supporting beams.
- M. Cooperate with other trades in permitting insertion of anchors, hangers, electrical outlets and other lightweight equipment.
- N. Field cut holes only with manufacturer's recommendations.
- O. The General Contractor is responsible for field cutting openings required by other trades.

- P. Cut no prestressing wires or reinforcing steel without the manufacturer's approval.
- Q. Fill grout keys full and strike off flush with top surface.
- R. Insert insulation plugs in end of voids of flat slabs as indicated on Drawings.

3.04 ERECTION TOLERANCES

- A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-116.
- B. Erect to the following tolerances:
 - 1. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch in 10 feet and 3/8 inch in 100 feet (6 mm in 3 m and 9 mm in 30 mm), non-cumulative.
 - 2. Maximum Offset from True Alignment Between Members: 1/4 inch (6 mm).
 - 3. Maximum Variation From Dimensions Indicated on Reviewed Shop Drawings: Plus or minus 1/8 inch (3 mm).
 - 4. Exposed Joint Dimension: 3/8 inch (9 mm) plus or minus 1/4 inch (6 mm).

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01500.
- B. Protect members from damage caused by field welding or erection operations.
- C. Provide non-combustible shields during welding operations.

3.06 CLEANING

- A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

SECTION 04055

MASONRY MATERIALS

PART 1 GENERAL

1.01 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01600.
- B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: MIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
- C. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.
- D. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C 150, Type I, gray color.
- B. Mortar Aggregate: ASTM C 144, standard masonry type.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Quicklime: ASTM C 5, non-hydraulic type.

- E. Grout Aggregate: ASTM C 33, pea gravel uniformly sorted from 3/8 inch to 1/2 inch.
- F. Water: Clean and potable.

2.02 MORTAR MIXES

- A. Mortar for Non-load Bearing Walls and Partitions: ASTM C 270, Type N using the Property Method to achieve 750 psi strength.
- B. Mortar for Reinforced Masonry: ASTM C 270; Type S using the Property Method to achieve 1900 psi strength.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270 and C 780.
- B. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within 2 hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 50 degrees F.

2.04 GROUT MIXES

- A. Bond Beams: 2500 psi strength at 28 days; 9-1/2 inches slump; premixed type in accordance with ASTM C 94.

2.05 GROUT MIXING

- A. Mix concrete in accordance with ASTM C 94.
- B. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

2.06 MANUFACTURERS - REINFORCEMENT, ANCHORAGES, AND ACCESSORIES

- A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:

1. Dur-O-Wal, Inc. Arlington Heights, IL.
2. Heckmann Building Products, Inc., Chicago, IL.
3. Hohmann & Barnard, Inc., Hauppauge, NY.

B. Substitutions: Submit in accordance with Section 01600.

2.07 REINFORCEMENT AND ANCHORAGES

A. Horizontal Joint Reinforcing:

1. Type: Standard truss design, fabricated from ASTM A 82 cold-drawn steel wire.
2. Side Rods: Two or more continuous 9 gage deformed side rods butt welded in same plane to continuous diagonal 9 gage plain cross rod at 16 inches on centers maximum.
3. Size: Standard length 10 to 20 feet; side rods spaced approximately 2 inches less than width of partition or wall in which placed.
4. Finish: Exterior walls; ASTM A 153, Class B-2, minimum 1.5 ounce per square foot zinc coating) hot-dip galvanized.
5. Provide prefabricated tee and corner units.
6. Acceptable product: Dur-O-Wal Truss by Dur-O-Wal or equal.

B. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60, unless noted otherwise on Drawings.

C. Expansion Joint Fillers:

1. Type: Closed cell neoprene complying with ASTM D 1056, Class RE41.
2. Compatible with sealant.
3. Self adhering on one side; 50 percent minimum compressibility.
4. Size: Thickness to suit joint size; depth to allow sealant application.
5. Locations: Vertical expansion joints, horizontal joints at head of masonry terminating below shelf angles, beams, or slabs; other locations as detailed.
6. Acceptable Products: D/A 2010 and 2015 by Dur-O-Wal or equal.

D. Control Joints: Install a vertical control joint every 25' on center, refer to Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Request inspection of spaces to be grouted.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Sections.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove grout spaces of excess mortar.

END OF SECTION

SECTION 04800

MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide unit masonry construction.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
- C. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.
- D. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.03 QUALITY ASSURANCE

- A. Fire Performance for Fire-Rated Brick and Concrete Block Assemblies: ASTM E 119.
- B. Fire Performance for Fire-Rated Glass Block Assemblies: ASTM E 163.
- C. Testing: Independent Testing Laboratory.
- D. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.
- E. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

1.04 RELATED SECTIONS

- A. Section 7190, Water Repellant Treatment: Masonry

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers: ACM Chemistries, Inc.; Blok-Lok Ltd.; CavClear; Clayton; Davis Colors; Dayton Superior; Degussa Admixtures, Inc.; Dur-O-Wal; Endicott Clay Products Co.; ESSROC Cement Corp.; Heckmann Building Products, Inc.; Hohmann & Barnard, Inc.; Innovative Building Products, Inc.; Mortar Net USA Limited; Mulia Inc.; North America Glass Inc.; Oldcastle Architectural Inc.; Pittsburgh Corning Corporation; Powers Fasteners; Quikrete Companies (The); Trenwyth Industries; VETROARREDO North America. Core-Fill 500 – Tailored Chemical Products, Air Krete, CP Chemical Co. or equal.

B. Masonry Applications:

1. Application: Concrete masonry bearing walls.
2. Application: Concrete masonry non-bearing partitions.

C. Concrete Masonry Units:

1. Concrete Masonry Units: ASTM C 90, 1500 f'm compressive strength:
 - a. Normal weight.
2. Size: Face dimension of 7-5/8 inches high by 15-5/8 inches long by width required for application.
3. Concrete Building Brick: ASTM C 55.
4. Special Finish: Standard aggregate, standard finish.
5. Bond Pattern: Running Bond.
6. Integral Water Repellent: Liquid polymeric admixture.

D. Mortar and Grout for Brick and Concrete Masonry Unit Assemblies:

1. Mortar Mix: ASTM C 270, Type S, for reinforced masonry, masonry below grade and masonry in contact with earth and ASTM C 270, Type N, for above-grade load bearing and non-load bearing walls and parapet walls and for interior load bearing and non-load bearing partitions.
2. Mortar Materials: Portland cement, ASTM C 150, Type I or II.
3. Mortar Materials: Masonry cement, ASTM C 91.
4. Mortar Materials: Ready mixed, ASTM C 207, Type S.
5. Mortar Aggregate: Natural color, ASTM C 144.
6. Grout Aggregate: ASTM C 404.
7. Hydrated Lime: ASTM C 207, Type S.
8. Color: Natural color.
9. Color: Colored pigmented mortar where exposed at building exterior and natural color elsewhere.

E. Reinforcing Steel:

1. Reinforcing Bars: ASTM A 615, Grade 60.
2. Reinforcing Bars: ASTM A 615, and ASTM A 775, Grade 60 epoxy-coated.
3. Deformed Reinforcing Wire: ASTM A 496.
4. Welded Wire Fabric: ASTM A 185, plain.
5. Welded Wire Fabric: ASTM A 497, deformed.

F. Reinforcing: Welded wire with deformed side rods.

1. Steel Wire: 9 gauge (.1875 inch) galvanized steel.
2. Steel Wire: 9 gauge (.1875 inch) stainless steel.
3. Type: Truss type.

G. Ties and Anchors:

1. Rigid Anchors: Galvanized steel straps.
2. Post-installed Anchors: Chemical or expansion anchors.

H. Masonry Accessories:

1. Nonmetallic expansion joint strips.
2. Preformed control joint gaskets.

I. Wall Insulation

1. Foamed in Place masonry insulation for thermal, sound and fire resistance.
2. Fire resistance ratings per ASTM E-119; Surface Burning Characteristics per ASTM E-84; Combustion Characteristics per ASTM E-136
3. Mfrs.: Core-Fill 500 – Tailored Chem Products; Air Krete, Inc.; CP Chemical Co.
4. Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant forming a cold setting foam insulation in the hollow cores of CMU's
5. Install per mfr recommendation after all CMU and structural concrete is finished filling all open cells and voids in hollow concrete masonry walls where shown. Install from interior and from bottom up using holes less than 1 inch in diameter and mortar seal all opening priors to finish work.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of Masonry Assemblies:
- B. Comply with PCA Recommended Practices for Laying
- C. Concrete Block, Brick Institute of America BIA Tech Notes, and NCMA TEK Bulletins.
- D. Comply with cold weather and warm weather protection procedures as recommended in BIA Tech Notes.
- E. Sawcut units when required. Maintain uniform joint width. Provide full bed, head and collar joints.
- F. Install lintels and accessories in masonry construction.
- G. Comply with applicable codes and regulations for spacing of ties and horizontal reinforcing.
- H. Provide expansion and control joints in accordance with BIA and NCMA recommendations.
- I. Remove and replace damaged units.
- J. Clean concrete masonry by dry brushing, NCMA TEK No. 28.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated ferrous metal items.
- B. Shop fabricated aluminum items.
- C. Included as applicable and described, all metallic items as specified and as shown on contract documents all necessary components to complete installations as required.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 05510 - Metal Stairs.
- C. Section 05520 - Handrails and Railings.
- D. Section 09900 - Painting: Paint finish.

1.03 REFERENCES

- A. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- B. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- C. AAMA 606.1 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- D. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- E. AAMA 608.1 - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- F. ANSI A14.3 - Ladders, Fixed, Safety Requirements.

- G. ASTM A36 - Structural Steel.
- H. ASTM A276 – Stainless Steel Bars and Shapes.
- I. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- K. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- L. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- M. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- N. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- O. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- P. ASTM B26 - Aluminum-Alloy Sand Castings.
- Q. ASTM B85 - Aluminum-Alloy Die Castings.
- R. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
- S. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- T. ASTM B210 - Aluminum-Alloy Drawn Seamless Tubes.
- U. ASTM B211 - Aluminum-Alloy Bar, Rod, and Wire.
- V. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- W. AWS A2.0 - Standard Welding Symbols.
- X. AWS D1.1 - Structural Welding Code.
- Y. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.04 SUBMITTALS FOR REVIEW

- A. Section 01310 - Submittals: Procedures for submittals.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.05 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of and stamped by a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located in the State of Ohio.
- B. Welders Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Stainless Steel Bars and Shapes: ASTM A276.
- E. Stainless Steel: ASTM A276.
- F. Pipe: ASTM A53, Grade B Schedule 40.
- G. Bolts, Nuts, and Washers: High Strength ASTM A325, other than high strength A307 galvanized to ASTM A153 for galvanized components.
- H. Welding Materials: AWS D1.1; type required for materials being welded.
- I. Ladders: ANSI A14.3.
- J. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide for carbon steel.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type II Organic zinc rich.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221, Alloy 6063, Temper T5.
- B. Sheet Aluminum: ASTM B209, Alloy, Temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, Alloy 6063, Temper T6.
- D. Aluminum-Alloy Bars: ASTM B211, Alloy 6063, Temper T6.
- E. Aluminum-Alloy Sand Castings: ASTM B26, Alloy.
- F. Aluminum-Alloy Die Castings: ASTM B85, Alloy, Temper.
- G. Bolts, Nuts, and Washers: Stainless steel or steel, galvanized to ASTM A153.
- H. Welding Materials: AWS D1.1; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch 3 mm maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch 1.5 mm.

- C. Maximum Misalignment of Adjacent Members: 1/16 inch 1.5 mm.
- D. Maximum Bow: 1/8 inch 3 mm in 48 inches 1.2 m.
- E. Maximum Deviation From Plane: 1/16 inch 1.5 mm in 48 inches 1.2 m.

2.05 FINISHES - STEEL

- A. Prepare surfaces to be primed in accordance with SSPC SP 2.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat.
- D. Structural Steel Members: Galvanize after fabrication to ASTM A123. Provide minimum 2.0 oz/sq ft (360 g/sq m) galvanized coating.
- E. Non-structural Items: Galvanized after fabrication to ASTM A123. Provide minimum 2.0 oz/sq ft (360 g/sq m) galvanized coating.

2.06 FINISHES - ALUMINUM

- A. Finish coatings to conform to AAMA 605.2.
- B. Exterior Aluminum Surfaces: Exterior Hardcoat Two step anodized to clear color, to 0.0007 inch (0.018 mm) thickness. Organic coating to color as selected.
- C. Interior Aluminum Surfaces: AAMA A41 anodized, prepared with a chemical C pre-treatment, anodized to clear color.
- D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.

- B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings or shop drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 ERECTION TOLERANCES

- A. To be true and plumb alignment.

3.05 SCHEDULE

- A. The following Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Bumper and Guard Rails: As detailed; galvanized finish.
- C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- D. Joist Hangers: Joist strap anchors, fabricated per Drawing detail; prime paint finish.
- E. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of joists and masonry; prime paint finish.

END OF SECTION

SECTION 05505

ALUMINUM RAILINGS, GRATING AND STAIRWAY FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the metal fabrications for the handrails, floor grating and access stairs. Grating, handrail and access stairs shall be provided and installed as shown on the drawings. The Contractor shall field verify with the treatment plant operator the location and appropriate connections of each handrail and floor grating.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance. Design, engineer, fabricate, and install the following metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.
 - 1. Top Rail of Handrail Systems: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 300 pounds applied at any point nonconcurrently, vertically downward, or horizontally.
 - b. Uniform load of 100 pounds per linear foot applied vertically and concurrently with a uniform load of 50 lbs/ft applied horizontally.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 pounds applied at any point nonconcurrently, vertically downward, or horizontally.

- b. Uniform load of 50 pounds per linear foot applied nonconcurrently, vertically downward, or horizontally.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
- 3. Floor Gratings: Capable of withstanding a uniform load of 250 pounds per square foot or a concentrated load of 300 pounds per foot of grating width, whichever produces the greater stress. No grating shall be installed which deflects more than $\frac{1}{4}$ inch under a uniform load of 100 pounds per square foot.
- 4. Stairways: Contractors responsibility to verify local ordinances and building codes and shall conform to Aluminum Association Specifications and Guidelines for Aluminum Structures.
 - a. Stair treads and stringers shall be designed for a uniform live load of 100 pounds per square foot and a concentrated vertical load of 300 pounds over an area of 4 square inches.

1.05 SUBMITTALS

- A. General. Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
- B. Product data for products used in miscellaneous metal fabrications, including 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.
 - 1. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.
- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications. Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel," and D1.2 "Structural Welding Code - Aluminum."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- C. Engineer Qualifications. Professional engineer licensed to practice in the State of Ohio and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project. Drawings sealed by a professional engineer shall be provided for all submittals.

1.07 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 delay of work.

PART 2 PRODUCTS

2.01 STAINLESS STEEL

- A. Bar Stock and Shapes. ASTM A 276, Type 304 or 316.
- B. Plate. ASTM A 240, Type 304 or 316.
- C. Bolts and Nuts. ASTM F 593 and ASTM F 594, Type 304 or 316.
- D. Pipe. ASTM A376, Type 304 or 316, Seamless Schedule 40, unless otherwise indicated on the Drawings.
- E. Bird Screen. Type 304, stainless steel wire cloth, minimum wire diameter 0.063 inch, No. 2 mesh.

2.02 ALUMINUM

- A. Extruded Bars and Shapes. ASTM B 221, alloys as follows.
 - 1. 6061-T6 or 6063-T6 for bearing bars of gratings and shapes.
 - 2. 6061-T1 for grating crossbars.

- B. Aluminum-Alloy Floor (Tread) Plate. ASTM B 632, Alloy 6061-T6.
- C. Aluminum Sheet. ASTM B 209, Alloy 6061-T6.
- D. Fasteners for Aluminum Gratings. Use fasteners made of same basic metal as fastened metal or stainless steel fasteners. Do not use metals that are corrosive or incompatible with metals joined.
- E. Rolled Sections. ASTM B 308, Alloy 6061-T6.
- F. Pipe. ASTM B 429, Alloy 6061-T6 or 6063-T6.
- G. Castings. ASTM B 26 or B 85.
- H. Landings. 6000 series aluminum alloy with 6061-T6 for primary structural components.

2.03 GROUT

- A. Non-shrink Nonmetallic Grout. Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
- B. Available Products. Subject to compliance with requirements, non-shrink nonmetallic grouts that may be incorporated in the work include but are not limited to the following:
 - 1. "Bonsal Construction Grout;" W. R. Bonsal Co.
 - 2. "Diamond-Crete Grout;" Concrete Service Materials Co.
 - 3. "Euco N-S Grout;" Euclid Chemical Co.
 - 4. "Kemset;" Chem-Masters Corp.
 - 5. "Crystex;" L&M Construction Chemicals, Inc.
 - 6. "Masterflow 713;" Master Builders.
 - 7. "Sealtight 588 Grout;" W. R. Meadows, Inc.
 - 8. "SonogROUT;" Soneeborn Building Products Div., Rexnord Chemical Products, Inc.
 - 9. "Stonecrete NM1;" Stonhard, Inc.
 - 10. "Five Star Grout;" U. S. Grout Corp.
 - 11. "Vibropruf #11;" Lambert Corp.
 - 12. Engineer approved equal

2.04 FASTENERS

- A. General. Provide stainless steel fasteners unless otherwise indicated. Select fasteners for the type, grade, and class required.

B. Connection Requirements

1. Make connections, not specifically detailed, using Tables I and III, Framed Beam Connections, in the latest edition of the AISC manual. The shop-fabricated portion of structural connections may be bolted, welded, or riveted. Except for connections detailed on the Drawings or specified otherwise, make all field connections with ASTM A 325 high-strength bolts.
2. Connections for miscellaneous metal work not included in the AISC definition of structural steel may be made with unfinished bolts. All unfinished bolts shall be equipped with self-locking nuts or lock washers.
3. Install high-strength bolts using turn-of-nut tightening as described in "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts" as set forth in the AISC manual. Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. Provide a platform or other means of access at each field connection until the connection has been inspected by the Engineer.
4. Field welded connections will not be acceptable for structural steel unless specifically permitted by the Engineer. Where structural or miscellaneous steel connections are welded, all butt and miter welds shall be continuous and where exposed to view shall be ground smooth. In addition, intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

2.05 PAINT AND PROTECTION

A. Protection of Aluminum in Contact with Other Materials

1. Coat aluminum surfaces to be placed in contact with other metals, except stainless steel, or concrete with two coats of a high-build coal tar coating.
2. Coating to be Tnemec "46-465 H.B. Tnemecol," Corchem Corporation "Corchem 146 High Build Coal Tar," or approved equal.
3. Solvent clean and otherwise prepare all surfaces in accordance with the coating manufacturer's recommendations prior to application.
4. Each coat to provide a dry film thickness of at least 10 mils.

2.06 METAL BAR GRATINGS

- A. General. Produce metal bar gratings of description indicated per metal bar grating standard "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM MBG 531-00 "Metal Bar Grating Manual."

B. Fabricate pressure-locked rectangular bar aluminum gratings to comply with requirements indicated below:

1. Mark/Size: Unless otherwise indicated on the Drawings, P-19-4 (pressure-locked with bearing bars 1-3/16 inch on center and cross bars 4 inches on center)/rectangular bearing bar or I-bar sizes as indicated.

C. Aluminum Finish: Mill.

D. Fabricate removable grating sections with trim banding. Include anchors and stainless steel fasteners for attachment to supports.

E. Fabricate cutouts in grating sections for penetrations indicated. Arrange layout of cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge band openings in grating that interrupt 2 or more bearing bars with bars of same size and material as bearing bars.
2. Do not notch bearing bars at supports to maintain elevation.

F. Available Manufacturers. Subject to compliance with requirements, manufacturers offering metal bar gratings that may be incorporated in the Work include, but are not limited to, the following:

1. Alabama Metal Industries Corp.
2. Barnett/Bates Corp.
3. Blaw-Knox Grating Div., Blaw-Knox Corp.
4. IKG Industries.
5. Klemp Corp.
6. McNichols Co.
7. Ohio Gratings, Inc.
8. Seidelhuber Metal Products, Inc.
9. Trueweld, Inc.
10. Engineer approved equal

2.07 ALUMINUM PIPE RAILINGS AND HANDRAILS

A. General. Fabricate pipe railings and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.

B. Aluminum Finish. Class I clear anodized finish, unless otherwise indicated.

- C. Interconnect railing and handrail members by butt-welding, welding with internal connectors, or assembling with flush type fittings using concealed or non-projecting pins and fasteners, at fabricator's option, unless otherwise indicated.
- D. Provide slip joints to facilitate removal of pipe railing at all intersections, changes in direction, or at intervals not to exceed 25 feet in straight runs of railing. The slip joint shall be designed and constructed to provide strength equivalent to a straight section of pipe.
- E. Form changes in direction of railing members as follows:
 - 1. By insertion of prefabricated elbow fittings.
 - 2. By mitering at elbow bends.
 - 3. By bending.
 - 4. By any method indicated above, applicable to change of direction involved.
- F. 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.
- G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- H. Close exposed ends of pipe by welding 3/16-inch-thick aluminum plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is ¼ inch or less.
- I. Toe Boards. Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use 4 inches high x 3/16-inch aluminum plate welded to, and centered between, each railing post.
- J. Brackets, Flanges, Fittings, and Anchors. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.
 - 1. For railing posts set in concrete, fabricate sleeves from steel pipe not less than 6 inches long and with an inside diameter not less than ½ inch greater than the outside diameter of post, with steel plate closure

- welded to bottom of sleeve.
2. For surface mounted railing posts, provide prefabricated aluminum mounting brackets with stainless steel anchors. Coat aluminum surfaces in contact with concrete with bituminous coating.
 3. For removable railing posts, fabricate slip-fit sockets from aluminum pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement. Coat exterior surfaces of sleeves with bituminous coating.

2.08 ALUMINUM STAIRS

- A. General. Fabricate aluminum stairs and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, as per these specifications and contract drawings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of 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.

3.02 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 F (55.5 C).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, 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 AWS recommendations and 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 provide adequate support for intended use.
- 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 miscellaneous metal work 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.

3.03 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 installation of 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 or bolt, as indicated, 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 which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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.
- F. Corrosion Protection. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- G. Expansion Anchors. Comply with anchor adhesive manufacturer's recommendations for:
 - 1. Location, spacing, depth of embedment, and installation of anchor.
 - 2. Drilling, cleaning, and preparation of holes to receive anchors.

3.04 INSTALLATION OF METAL BAR GRATINGS

- A. General. Install gratings to comply with recommendations of NAAMM grating standard referenced under Part 2 that apply to grating types and

bar sizes indicated, including installation clearances and standard anchoring details.

- B. Secure units to supporting members with stainless steel clips and fasteners.

3.05 INSTALLATION OF PIPE RAILINGS AND HANDRAILS

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
 - 1. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-reactive setting cement, mixed and placed to comply with anchoring material manufacturer's directions.
 - 2. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1½-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
 - 1. Use type of bracket with pre-drilled hole for exposed bolt anchorage.
 - 2. For concrete and masonry anchorage, use stainless steel epoxy set anchors.

END OF SECTION

SECTION 05530

GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed floor, mezzanine, stair tread and gratings.
- B. Flat surface floor, stair tread plating.
- C. Perimeter closure.

1.02 RELATED SECTIONS

- A. Section 03100-Concrete Formwork. Placement of grating frames in concrete.
- B. Section 05500 - Metal Fabrications.
- C. Section 05505 - Metal Stairs: Framing for grating and stair treads.
- D. Section 09900 - Painting: Field paint finish.
- E. Section 06600 - FRP grating - glass fiber reinforcement.

1.03 REFERENCES

- A. ASTM A36/A36M - Structural Steel.
- B. ASTM A123 - Zinc (Hot Galvanized) Coatings on Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
- D. ASTM A510 - Wire Rods and Coarse Round Wire, Carbon Steel.
- E. ASTM A525 - Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process.
- F. ASTM A569/A569M - Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.
- G. ASTM B210 - Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

- H. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- I. AWS D1.1 - Structural Welding Code.
- J. AWS D1.2 - Structural Welding Code - Aluminum.
- K. AWS A2.0 - Standard Welding Symbols.
- L. NAAMM A202.1 - Metal Bar Grating Manual.
- M. SSPC - Steel Structures Painting Council: Steel Structures Painting Manual.

1.04 PERFORMANCE REQUIREMENTS

- A. Aluminum Grating-Design Live Load: Uniform load of 200 lb/sq ft minimum; concentrated load of 2,000 lb force and shall not produce a fiber stress exceeding 12,000psi.
- B. Maximum Allowable Deflection Under Live Load: $1/240$ of span; size components for single span.
- C. Maximum Spacing between Bars: Bars at maximum spacing of one and three-sixteenths inches center to center and cross bars of three-sixteenths inch minimum thickness at maximum spacing of four inches center to center.

1.05 SUBMITTALS FOR REVIEW

- A. Section 01310 - Submittals: Procedures for submittals.
- B. Product Data: Provide manufacture's name, grating type, span and deflection tables, and frame details.
- C. Shop Drawings: Indicate details of gratings, plates, component supports, anchorage, openings, perimeter construction details, and tolerances.
- D. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.06 SUBMITTALS FOR INFORMATION

- A. Section 01310 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate special requirements of

opening, perimeter framing.

1.07 QUALITY ASSURANCE

- A. Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Ohio.
- B. Welders' Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.08 PROJECT CONDITIONS

- A. Section 01039 - Coordination and Meetings.
- B. Coordinate the Work with placement of frames, tolerances for placed frames and concrete openings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. IKG – Borden or equal.
- B. Substitutions: Permitted upon approval by the Engineer.

2.02 MATERIALS

- A. Formed Stainless Steel Plates: To shapes indicated shape, with raised lug pattern;
- B. Aluminum for Pressure Locking: ASTM B221 extruded or drawn seamless aluminum alloy of shapes indicated.
- C. Cross Bars: ASTM A510 where applicable
- D. Welding Materials: AWS D1.1 type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide where applicable.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type II Organic zinc rich.
- G. All gratings shall be a minimum one inch in depth.

2.03 ACCESSORIES

- A. Fasteners and Saddle Clips: Stainless steel.
- B. Perimeter Closure: Of same material as grating.
- C. Aluminum angle frames shall be set in concrete as indicated on the Drawings. Where a wall forms one side of an opening an angle support shall be anchored in the wall. Support frames shall be continuous wherever possible, with corners mitered, welded and the top surface ground smooth. Coat b
- D. Edge Banding: Banding at edges, at intermediate panel edges for Aluminum unless otherwise noted on drawings.

2.04 FABRICATION

- A. Fabricate grates and plates to accommodate design loads to sizes indicated.
- B. Mechanically clinch joints of intersecting metal sections by swaging or pressing. Notching or cutting of top or bottom flanges of bearing bars to receive cross bars will not be permitted.
- C. Fabricate support framing for all openings.
- D. Top Surface: Serrated, Non-slip.
- E. Bearing Bar: 1 3/16 inch spaced on centers.
- F. Cross Bar: 3/16 inch minimum thickness at maximum 4 inch centers.
- G. Removable Panels: With vandal resistant recessed finger lift rings.

2.05 FINISHES

- A. Stainless Steel: No. 4 finish.
- B. Non-slip Surfacing: Serrated Aluminum for outdoor locations.
- C. Smooth Surfacing: Aluminum oxide for indoor locations.
- D. Non-slip Surfacing: Chemical resistant resin all cuts factory sealed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes and dimensional tolerances are acceptable.
- B. Verify that supports or anchors are correctly positioned.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Place frames in correct position, plumb and level.
- C. Anchor by bolting through saddle clips or flange blocks.
- D. Set perimeter closure flush with top of grating and surrounding construction.
- E. Secure to prevent movement.
- F. All grating installed in concrete openings with perimeter angle frames shall be removable unless otherwise noted on the Drawings. Gratings designated as fixed shall be firmly fastened in place with approved fasteners. Grating at platforms shall be fastened, provide approved fasteners spaced not more than 18 inches center to center. Grating shall not be welded to supporting members unless noted on the Drawings. FRP grating shall have cut ends sealed with resin.

3.03 TOLERANCES

- A. Conform to NAAMM A202.1.
- B. Maximum Space Between Adjacent Sections: 1/4 inch.
- C. Maximum Variation From Top Surface Plane of Adjacent Sections: Joints between grating panels shall be not less than one-sixteenth inch nor more than three-eighths inch. After installation all grating shall provide a flat, even, uniform, non-rattling bearing on the supports.

3.04 CLEANING

- A. Section 01700 - Contract Closeout: Cleaning installed work.

3.05 SCHEDULES

- A. Not applicable. Furnish as required and as noted on Drawings

END OF SECTION

SECTION 06114

WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof curbs, cants, and perimeter nailers.
- B. Blocking roof soffit and fascia.
- C. Blocking in wall and roof openings.
- D. Wood framing, furring and grounds.
- E. Concealed wood blocking for support of toilet and bath accessories, wall cabinets and wood trim. As applicable.
- F. Telephone and electrical panel back boards.
- G. Concealed wood frame - blocking for ceiling.
- H. Preservative treatment of wood. As applicable.

1.02 RELATED SECTIONS

- A. Section 03415 - Precast Concrete Hollow Core Planks: Concrete openings to receive wood blocking. As applicable.

1.03 REFERENCES

- A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
- B. ANSI A208.1 - Mat-Formed Wood Particleboard.
- C. APA (American Plywood Association).
- D. AWPA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.
- E. AWPA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- F. NFPA (National Forest Products Association).
- G. RIS (Redwood Inspection Service).

- H. SPIB (Southern Pine Inspection Bureau).
- I. WCLIB (West Coast Lumber Inspection Bureau).
- J. WWPA (Western Wood Products Association).

1.04 SUBMITTALS

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide technical data on wood preservative materials.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Lumber Grading Rules: NFPA, RIS, SPID, WCLIB, WWPA.
- B. Miscellaneous Framing: Stress Group D, species, 19 percent maximum moisture content, pressure preservative treat, AWP.
- C. Plywood: APA Rated Sheathing Structural I, Grade C-D; Exposure Durability 1; sanded.

2.02 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.03 FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWP Treatment C1 using water borne preservative with 0.25 percent retainage.

- B. Wood Preservative (Surface Application): Clear, type, manufactured by Benjamin Moore Paints or equal.

PART 3 EXECUTION

3.01 FRAMING

- A. Set members level and plumb, in correct position.
- B. Place horizontal members, crown side up.
- C. Construct curb members of single pieces.
- D. Space framing and furring 16 inches (400 mm) oc.
- E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- F. Coordinate curb installation with installation of decking and support of deck openings, roofing vapor retardant, parapet construction, and miscellaneous framing.

3.02 SHEATHING

- A. Secure sheathing to framing members with ends over firm bearing and staggered.
- B. Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 12 inches (300 mm) beyond size of electrical panel. If applicable.

3.03 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings and treat all site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.04 SCHEDULES

- A. Roof Blocking: S/P/F species, 19 percent maximum moisture content,

pressure preservative treatment.

B. Telephone and Electrical Panel Boards: 3/4 inch (19 mm) thick, square edges, site brush applied preservative treated.

C. Wood stud framing, blocking and furring strips as required and specified.

END OF SECTION

SECTION 06600

FRP RAILING & GRATING

PART 1 GENERAL

1.01 SCOPE

- A. Work of this Section includes, but is not limited to:
 - 1. FRP Handrails
 - 2. Molded FRP Grating
- B. Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) products as specified herein.

1.02 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.

1.03 QUALITY ASSURANCE

- A. The material covered by these specifications shall be furnished by an ISO-9001:2008 certified manufacturer of proven ability who is regularly engaged in the manufacture, fabrication and installation of FRP systems.
- B. Substitution of any component or modification of system shall be made only when approved by the Engineer.
- C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.04 DESIGN CRITERIA

- A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.
- B. Design live loads of FRP gratings and floor panels shall not be less than 100 PSF (4.79 kN/m) uniformly distributed unless specifically stated

otherwise in drawings and/or supplementary conditions or in governing building code as applicable. Grating and floor panel deflection at the center of a simple span not to exceed 0.25" (6.4 mm).

- 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 unless specifically stated otherwise in drawings and/or supplementary conditions. Connections shall be designed to transfer the loads.
- D. Temperature exposure is limited to 100°F (38°C) unless specifically stated otherwise in drawings and/or supplementary conditions.

1.05 SUBMITTALS

- A. Shop drawings of all FRP structural members, handrails, gratings, plate, ladders and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300.
- B. Manufacturer's catalog data showing:
 - 1. Dimensions, spacing, and construction of grating
 - 2. Design tables showing limits for span length and deflection under various uniform and concentrated loads
 - 3. Materials of construction
- C. Detail shop drawings showing:
 - 1. Dimensions
 - 2. Sectional assembly
 - 3. Location and identification mark
 - 4. Size and type of supporting frames required

1.06 SHIPPING AND STORAGE INSTRUCTIONS

- A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.
- B. All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, stair treads, structural shapes and building panels shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed

from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

- C. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

PART 2 PRODUCTS

2.01 GENERAL

- A. Materials used in the manufacture of the FRP products shall be raw materials in conformance with the specification and certified as meeting the manufacturer's approved list of raw materials.
- B. All raw materials shall be as specified by the contract.
- C. The visual quality of the pultruded shapes shall conform to ASTM D4385.
- D. With the exception of molded gratings and treads, all FRP products shall be manufactured using a pultruded process utilizing polyester resin with flame retardant. A synthetic surface veil fabric shall encase the glass reinforcement. FRP shapes shall achieve a flame spread rating of 25 or less in accordance with ASTM test method E-84, the flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635.
- E. If required, after fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating.
- F. FRP products exposed to weather shall contain an ultraviolet inhibitor.
- G. All exposed surfaces shall be smooth and true to form, consistent with ASTM D4385.
- H. Manufacturers:
 - 1. Strongwell
 - 2. Or approved alternative manufacturer

2.02 FRP STANDARD RAILINGS

- A. Design
 - 1. The FRP standard railing system shall be designed to meet the configuration and loading requirements of OSHA, IBCO, or any

governing building code as applicable, with a minimum factor of safety on loading of 2.0.

B. Material

1. The rails and posts shall be 1.90" (48 mm) x 0.195" (5 mm) round tube (1.5" nominal ID) manufactured by the pultrusion process. The pultruded parts shall be made with a fire retardant resin that achieves a flame spread rating of 25 or less in accordance with ASTM test method E84, flammability characteristics of UL 94 V0 and meet the self-extinguishing requirement of ASTM D635. The resin matrix shall be polyester or and shall contain a UV inhibitor. The parts shall be coated with an industrial grade polyurethane coating for additional UV protection and wear resistance. The color yellow.
2. Mechanical properties shall meet or exceed the values as follows:

PROPERTIES	TEST METHOD	UNITS	ROUND TUBE VALUES
Tensile Stress, LW	ASTM D638	psi N/mm ²	30,000 207
Tensile Modulus, LW	ASTM D638	10 ⁶ psi 10 ³ N/mm ²	2.5 17.2
Compressive Stress, LW	ASTM D695	psi N/mm ²	30,000 207
Compressive Modulus, LW	ASTM D695	10 ⁶ psi 10 ³ N/mm ²	2.5 17.2
Flexural Stress, LW	ASTM D790	psi N/mm ²	30,000 207
Flexural Modulus, LW	ASTM D790	10 ⁶ psi 10 ³ N/mm ²	1.6 11.0
Short Beam Shear, LW	ASTM D2344	psi N/mm ²	4,500 31
Density	ASTM D792	lbs/in ³ N/mm ³	.060 - .070 0.0000163 - 0.0000193
24 hr. Water Absorption [§]	ASTM D570	% max by wt.	.6
Coefficient Of Thermal Expansion, LW [§]	ASTM D696	10 ⁻⁶ in/in/°F 10 ⁻⁵ mm/mm/°C	7 1.2

[§] Measured as a percentage maximum by weight.

[§] Typical values because these are shape and composite dependent tests.

C. Fabrication of Standard Railing System

1. The fiberglass standard railing system shall be fabricated into finished sections by fabricating and joining together the pultruded tube using molded or pultruded components; epoxy bonded and connected as shown in the fabrication details. Railing sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a water proof tag.
2. Sections shall be sized for ease of removal in areas where railing is designated as "removable". The maximum length of any section shall not exceed 12'.
3. Where removable railing has been designated, posts shall be installed utilizing sleeves embedded in concrete. Sleeve design and embedment shall be in accordance with manufacturer's recommendations.
4. Railing systems designated for common accessible areas shall incorporate at top rail, mid-height rail and kick plate. Railing systems designated for storage areas shall incorporate a top rail, mid-height rail and lower rail. Alternatively for storage area railings, a kick plate may be substituted for the lower rail.

D. Installation of Handrail Sections

1. The fabricated railing sections shall be supplied complete with fittings by the FRP manufacturer. The components used to join fabricated sections together may be shipped loose, to be epoxied and riveted, if required, together, if required in the field by the Contractor.
2. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawings.

E. Approved Fabricators

1. Strongwell
2. Or approved equal.

2.03 MOLDED GRATING AND TREADS:

A. General

1. Grating shall be DURAGRATE® as supplied by Strongwell or approved equal.

2. The panels shall sustain a deflection of no more than 0.25" (6.4 mm) under a uniform distributed load of 100 PSF (4.79 kN/m) for the span lengths shown on the plans.
3. Grating panels provided for floor sumps shall be supplied in a minimum of two sections to support ease of access and panel removal. Panel layout and bearing edges shall consider this requirement as a component of their design.

B. Design

1. The grating shall be one piece construction with the tops of the bearing bars and cross bars in the same plane.
2. The mesh pattern and thickness shall be 1" (25.4 mm) x 4" (101.6 mm) rectangular mesh, 1" (25.4 mm) thick.
3. The resin used in the manufacture of the grating shall be vinyl ester (chemical resistant – fire retardant).
4. The color shall be yellow.
5. Grating shall be fire retardant with a flame spread rating of 25 or less when tested in accordance with ASTM E-84.
6. For slip resistance, the top of each bar shall have sand or quartz grit applied.

C. Products

1. The FRP molded grating and treads shall be manufactured by the open mold process.
2. Molded stairtreads shall be 1-1/2" (38.1 mm) thick in a 1-1/2" (38.1 mm) x 6" (152.4 mm) rectangular mesh pattern. The resin system will be the same as the molded grating. The stair tread shall come complete with anti-slip nosing.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of 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.

3.02 INSPECTION AND TESTING

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

3.03 INSTALLATION, GENERAL

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
- B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP 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 form work for items that are to be built into concrete masonry or similar construction.

3.04 ALL FRP INSTALLATION

- A. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.
- B. Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07160

VAPOR BARRIERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide membrane vapor barriers as shown and specified. Work includes:

1. Interior concrete floor slabs-on-grade.

1.02 PROJECT CONDITIONS

- A. Do not install membrane vapor barriers until substrate construction and all penetrating items and features are completed.
- B. Obtain Civil Engineer's acceptance of installed membrane vapor barriers before installing covering materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Membrane vapor barrier: Polyethylene sheeting, minimum 6 mil thickness, unless indicated differently on the drawings at a specific site, with a vapor transmission rating of 0.20 perms or less.
- B. Tape: Pressure sensitive tape produced by vapor barrier manufacturer; specifically designed for sealing below grade vapor barrier sheet joints. Single faced and double faced as required by installation conditions.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Interior concrete floor slabs-on-grade.
1. Install a single layer of membrane vapor barrier material over level compacted base.
 2. Lap joints minimum of 6" and tape. Secure vertical surfaces to walls and column bases; fold corners. Provide sealed contact with piping, conduit, and all other penetrating items.
 3. Seal punctures and cuts before placing concrete.
 4. Trim exposed vapor barrier at floor line after concrete has been cured and hardened.

B. Perimeter Walls

1. Install a single layer of membrane vapor barrier over framing members.
2. Lap joints minimum 6" and tape.
3. Coordinate installation with gypsum board installation.

3.02 PROTECTION

- A. Protect installed membrane vapor barrier from damage until installation of covering materials. Seal all cuts, punctures, and penetrations of membrane vapor barriers with tape.
- B. When vapor barrier is used in conjunction with perimeter insulation, the vapor barrier shall be placed in a manner to isolate the insulation from the prepared subgrade and foundation wall surfaces.

END OF SECTION

SECTION 07180

WATER REPELLENTS

PART 1 GENERAL

1.01 SCOPE

A. Apply water repellent to the following surfaces:

1. Exterior CMU surfaces.

1.02 QUALITY ASSURANCE

A. Manufacturer: A firm with not less than 5 years' experience in manufacturing the type of water repellents required for this project.

B. Installer: A firm with not less than 3 years of successful experience in application of water repellents of types required on substrates similar to those of this project and a firm licensed or approved by the manufacturer.

C. Test Application

1. CMU: A sample wall panel (mock-up) of the exterior masonry wall construction will be built at the site. Apply water repellent to one-half of the exterior CMU of the sample panel. Mask off the other half of the sample panel. Use the same water repellent, number of coats, amount of water repellent per coat and installation techniques as will be used on the entire project.
2. General: Apply water repellent to the samples and sample panel in the presence of the CIVIL ENGINEER and manufacturer's representative. Obtain CIVIL ENGINEER's acceptance of water repellent on each sample material before applying water repellent to building. The sample applications shall be used as a standard for judging water repellent work.

1.03 SUBMITTALS

A. Shop Drawings: Submit manufacturer's specifications, installation instructions and general recommendations for water repellents. Include data substantiating that materials are recommended by manufacturer for applications indicated. Include specimen copies of manufacturer's warranty to be issued for this project.

B. Certificates: Upon completion of the water repellent work and as a condition of its acceptance, deliver to the CIVIL ENGINEER a certificate

from the manufacturer of the water repellent, and co-signed by the applicator, stating that the materials and methods used in the water repellent work comply with the specified requirements and that all surfaces specified to receive water repellent have been treated with water repellent in accordance with these specifications.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in sealed containers clearly marked with manufacturer's identification including type of materials in containers.
- B. Store materials in area protected from rain or standing water, where temperatures do not exceed limits of manufacturer and in area with adequate ventilation.
- C. Handle materials with care and in accordance with manufacturer's recommendations.

1.05 JOB CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer), when ambient temperature is less than 50 degrees F., or when substrate surfaces have cured for less than a period of 2 months, or when rain or temperatures below 40 degrees F. are predicted for a period of 24 hours, or earlier than 3 days after surfaces became wet from rainfall or other moisture sources, or when substrate is frozen, or at surface temperature of less than 40 degrees F.

1.06 SPECIAL PROJECT WARRANTY

A. Manufacturer's Warranty

- 1. Provide written warranty from the manufacturer of the water repellent, warranting that the surfaces treated with water repellent will retain their hydrophobic or water repellent effect for a period of 10 years from date when original application of water repellent is completed.
- 2. The warranty shall be signed by the manufacturer of the water repellent and the manufacturer shall agree in writing to furnish all labor and materials necessary to restore the hydrophobic or water repellent effect to the treated surfaces within a 10 year period from date of completion of original application of water repellent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Water repellent shall be clear, non-yellowing, non-staining, penetrating, breathable liquid material designed specifically for the type of applications included in this project.
- B. Coverage: Apply at coverage rates recommended by manufacturer to achieve a warranted application; warranty to be as herein before specified.
- C. System/Manufacturer: Provide one coat of Hydrozo Clear Double 7 or equal.
- D. Acceptable Manufacturers: The following manufacturers products are acceptable providing they conform to the requirements of this section:
 - 1. Gemite Products, Inc.
 - 2. Trocal.
 - 3. Dynamit-Nobel.
 - 4. Or equal

PART 3 EXECUTION

3.01 INSPECTION

- A. Installer must examine substrate and conditions under which water repellent is to be applied and must advise General Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- B. Advise General Contractor of areas requiring repointing of mortar joints.

3.02 PREPARATION

- A. Clean substrate of substances which might interfere with penetration/adhesion of water repellents. Test for moisture content, in accordance with repellent manufacturer's instructions, to ensure that surface is sufficiently dry.
- B. Coordination with Sealants: Delay application of water repellents until installation of sealants has been completed in joints adjoining surfaces to be coated with repellent.
- C. Protect adjoining work from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum, steel and glass where there is possibility of water repellent staining surfaces. Protect surfaces designated to receive a specific type of repellent from overspray of another type. Cover live plant materials with drop cloths. Clean water repellent from adjoining

surfaces immediately after spillage. Comply with manufacturer's recommendations for cleaning.

3.03 INSTALLATION

- A. Begin application only in presence and with advice of manufacturer's technical representative.
- B. Apply saturation spray coating of water repellent on surfaces indicated for treatment. Comply with manufacturer's instructions and recommendations, using airless spraying procedure unless otherwise indicated.

END OF SECTION

SECTION 07190

WATER REPELLANT TREATMENT: MASONRY

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope: Furnish all labor, materials, equipment, and incidentals required to provide water repellent treatment on the exterior of the Treatment Building.
- B. Location:
 - 1. All exterior exposed surfaces.
- C. Related Work Specified Elsewhere:
 - 1. Section 09900 – Painting
- D. Coordination:
 - 1. Coordinate the Work required under other sections with the specific requirements of the water-repellent treatment.
 - 2. Do not use membrane curing compound on concrete surfaces designated to receive water repellent treatment.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer with a minimum of 2 years' experience in the application of such materials.
- B. The specifications in this Section are subject to the administrative and procedural requirements specified in Division 1, as well as the broader requirements of the General Conditions.
- C. Submit manufacturer's published data indicating that each material complies with the requirements and is intended for the applications shown.

1.03 SUBMITTALS

- A. Submittals shall meet the requirements of Sections 01300
- B. Product Data: Comply with Section 01300

1.04 PRODUCT DELIVERY, STORAGE, AND PROTECTION

- A. General: Comply with Section 01600.
- B. Delivery of Materials: Label with the following information:
 - 1. Name of material and supplier.
 - 2. Formula or specification number, lot number, and date of manufacture
- C. Storage of Materials:
 - 1. Store in accordance with manufacturer's instructions.
 - 2. Use no materials which are outdated as indicated by shelf life.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General Masonry Surface Treatment
 - 1. Properties:
 - a. Minimum 12 percent solids by weight, aqueous silane.
 - b. Penetration of 1/8-inch to 3/8-inch.
 - c. Water repellency of 96 percent after 4 hours, when tested according to ASTM C 67.
 - d. Moisture Vapor Transmission Rating: Approximately 50 grams per square foot per 24 hours at 25 degrees C.
 - e. Shall not darken or yellow masonry surfaces to which it is applied as determined by on-site test areas.
 - 2. Product and Manufacturer:
 - a. Hydrozo Envirosea Double 7, by Hydrozo Coatings Company or equal.
- B. Miscellaneous:
 - 1. Equipment Cleaner: Water.
 - 2. Product Thinner: None. Use products full strength unless advised otherwise by manufacturer for specific applications.

PART 3 EXECUTION

3.01 INSPECTION

- A. Contractor, the material manufacturer's representative and the material applicator must examine the surfaces to be treated and the conditions under which the Work is to be performed.

- B. Discuss with the RPR conditions detrimental to the proper and timely completion of the Work and the performance of the water repellent.
- C. Proceed with the water repellent work only after detrimental conditions have been corrected in a satisfactory manner.
- D. Obtain the acceptance of the RPR before any application of the treatment so that it can be monitored as required.

3.02 SURFACE PREPARATION

- A. Assure that all patching, crack control calking, masonry pointing, and expansion joint sealing, has been satisfactorily completed and allowed to properly cure a minimum of 72 hours prior to the application of water repellent treatment.
- B. Assure that masonry surfaces placed under this contract have cured a minimum of 28 days prior to the application of water repellent treatment.
- C. Surfaces shall be clean, dry, and grease free.
 - 1. Concrete surfaces shall be cleaned of any dirt, grease, curing compounds, form oils, and other foreign matter by use of chemical cleaning and pressure water rinsing if necessary.

3.03 AMBIENT CONDITIONS

- A. Surface, air, and material temperatures should be 50°F or higher during application and drying time.
- B. Do not apply when surface temperature is over 90°F.
- C. Do not apply when weather conditions indicate likelihood of rainfall during application or drying time.

3.04 APPLICATION

- A. Apply treatment to a sample area acceptable to RPR at the job site to demonstrate material characteristics and application techniques.
- B. If sample area is unsatisfactory, cooperate with RPR in selection of alternate water repellent treatment materials.
- C. Application of water repellent treatments shall be by an applicator approved by the manufacturer, and one who has a minimum of 2 years

experience with the manufacturer's products.

- D. Protect adjacent work and materials to remain uncoated during water repellent application. Provide drop cloth or masking if required.
- E. Coverage rate shall be 80 square feet per gallon.
- F. Application and coverage shall be in accordance with manufacturer's printed instructions.
- G. Protect all surfaces until the material has completely dried.

3.05 CLEAN-UP

- A. Immediately clean all adjacent surfaces with water, including windows, doors, equipment, and floor hatches, of any overspray or dripped material.
- B. Clean all construction debris from the surrounding areas to the satisfaction of the RPR.
- C. Upon completion of work of other trades, touch up and restore all damaged or defaced surfaces as determined by RPR.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.01 PERFORMANCE REQUIREMENTS

- A. Provide continuity of thermal barrier at building enclosure elements.
- B. Provide continuity of vapor and air barrier at building enclosure elements.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation during inclement weather or when surfaces are moist.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following. Refer to Articles below for specific products.

- 1. Johns Manville, Denver, CO.
- 2. United States Gypsum Co., Chicago, IL.
- 3. Owens Corning Fiberglas Corp., Toledo, OH.
- 4. Fibrex Co., Aurora, IL.
- 5. Certainteed Corp., Valley Forge, PA.
- 6. Celotex Corporation, Tampa, FL.
- 7. Amoco Foam Products Co.
- 8. Tex-Styrene Inc.
- 9. Dow Chemical
- 10. W. R. Grace.
- 11. Concrete Block Insulating Systems, Korfill
- 12. Or equivalent.

- B. Substitutions: Submit in accordance with Section 01600.

2.02 BATT (THERMAL) INSULATION - KRAFT FACED -INSULATION TYPE 1

- A. Glass fiber composition faced with integral kraft paper-faced vapor barrier, minimum 1 pound per cubic foot density, meeting following standards:

1. ASTM E 84: Flame spread 25 maximum; smoke developed 450 maximum.
2. ASTM C 518: R value of 3.2 per inch of thickness.
3. ASTM C 665: Type III.

2.03 RIGID BOARD, INSULATION TYPE 3

A. Polystyrene Insulation: Extruded cellular type, meeting the following:

1. Aged Thermal Resistance: R value of 8.0.
2. Thickness: To meet the R value.
3. Density: 8 pcf minimum.
4. Compressive Strength: 25 psi.
5. Water Absorption: 0.3 percent maximum per ASI/ASTM D 2842.
6. Edges: Tongue and groove.

B. Acceptable Products:

1. Styrofoam SM by Dow.
2. Or Equal.

2.04 BLOCK INSULATION INSERTS FOR CONCRETE MASONRY

A. ASTM C 578-95. Type 1, Specification for Rigid Cellular Polystyrene Thermal Insulation.

B. ASTM C 90-95. Specification for Load-Bearing Concrete Masonry Units

C. Install per manufacturers specifications.

D. Acceptable Products:

E. Concrete Block Insulating Systems, Korfill or equal.

2.05 ACCESSORIES

A. Joint Tape: Pressure sensitive type, recommended by insulation manufacturer.

B. Insulation Adhesive: Type recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 BATT AND BLANKET INSTALLATION

A. Install insulation either friction fit, using adhesive, or mechanical fasteners in

accordance with manufacturer's recommendations after mechanical and electrical services have been installed.

- B. Fit insulation tight within stud spaces, above Soffits, behind fascias, and tight to and behind mechanical and electric services within plane of insulation, leaving no gaps or voids. Butt insulation tightly. Cut and fit tightly around items penetrating insulation. Stagger and butt joints, or cavity of a cavity wall system.
- C. Within metal stud or joist systems install full height and width in such manner that voids or openings do not occur. Insulation is required for full width between studs, including cavity of each stud. Do not allow insulation to obstruct vents.
- D. Cut and trim insulation neatly, to fit spaces. Cut insulation oversize to ensure tight butt joints when installed. Cut insulation to fit around protrusions and irregularly shaped projections. Use batts free of ripped backs or edges.
- E. Batt Insulation with Vapor Barrier Membrane
 - 1. Install insulation with factory applied membrane facing "warm in winter" side of building spaces. If in doubt, confirm location with Owner's Representative.
 - 2. Lap ends and side flanges of membrane over framing members; fasten in place at maximum 6 inches on center or tape in place.
 - 3. Tape seal butt ends; lap side flanges and ends; do not tear membrane.
- F. Install sound attenuating blankets above ceilings and in stud cavities where detailed or scheduled. Butt tightly.

3.02 RIGID BOARD INSTALLATION – FOUNDATION PERIMETER

- A. Apply adhesive in three continuous beads per board length.
- B. Install boards on foundation wall and grade beam perimeter. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and to protrusions.
- C. Extend boards over control and expansion joints, unbounded to foundation 6 inches either side of joint.

3.03 BLOCK INSULATION INSERTS FOR CONCRETE MASONRY

- A. Inserts are placed in blocks prior to installation
- B. Install per manufacturers specifications.

3.04 SCHEDULES

A. Roof Insulation: Refer to Section 07500.

B. Foundation: Type 3.

END OF SECTION

SECTION 07500

SINGLE-PLY MEMBRANE ROOFING

PART 1 GENERAL

1.01 SCOPE

- A. Thermoplastic polyolefin (TPO) roofing membrane adhered to mechanically attached roof insulation and accessories for a complete installation as specified below. Membranes referred to as reinforced membrane, reinforced roofing membrane, roofing membrane, or single ply membrane shall all mean the same roofing material specified in this section.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Section 04055, Masonry Materials
- B. Section 07700, Roofing Specialties and Accessories

1.03 SUBMITTALS

- A. Issue submittals in accordance with Section 1300 - Submittals.
- B. Submittals under this Section shall include:
 - 1. Manufacturers' specifications and installation instructions on all specified products.
 - 2. Samples of roofing membrane, mechanical fasteners, and insulation.
 - 3. Shop drawings of entire roof system. Show layout, details, dimensions, locations and installation methods of all sheet roofing, insulation, metal flashings, flashing and specialty items as indicated on the Drawings. Do not commence fabrication of any work or begin installation until approval has been obtained from the Engineer and the roofing manufacturer.
 - 4. Form of roofing manufacturer's warranty.

1.04 QUALITY ASSURANCE

- A. Provide materials tested by UL or other nationally-recognized laboratory, for Class A fire-resistance rating.
- B. Unless shown otherwise on drawings, construction details shall conform to manufacturer's recommendations and to National Roofing Contractors Association "NRCA Construction Details" Guide.

- C. All flexible sheet membrane roofing and flashing material furnished and installed under this Section shall be the product of a single manufacturer, or shall be specifically approved for use with his materials by the manufacturer whose roofing specification is used. Materials shall be high grade, first quality of domestic USA manufacturer with an application history of ten(10) years in the United States. Furnish a written affidavit stating that these requirements have been complied with.
- D. Roofing and flashing shall be applied by a roofing applicator licensed, franchised, or approved by the roofing materials manufacturer, using experienced skilled roofers. Furnish a written affidavit stating that the roof applicator is licensed.
- E. The completed roofing system shall exceed EPA Energy Star requirements.

1.05 WARRANTY

- A. Provide executed copy of membrane roofing manufacturer's standard "no dollar limit" warranty, for entire roofing system, including flashing endorsement, directly from manufacturer to Owner, signed by authorized representative of manufacturer. Length of warranty period after Substantial Completion: 15 years, also provide Manufacturer's 20 year membrane warranty.

PART 2 PRODUCTS

2.01 ROOFING MATERIALS AND ACCESSORIES

- A. Assembly shall consist of a TPO (thermoplastic polyolefin) sheet membrane adhesive-bonded to mechanically-fastened insulation. Acceptable products include:
 - 1. Carlisle Syntec SureWeld
 - 2. Firestone Ultraply TPO
 - 3. GAF Everguard TPO
 - 4. Or equal
- B. TPO (thermoplastic polyolefin) membrane:
 - 1. Per ASTM D 6878-03.
 - 2. Type: 60-mil reinforced.
 - 3. Color: Black
- C. Accessories: as supplied or recommended by roofing manufacturer, including sheet seaming system, tapered edge strips, sealants, tapes in

seam sealant, membrane and roof drain flashing, protective mat or board, slip sheet, and expansion joint cover.

D. Flashing at roof penetrations:

1. Flash roof penetrations, interruptions, and intersections with sloped or vertical surfaces, using manufacturer's standard flashing in longest pieces possible.
2. Pre-fabricated conical pipe penetration accessory may also be used, including all required accessories including sealant, sealing mastic, fasteners, and clamping ring.

2.02 INSULATION

A. Material:

1. Rigid polyisocyanurate board, faced on both sides with fiberglass-reinforced roofing felts. Minimum in-service R-value/in:6.0, and a minimum compressive strength of 20 psi.
 2. Acceptable manufacturers: as approved by membrane manufacturer for 15 years total system warranty.
 3. Provide a complete plan of insulation installation showing slope and tapered insulation. Average insulation value over all slopes shall be R equal to 30.
- B. Where pitch to drainage outlet is not attained by sloping roof structure, provide minimum pitch of 1/8 inch per foot, with crickets pitching 1/4 inch per foot.
- C. Insulation fasteners: FMRC (Factory Mutual Research-Approved) shank or toggle-type to achieve secure attachment to or through substrate, galvanized steel, designed so as not to damage membrane. Provide matching washers, interlocked with fasteners, of large enough diameter to resist pull-through. Provide minimum 1/2 in. penetration at steel deck, 1in. at other types of substrate.
- D. Insulation and mechanical fasteners shall be supplied or approved by roof membrane manufacturer.

2.03 RELATED MATERIALS

- A. Protective Mat: Carlisle HP Protective Mat or equal. UV resistant, polypropylene fabric for use as an underlayment for pavers.

PART 3 EXECUTION

3.01 JOB CONDITIONS

- A. Store materials on raised platforms or pallets, in temporary sheds or under light-colored opaque tarpaulins, well-secured from wind. Each day, verify that stored materials are clean and dry. Protect sheet materials from abrasion and puncturing.
- B. Store adhesives and sealants at 60-to-80 degree F temperatures. Should these materials be exposed to lower temperatures, store at 60-to-80 degrees for a minimum of 24 hours before use.
- C. Do not install any portion of roof assembly over wet substrate, in inclement weather, or when precipitation is forecast.
- D. Protect substrate and installed materials from damage during roofing installation and subsequent operations such as installation of roof-top mechanical equipment, by proper selection and operation of materials-handling equipment, provision of plywood panels for temporary walkways, etc.

3.02 PREPARATION

- A. Before beginning installation, inspect existing conditions for unevenness, excessive corrosion, deteriorated decking, or other conditions which would prevent satisfactory installation of roofing system.
- B. Verify that structural roof openings have been provided as detailed, and that wood nailers, blocking, curbs, etc. have been properly installed and are suitable for installation of roofing system.
- C. Remove water, ice, dirt, debris, oil deposits etc., using appropriate cleaning methods. Install no roofing or insulation over wet or dirty substrates. Sweep off loose material immediately before beginning work.

3.03 ROOFING AND ROOF INSULATION INSTALLATION

- A. Install insulation with long joints continuous and end joints staggered. Limit joints between adjacent units to ¼ in. maximum. Neatly cut and fit insulation around roof penetrations.
- B. Secure insulation to structural deck, in accordance with manufacturer's instructions and FM 1-28, including fastener placement diagrams for different types and sizes of insulation board. Provide a minimum of one fastener for every 2 sq. ft. of surface area.
- C. At completion of each day's work, provide temporary protection consisting of strip of roofing membrane, extending six inches onto deck and six

inches over ends of exposed insulation, secured with adhesive.

D. Membrane

1. Position the membrane over the acceptable substrate. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.
2. Apply Bonding adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Bonding Adhesive along the splice edge of the membrane to be hot air welded over the adjoin sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
 - a. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
3. Position adjoining sheets to allow minimum overlap of 2 inches.
4. Hot air weld the Sure-Weld membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
5. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.
6. Apply Sure-Weld Bonding Adhesive to the exposed underside of the membrane sheet and the substrate.
7. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
8. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

E. Install roof penetration flashing as detailed on drawings and in accordance with manufacturer's recommendations. Extend base flashing up vertical surfaces 8 in minimum and horizontally 4 in. minimum. Adhere to vertical surfaces with manufacturer's recommended adhesive and properly terminate.

F. Unless otherwise detailed on the Drawings, use the following flashing standards:

G. Roof curb for HVAC equipment: Carlisle Detail SW-5 or related detail from alternate manufacturer.

- H. Hot stack penetration: Carlisle Detail SW-8-C or related detail from alternate manufacturer.
- I. Cold pipe penetration (3" diameter minimum): Carlisle detail SW-8A or related detail from alternate manufacturer.
- J. Roof Drain: Carlisle Detail SWA-6 or related detail from alternate manufacturer.
- K. Splice flashing to main roof sheet before bonding to vertical surface. Seal splice at least 3 in. beyond fasteners attaching horizontal membrane. Take care that flashing does not bridge at transitions from horizontal to vertical.
- L. After joints have set up, test all spliced joints for continuity by running a screwdriver along joint. Resplice as required.
- M. Temporarily seal loose edges of membrane at night or when inclement weather is threatening, to prevent water from flowing under completed portion of roof. Pull sheet free from sealing compound before continuing work.
- N. Do not use oil-base or plastic roofing cement in conjunction with elastomeric roofing material.
- O. Prime metal flashing as recommended by roofing manufacturer, and secure elastomeric sheet material to metal flashing and curbs with manufacturer's recommended adhesive. Overlap elastomeric over metal 4 in. minimum.
- P. Protective Mat: Install in accordance with Manufacturer's recommended specifications.
- Q. Immediately after completion, manufacturer's representative shall inspect and approve installed roof membrane. Manufacturer's representative shall issue written report and approval to Engineer before substantial Completion.
- R. At job completion, clean adhesives from walls, ground surfaces, flashing, and accessories. Remove debris from roof surfaces. Provide three copies of manufacturer's maintenance and repair recommendations for elastomeric roofing. Provide a written warranty.

END OF SECTION

SECTION 07700

ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

- A. Miscellaneous roofing specialties and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

1. Bilco.
2. Babcock Davis.
3. Milcor
4. Or equivalent.

- B. Substitutions: Under provisions of Section 01600.

2.02 PIPE PORTALS

- A. Acceptable Products and Manufacturers:

1. N-Series Pipe Portal, Custom Curb, Inc., Chattanooga, TN.
2. PCC Cap, The Pate Company, Broadview, IL.
3. Pipe Portal System, Roof Products Systems Corporation, Bensenville, IL.
4. TP-1 Piping Cover, ThyCurb Division of Thybar Corporation., Addison, IL.
5. Or equivalent.

- B. Description:

1. Manufacturer's standard ABS and EPDM rubber boots to accommodate 3/8 through 6 inch diameter pipe.
2. Furnish complete with stainless steel hose clamps.
3. Accommodate quantity and size of piping to pass through portal caps.
4. Fabricate for mounting atop manufactures curb.

2.03 FABRICATION

- A. Fabricate free of visual distortions and defects. Weld corners and joints.

- B. Provide for removal of condensation.
- C. Provide weather tight assembly.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions and proceed with work in accordance with manufacturer's recommendations.
- B. Verify that deck, curbs, blocking, cants, roof membrane, and base flashing are in place and positioned correctly.

3.02 INSTALLATION

- A. General:
 - 1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
 - 2. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.
 - 3. Securely anchor roof accessories to supporting substrates with appropriate type fasteners.
 - 4. Coordinate with installation of roofing system and related flashings.
- B. Curbs: Integrate curbs with adjacent roofing systems, base flashings, and counter flashings to create watertight conditions.
- C. Install in accordance with manufacturer's instructions.
- D. Coordinate with installation of roofing system and related flashings for weather tight installation.
- E. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

END OF SECTION

SECTION 07900

SEALANTS

PART 1 GENERAL

1.01 SCOPE

- A. General: Prepare joints and apply sealant at all locations which normally require sealing to prevent infiltration of air, water, and insects and to reduce transmission of sound.
- B. Apply sealants to exterior and interior non-static joints. Do not seal normal drainage points or weep holes. Include the following:
 - 1. masonry control joints
 - 2. around windows, door frames, aluminum entrances and other penetrations or openings in exterior walls
 - 3. threshold bedding
 - 4. intersection of dissimilar wall surfaces
 - 5. perimeter seal of metal door and borrowed light frames where they abut masonry
- C. Sealing of joints in concrete construction, including sidewalk joints, concrete paving joints and floor joints, and floor joints as indicated.
- D. Sealing of all exterior and interior locations where materials or equipment do not fit together or against the adjoining surface with a hairline joint.
- E. Caulking of interior static joints. Include the following:
 - 1. intersection of exposed structure or ceiling construction with masonry walls
 - 2. perimeter seal of metal door and borrowed light frames where they abut drywall
 - 3. intersection of cabinets, casework and similar items applied to or recessed in walls
- F. Sealing between wall and wall mounted plumbing fixtures and floor and floor mounted plumbing fixtures.
- G. Sealing at intersection of plastic laminate tops and side/backsplashes to each other and to wall.
- H. Sealing at reglets and flashings set in sealant.

- I. Trim exposed masonry flashing.

1.02 GENERAL PERFORMANCE

- A. Except as otherwise indicated, joint sealant is required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application.
- B. Failures of installed sealant to comply with this requirement will be recognized as failures of both materials and workmanship.

1.03 SUBMITTALS

- A. Submit manufacturer's product data and installation instructions.
 - 1. Certification, in the form of manufacturer's standard data sheet or by letter, that each type of compound and sealant to be furnished complies with these specifications.
 - 2. Statement that each product to be furnished is recommended for the application shown and is compatible with all materials to which applied.
 - 3. Instructions for handling, storage, mixing, priming, installation, curing and protection for each type of sealant.
- B. Submit manufacturer's color chart for color selections.
- C. Submit cured sealant samples in colors required for the work. Civil Engineer's or Owners Representative approval will be for color only. Compliance with other requirements is the Contractor's responsibility.

1.04 STORAGE AND HANDLING

- A. Prevent inclusion of foreign matter or the damage of materials by water or breakage.
- B. Procure and store in original containers until ready for use.
- C. Materials showing evidence of damage shall be rejected.

1.05 WARRANTY

- A. Contractor and joint sealant applicator shall jointly warranty joint sealant work for five (5) years from date of final acceptance. Warranty shall include replacing joints which fail to perform as airtight; or fail in adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration and stain resistance, general durability or any other form of

apparent deterioration (excluding inherent qualities and limitations clearly specified in the manufacturer's submitted product data).

B. Comply with these specifications for repair or replacement of work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Definition: The term "sealant" will be understood to be an elastomeric type. The term "caulk" will be understood to be a synthetic resin base of highest quality acrylic latex compound.
- B. General: Provide colors as selected by Civil Engineer from manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures. Where exposed to foot traffic, select materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealant system.
- C. Manufacturers: Bostik; Dow Corning Corporation; Euclid Chemical; Tremco Manufacturing Company; General Electric Company; Sika Chemical Co.; Mameco International; Sonneborn; Vulchem or approved equal.
 - 1. Manufacturers listed under the following applications are for basis of design. Equal products by above listed manufacturers are acceptable.
 - a. Above Grade Exterior Joints: Two-part elastomeric polyurethane sealant meeting ASTM C920, Type M, Grade NS, Class 25.
 - 1) Bostik Chem-Calk 500
 - 2) Euclid Eucolastic II
 - 3) Sonneborn Sonolastic NP 2
 - 4) Tremco Dymeric 511
 - 5) Or equal
 - b. Exterior or Interior Horizontal Wearing Expansion Joints: Two-part polyurethane based elastomeric sealant, complying with ASTM C920, Class 25, Type M, Grade P. Self-leveling or gun grade type as recommended by manufacturer for application shown.
 - c. For Joints in Exterior Concrete Pavements, Sidewalks and Interior Floors.
 - 1) Bostik Chem-Calk 550
 - 2) Euclid Eucolastic II
 - 3) Sonneborn Sonolastic SL 2
 - 4) Tremco THC 900/901
 - 5) Or equal
 - d. Above-Grade Interior Joints: Single or multi-component polyurethane gun-grade, non-sag sealant complying with ASTM C920, Type S or M, Class 25, Use NT, M, A, Grade NS; tensile strength (ASTM

D412) of 150 psi, and an ultimate elongation (ASTM D412) of 300%.

- 1) Euclid Eucolastic I or II
 - 2) Sonneborn Sonolastic NP 1 or NP 2
 - 3) Bostik Chem-Calk 2639
 - 4) Tremco Dymonic
 - 5) Or equal
- e. Sealants at Countertops, Backsplashes and Plumbing Fixtures: Provide clear silicone sealant at countertops and backsplashes; white silicone sealant at plumbing fixtures, unless colored fixtures are selected, then sealant color shall match fixture color. Meet or exceed ASTM C920, Type S, Grade NS, Class 25.
- 1) Dow 786
 - 2) GE SCS 1702.
 - 3) Sonneborn Sonolastic Omniplus
 - 4) Tremco Tremsil 600
 - 5) Or equal
- f. Caulk Joints – Interior, Static: High quality acrylic latex compound, non-staining non-bleeding complying with ASTM C834, as supplied by one of the above listed manufacturers, and installed in strict accordance with manufacturer's instructions.

2.02 ACCESSORIES

- A. Joint Primer/Sealer: Non-staining type, recommended by sealant manufacturer; compatible with joint forming material.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming material.
- C. Bond Breaker Tape: Pressure sensitive polyethylene or plastic tape, recommended by sealant manufacturer, to suit applications where bond to substrate should be avoided for proper joint sealant performance.
- D. Joint Backing: Compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material recommended by sealant manufacturer for back-up sealant; compatible with joint sealant, oversized 30%.
- E. Pavement Joints: Provide closed cell expanded rubber complying with ASTM D1056. Similar to Everlastic Type NN3 by Williams Products.
- F. Solvents: Cleaning agent recommended by the manufacturer of the sealant in writing to Civil Engineer or Owners Representative.
- G. Expanding Joint Filler

1. Description: Precompressed, self-expanding polyurethane foam.
2. Size: As required for specific joint width.
3. Manufacturer: Willseal by Illbruck or equivalent product by Williams Products or Polyte Manufacturing Corp. or equal

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine substrates and installation conditions. Do not proceed with joint sealant work until unsatisfactory conditions have been corrected.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PREPARATION

- A. Clean, seal and prime surfaces in accordance with manufacturer's recommendations. Confine primer/sealant to areas of sealant bond.
- B. Remove dust, dirt, loose coatings, moisture and other substances which could interfere with sealant bond.
- C. Remove lacquers and protective films from metal surfaces.

3.03 INSTALLATION

- A. Apply joint sealant as late as possible in construction, preceding painting and following cleaning operations. Do not apply sealant during inclement weather conditions or when temperature is above or below manufacturer's limitations for installation.
- B. Install joint sealant materials and accessories in strict accordance with manufacturer's installation instructions.
- C. Set joint filler units at depth or position in joint as indicated to coordinate with other work. Do not leave voids or gaps between ends of joint filler units.
- D. Install sealant backer rod, except where recommended to be omitted by sealant manufacturer for application indicated. Use rod diameter that will cause compression when installed.
- E. Install bond breaker tape and where required by manufacturer's recommendations to ensure that sealants will perform as intended.

- F. Apply joint sealants in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces on both sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. At horizontal joints between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt. Hand tool and finish all joints.
- G. Install joint sealants within recommended temperature ranges and to depths indicated or when not indicated, as recommended by sealant manufacturer. For normal moving vertical and horizontal joints, fill joints to a depth equal to 50% of joint width, but not more than 1/2" deep nor less than 1/4" deep, measured at the center section of bead.
- H. Confine materials to joint areas with masking tapes or other acceptable methods. Remove excess sealant materials promptly as work progresses and clean adjoining surfaces.
- I. Masonry Flashing: Where sealant joint is in direct contact with flexible masonry flashing, trim flashing flush with face of masonry after sealant is installed and cured. Verify during this procedure that weep holes have not been compromised during sealing operations.

3.04 CLEANING

- A. Upon completion, remove and dispose of masking materials; remove all excess sealing materials; clean adjacent materials of all soil and stain resulting from sealing operations.
 - 1. Replace damaged material which cannot be properly cleaned with new materials.

END OF SECTION

SECTION 07920
JOINT SEALANTS

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Certifications:

1. Manufacturer's certification that products:
 - a. Furnished for the specific project meet or exceed specified requirements.
 - b. Assembled for each joint are compatible with each other and with joint substrates under conditions of service and application.
 - c. Are suitable for the indicated use.
2. Manufacturer's certification that sealants, primers, and cleaners, comply with local regulations controlling the use of volatile organic compounds.
3. Contractor's and installer's certification that products are installed in accordance with Contract Documents, based on inspection and testing specified as part of Field Quality Control.

1.02 SEQUENCING

- A. Coordinate installation of sealants with substrates to which they are applied.**

1.03 WARRANTY

- A. Provide warranties under provisions of Section 01730.**
- B. Warrant installed products to be free from defects in material, labor, or installation techniques for 2 years.**
- C. Include coverage for installed sealants and accessories which:**
1. Fail to achieve air tight seal.
 2. Fail to achieve watertight seal.
 3. Exhibit loss of adhesion.
 4. Exhibit loss of cohesion.
 5. Do not cure.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Acrylic Latex (Designation AL):**

1. Description:
 - a. ASTM C 834.
 - b. Non-sag; non-staining; non-bleeding.
 - c. Joint movement range without cohesive/adhesive failure: Plus 7.5 percent to minus 7.5 percent of joint width.
 - d. Color: As selected by Owner's Representative from manufacturer's full color range.
2. Acceptable Products:
 - a. AC-20, Pecora.
 - b. Sonolac, Sonneborn.
 - c. Acrylic Latex 834, Tremco.
 - d. Or equal

B. Silicone - General Purpose (Designation S-GP):

1. Description:
 - a. ASTM C 920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, [M,] G, A, 0
 - b. Low modulus, single component, neutral curing, non-staining, non-bleeding silicone sealant.
 - c. Joint movement range without cohesive/adhesive failure: Plus 50 percent to minus 50 percent of joint width.
 - d. Color: Selected by Owner's Representative from manufacturer's full color range.
2. Acceptable Products:
 - a. 795, Dow Corning.
 - b. Silpruf, General Electric.
 - c. 864, Pecora.
 - d. Rhodorsil 5C, Rhone-Poulenc.
 - e. Spectrum 1, Tremco.
 - f. Or equal

C. Silicone - Sanitary (Designation S-S):

1. Description:
 - a. ASTM C 920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, M, G, A, 0
 - b. Neutral or acid curing, non-staining, non-bleeding, fungicide-containing.
 - c. Color: Selected by Owner's Representative from manufacturer's full

- color range.
- d. Complying with United States Food and Drug Administration Regulation 21CFR-177-6000.
- 2. Acceptable products:
 - a. 786 Mildew-Resistant Silicone Sealant, Dow Corning.
 - b. Sanitary 1700, General Electric.
 - c. 863, Pecora.
 - d. Rhodorsil 3B, Rhone Poulenc.
 - e. Tremsil 600, Tremco.
 - f. Or equal
- D. Urethane - Traffic-Bearing (Designation U-TB):
 - 1. Description:
 - a. ASTM C 920:
 - 1) Type: M
 - 2) Grade: P or NS
 - 3) Class: 25
 - 4) Uses: T, M, 0
 - b. Chemical curing, non-staining, non-bleeding.
 - c. Joint movement range without cohesive/adhesive failure: Plus 25 percent to minus 25 percent of joint width.
 - d. Shore A hardness: 35 minimum, when tested in accordance with ASTM D 2240.
 - e. Color: Selected by Owner's Representative from manufacturer's full color range
 - 2. Acceptable Products:
 - a. Vulkem 245,202, Mameco.
 - b. Dynatred, Pecora.
 - c. Sikaflex 2c/SL, Sika.
 - d. THC 900/901, Tremco.
 - e. Or equal

2.02 ACCESSORIES

- A. Joint Cleaner, Primer, Backing Rods: As recommended by sealant manufacturers.
- B. Masking Tape: Non-staining, non-absorbent material compatible with sealants and surfaces adjacent to joints.

2.03 MIXES

- A. Comply with manufacturer's instructions.
- B. Mix thoroughly with mechanical mixer without mixing air into sealants.
- C. Continue mixing until sealant is uniform in color and free from streaks of

unmixed materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Ensure that concrete and masonry have cured minimum of 28 days.
- B. Verify that sealant backing is compatible with sealant.
- C. Verify that substrate surface:
 - 1. Is within manufacturer's moisture content range.
 - 2. Complies with manufacturer's cleanliness and surface preparation requirements.
- D. Joint Width:
 - 1. Verify joints are greater than minimum widths required by manufacturer.
 - 2. If joints are narrower than minimum required widths, widen narrow joints to indicated width.
 - 3. Do not place sealant in joints narrower than manufacturer's required minimum.

3.02 PREPARATION

- A. Prepare, clean, and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and matter which might impair adhesion of primer and sealant to substrate.
- C. Remove form release agents, laitance, and chemical retarders, which might impair adhesion of primer and sealant to concrete and masonry surfaces.
- D. Comply with ASTM C 1193.
- E. Protect elements adjoining and surrounding work of this Section from damage and disfiguration.
- F. Priming:
 - 1. Prime joint substrates unless priming is not required by manufacturer's sealant substrate compatibility and adhesion test.

3.03 APPLICATION

A. General:

1. Comply with results and recommendations from:
 - a. "Manufacturer's compatibility and adhesion test.
2. Provide compatible sealant system between dissimilar assemblies and adjacent construction.
3. Seal locations necessary to create and secure continuous enclosure even though Drawings may not indicate all locations; do not seal weep holes.
4. Seal to prevent migration of water, vapor, and air through joints.
5. Comply with manufacturer's required application temperature and relative humidity ranges.
6. Consult manufacturer when sealant cannot be applied within these ranges.

B. Sealant Backing Bond Breaker:

1. Measure joint dimensions and size materials to achieve manufacturer-required width-to-depth ratios.
2. Install to achieve sealant depth and sealant contact depth no greater than distance required by manufacturer for sealant material, joint width, and joint movement range.
3. Install using blunt instrument to avoid puncturing.
4. Install to provide optimum joint profile and in manner to provide not less than 6 mm (1/4 inch) sealant depth when tooled.
5. Install tape where insufficient joint depth makes use of rod not possible. Match tape width to joint width to prevent three-side adhesion. Do not wrap tape onto sides of the joint.

C. Sealant:

1. Install sealants at same time as installation of backing bond breaker materials.
2. Comply with manufacturer's requirements for applying different sealant materials in direct contact with each other.
3. Install sealant with pressure-operated devices to form uniform continuous bead.
4. Use sufficient pressure to fill voids and joints full.
5. Install to adhere to both sides of joint.
6. Install to not adhere to back of joint; provide sealant backing.
7. Install sealant free of air pockets and embedded matter.
8. Recess sealant 3 mm (1/16 inch) from surface of pavements and horizontal surfaces.

D. Sealant Tooling:

1. Comply with manufacturer's tooling method requirements.
2. Tool sealant within manufacturer's tooling time limits.
3. Remove excess sealant from surfaces adjacent to joint.
4. Allow acrylic latex sealant to achieve firm skin before paint is applied.

3.04 SCHEDULE

A. Sealant Schedule:

1. Exterior locations:
 - a. Wall joints: S-GP
 - b. Perimeter of penetrations through walls: Designation S-GP
 - c. Expansion joints in ceilings, soffits, and overhead surfaces: Designation S-GP
 - d. Control joints and perimeter of penetrations in ceilings, soffits, and overhead surfaces: Designation: S-GP
 - e. Wall and ceiling joints between frames and their rough opening: Designation S-GP
 - f. Wall and ceiling joints between frames and adjoining surfaces: Designation S-GP
 - g. Joints and perimeter of penetrations in horizontal pedestrian and vehicle traffic surfaces: Designation U-TB.
 - h. Joints in Section 07610: Designation S-GP.
2. Interior Joints:
 - a. Wall and ceiling joints subject to movement: Designation U-MC.
 - b. Wall and ceiling joints not subject to movement: Designation AL.
 - c. Interior side of exterior openings: U-MC.
 - d. Floor joints: Designation U-TB.]
 - e. Wall and ceiling joints between frames and their rough opening: Designation AL.
 - f. Wall and ceiling joints between frames and adjoining surfaces: Designation AL.
 - g. Interior Sanitary Joints; Joints Between Plumbing Fixtures and Adjoining Floor, Wall, and Ceiling Surfaces; Joints in Dietary and Food Preparation Areas, Kitchens, Food Storage Areas, and Areas Subject to Frequent Wet Cleaning, including joints between walls and floors, Joints Between Back Splashes and Wall Substrates: Designation S-S.

END OF SECTION

SECTION 08100

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Standard and custom hollow metal doors and frames.
- B. Factory finishing hollow metal doors and frames and factory machining for hardware.
- C. Louvers installed in hollow metal doors
- D. Light frames and glazing installed in hollow metal doors.

1.02 RELATED SECTIONS

- A. Section 04800 – Masonry Assemblies
- B. Section 08710 – Door Hardware
- C. Section 08800 – Glazing
- D. Section 09900 – Painting

1.03 CODES AND REFERENCES

- A. Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ANSI/SDI A250.13 - Testing and Rating of Sever Windstorm Resistant Components for Swing Door Assemblies.
 - 7. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-

Alloy with Improved Formability.

8. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
9. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
12. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Doors Under Specified Pressure Differences Across the Specimens.
13. ASTM E 413 - Classification for Rating Sound Insulation.
14. ASTM E1332 - Standard Classification for Determination of Outdoor-Indoor Transmission Class.
15. ANSI/NAMM/HMMA 867-06 - Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames.
16. ANSI/BHMA A156.15 - Hardware Preparation in Steel Doors and Frames.
17. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
18. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
19. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
20. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
21. UL 10C (1998) - Positive Pressure Fire Tests of Door Assemblies; UL 1784 (2001) -Standard for Air Leakage Tests of Door Assemblies.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and

- metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.
- E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings,

based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.

1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.34, R-Value 2.9, including insulated door, thermal-break frame and threshold.
2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
- D. Door and frames to be stacked in a vertical upright position.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION

- A. A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral

anchors. Deliver such items to Project site in time for installation.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. CECO Door Products.
 - 3. Curries Company.
 - 4. Steelcraft.
 - 5. Or equal.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated

below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral core, or vertical steel-stiffener core.
 - a. Polystyrene and Polyurethane (Insulated) Doors: Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value 11 or better.
 - b. Standard Vertical Steel-Stiffener Core: Minimum 22 gage steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - c. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gage thick steel, Model 2 (Fully welded, seamless face and edges).
 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Edge, 1/8 inch in 2 inches.
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gage plate 1-1/4" x 9" or minimum 14 gage continuous channel with pierced holes, drilled and tapped.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Manufacturers Basis of Design:
 - a. CECO Door Products (C): Regent (honeycomb), Legion (polystyrene), or Imperial (polyurethane) Series.
 - b. CECO Door Products (C) - Steel-Stiffener: Medallion Series.
 - c. CECO Door Products (C) - Temperature Rise: Fuego and Medallion 450 Series.
 - d. Curries Company (CU): 707 (polystyrene, honeycomb and polyurethane) Series.
 - e. Curries Company (CU) - Steel-Stiffener: 747 Series.
 - f. Curries Company (CU) - Temperature Rise: 727 and 747-450 Series.
 - g. Or equal.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for

level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 3 and Physical Performance Level B (Heavy Duty), Minimum 18 gage thick steel, Model 2 (Fully welded, seamless face and edges).
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 10 gage plate 1-1/4" x 9" or minimum 14 gage continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
7. Manufacturers Basis of Design:
 - a. CECO Door Products (C): Regent (honeycomb) or Legion (polystyrene) Series.
 - b. CECO Door Products (C) - Temperature Rise: Fuego and Medallion 450 Series.
 - c. Curries Company (CU): 707 (polystyrene and honeycomb) Series.
 - d. Curries Company (CU) - Temperature Rise: 727 and 747-450 Series
 - e. Or equal.

2.04 ENERGY EFFICIENCY HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 1. Design: Flush panel.
 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA

867 "Laminated Core".

- a. Provide 22 gage steel stiffeners at 6 inches on-center internally welded at 5" on center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a minimum R Factor of 11.01, per ASTM C518.
3. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), Minimum 18 gage thick steel, Model 2 (Fully welded, seamless face and edges).
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Edge, 1/8 inch in 2 inches.
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gage plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - Trio-E Series.
 - b. Curries Company (CU) - 777 Trio-E Series.
 - c. Or equal.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gage steel-stiffeners at 6 inches on-center internally welded at 5" on center to integral core assembly, No stiffener face welding is permitted.
 - b. Acoustical sound transmission rating shall be no less than STC 38 complying with ASTM E 90 and must be visible on factory applied labels.
 3. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), Minimum 18 gage thick steel, Model 2 (Fully welded, seamless face and edges).
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Edge, 1/8 inch in 2 inches.

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gage plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - Trio Series.
 - b. Curries Company (CU) - 777 Trio Series
 - c. Or equal.
- D. Stile and Rail Hollow Metal Doors: Subject to the same compliance standards and requirements as standard hollow metal doors, provide insulated tubular stile and rail constructed, 1-3/4" thick doors fabricated from minimum 16 gage steel with flush tubular steel tops. Stiles to extend the full height of the door and rails internally welded or permanently mechanically joined to the stiles forming a neat seam on the face.
1. Manufacturer Basis of Design:
 - a. CECO Door Products (C) – Thru Lite Series.
 - b. Or equal.

2.05 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Masonry Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A653/A653M, Coating Designation A60.
 1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 14 gage (0.067-inch -1.7-mm) thick steel sheet.
 4. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 12 gage (0.081- inch -2.7-mm) thick steel sheet.
 5. Frames for Level 2 Steel Doors: Minimum 16 gage (0.053-inch -1.3-mm) thick steel sheet.
 6. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - SQ/SU and SR Series.
 - b. Curries Company (CU) - M and G Series.

c. Or Equal.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A1008/A1008M.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames for Level 2 Steel Doors: Minimum 16 gage (0.053-inch -1.3-mm) thick steel sheet.
4. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 16 gage thick steel sheet.
5. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 14 gage thick steel sheet.
6. Frames for Wood Doors: Minimum 16 gage thick steel sheet.
7. Frames for Borrowed Lights: Minimum 16 gage thick steel sheet.
8. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - SQ/SU and SR Series. (Masonry); DU/DQ, DC, and DC Series (Drywall).
 - b. Curries Company (CU) - M and G Series (Masonry); C, CK, and CG Series (Drywall).
 - c. Or Equal.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.06 ENERGY EFFICIENCY HOLLOW METAL FRAMES

A. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate from minimum 16 gage galvanized steel, with positive 3/8" vinyl thermal break and integral vinyl weatherstripping. Thermal break frames available as knock down types only.

1. Manufacturers Basis of Design:
 - a. CECO Door Products - Thermal Break SQT and SRT Series.
 - b. Curries Company - Thermal Break M and C Series.
 - c. Or equal.

B. Weatherstripped Frames: Subject to the same compliance standards and

requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.

1. Manufacturers Basis of Design:
 - a. CECO Door Products - Weatherstripped SQW and SRW Series.
 - b. Curries Company - Weatherstripped WM, WC, and WG Series.
 - c. Or Equal.

2.07 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb. Formed from same material as frames, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.09 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing

device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.10 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 18 gage thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
- E. Glazing: Comply with requirements in Section 08800 - Glazing and with the hollow metal door manufacturer's written instructions.
 1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.11 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016

inches thick.

2.12 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
 - 4. Astragals: Provide overlapping astragals as noted in door hardware sets in Section 08710 - Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Section 08710 - Door Hardware.
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
 5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 6. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Section 08710 - Door Hardware.
 7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 8. Mortar Guards: Weld guard boxes to frame at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 10. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Section 08710 - Door Hardware.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08710 - Door Hardware.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

2.13 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Pre-Finishes: Factory apply electrostatic paint finish to doors and frames in accordance with ANSI A250.3 test procedure acceptance criteria for steel doors and frames with factory applied finished coatings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4- inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Section 08800 - Glazing and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat or painted finishes and apply touchup of compatible air drying, rust-inhibitive primer or paint.

END OF SECTION

SECTION 08330

OVERHEAD COILING SERVICE DOORS

PART 1 GENERAL

1.01 SCOPE

- A. Overhead coiling insulated doors.

1.02 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Support framing and framed opening.
- B. Section 06114 – Wood Blocking and Curbing.
- C. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.
- D. Section 09900 - Painting: Field applied finish.

1.03 REFERENCES

- A. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
- B. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
- C. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- D. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- F. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- G. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

A. Overhead coiling insulated doors:

1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components in conformance with ASTM E 330.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required. Provide written warranty with date of warranty and have owner sign the warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years' experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weather tight location.

1.08 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp.
- B. Wayne Dalton

C. Or approved equal.

2.02 INSULATED OVERHEAD COILING SERVICE DOORS

A. Overhead Coiling Stormtite Insulated Service Doors: Overhead Door Corporation Model 625 or comparable models from alternate manufacturers.

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
 - b. Front slat fabricated of:
 - 1) 24 gauge galvanized steel.
 - c. Back slat fabricated of:
 - 1) 24 gauge galvanized steel.
 - d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
 - 1) R-Value: 7.7, U-Value: 0.13.
 - 2) Sound Rating: STC-21.
2. Performance:
 - a. Through Curtain Sound Rating: Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E 90.
 - b. Installed System Sound Rating: STC-21 as per ASTM E 90.
 - c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
 - d. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft².
3. Finish:
 - a. Galvanized Steel: Slat and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
 - 1) Polyester Top Coat.
 - a) Brown polyester. Color to be Owner approved
4. Weatherseals:
 - a. Vinyl bottom seal, exterior guide and internal hood seals.
5. Bottom Bar:
 - a. Two galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
6. Guides: Three Structural steel angles
 - a. Finish: PowderGuard Zinc Finish for guides, bottom bar and head plate.
7. Brackets:
 - a. Galvanized steel to support counterbalance, curtain and hood.
8. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch

- per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
- 9. Hood: Provide with internal hood baffle weatherseal.
 - a. 24 gauge galvanized steel with intermediate supports as required.
- 10. Manual Operation:
 - a. Chain hoist.
- 11. Windload Design:
 - a. Standard windload shall be 20 PSF.
- 12. Locking:
 - a. Chain keeper locks for chain hoist operation.
- 13. Wall Mounting Condition:
 - a. Face-of-wall mounting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
- F. Install perimeter trim and closures.
- G. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.04 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 08550

VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fixed Interior Windows

1.02 REFERENCES

- A. American Architectural Manufacturer Association (AAMA)

- 1. ANSI/AAMA/NWDA 101/I.S.2 /NAFS; Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

- B. National Fenestration Rating Council (NFRC)

- 1. NFRC 100; Procedure for Determining Fenestration Thermal Properties
 - 2. NFRC 200; Solar Heat Gain Coefficient and Visible Transmittance

1.03 DESIGN REQUIREMENTS

- A. Provide windows capable of complying with requirements indicated, based on testing manufacturer's window that are representative of those specified and that are of test size required by ANSI/AAMA/NWDA 101 I.S.2/NAFS.

- B. Structural Requirements – Provide windows capable of complying with requirements indicated:

- 1. Design pressure: 30 psf

1.04 SUBMITTALS

- A. Refer to Section 01300 – Submittals.

- B. Product Data: Submit window manufacturer current product literature, including installation instruction.

- C. Samples: Provide finish samples for all products.

- D. Quality Assurance Submittals

- 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

2. Manufacturer Instructions: Provide manufacturer's written installation instructions.

E. Closeout Submittals

1. Refer to Section 01700 – Contract Closeout.

1.05 QUALITY ASSURANCE

A. Certifications

1. WDMA Hallmark certification label indicating windows meet the design requirements.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600 - Materials and Equipment.
- B. Deliver windows materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store windows as recommended by manufacturer.

1.07 WARRANTY

- A. Manufacturer standard warranty indicating that the window unit will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
 1. Window Unit: 10 years
 2. Glazing:
 - a. Laminated Glass: 5 years against delamination

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

- A. Basis of Design: Windows are based on the JELD-WEN®'s Vinyl Windows.

2.02 MANUFACTURED UNITS

A. Frame

1. Jamb Depth
 - a. Fixed Windows: 2-29/32 inch

B. Glazing

1. Window Glazing
 - a. Strength: Laminated
 - b. Type: Type 1- Clear

2.03 CONSTRUCTION ACCESSORIES

- A. Provide manufacturer recommended sealants to maintain watertight / airtight conditions.

2.04 FABRICATION

A. Fixed Windows

1. Frame: Fusion welded corners
2. Glass: Mounted using silicone glazing compound or glazing tape.

2.05 FINISH

- A. Color: Manufacturer's standard color.

PART 3 EXECUTION

3.01 GENERAL

- A. Install windows in accordance with manufacturer's installation guidelines and recommendations.

3.02 EXAMINATION

- A. Inspect window prior to installation.
- B. Inspect rough opening for compliance with window manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.03 PREPARATION

- A. Prepare windows for installation in accordance with manufacturer's recommendations.

3.04 INSTALLATION

- A. Insert window into rough opening:

1. Shim side jambs straight.
2. Inspect window for square, level and plumb.
3. Fasten window through jamb, shim and into rough opening jamb.
4. Test and adjust for smooth operation of window.
5. Ensure weep holes are clear of debris for proper drainage.

3.05 CLEANING

- A. Remove protective film from glass.
- B. Clean the exterior surface and glass with mild soap and water.

3.06 PROTECTION

- A. Protect installed windows from damage.

END OF SECTION

SECTION 08551

VINYL WINDOWS – DOUBLE HUNG

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vinyl Windows: Double Hung Windows opaque

1.02 REFERENCES

- A. American Architectural Manufacturer Association (AAMA)

- 1. AAMA/WDMA/CSA 101/I.S.2 /A440 - North American Fenestration Standard/Specification for windows, doors, and skylights (NAFS).

- B. National Fenestration Rating Council (NFRC)

- 1. NFRC 100 - Procedure for Determining Fenestration Thermal Properties
 - 2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

- C. ASTM International

- 1. ASTM E90 – Laboratory measurement of Airborne Sound Transmission of Building Partitions and Elements.
 - 2. ASTM E1332 – Standard Classification for Rating Outdoor – Indoor Sound Attenuation.

1.03 SUBMITTALS

- A. Refer to Section 01300 – Submittals.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:

- 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- C. Shop Drawings: Submit shop drawings indicating details of construction, flashings and relationship with adjacent construction.

- D. Selection Samples: For each factory-finished product specified, two complete sets of color chips representing manufacturer's full range of available finishes.

- E. Verification Samples: For each factory-finished product specified, two samples, minimum size 6 inches (150 mm) square, representing actual finishes.
- F. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
- G. Closeout Submittals: Refer to Section 01730.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 5 year(s) installing similar assemblies.
- B. Certifications: AAMA certification label indicating assemblies meet the design requirements.
- C. Pre-installation Meeting: Conduct pre-installation meeting on-site two weeks prior to commencement of installation.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600 - Materials and Equipment.
- B. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- C. Deliver and store assembly materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect from damage.

1.06 WARRANTY

- A. Manufacturer standard warranty indicating that the window unit will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
 - 1. Window Unit: 10 years
 - 2. Glazing:
 - a. Insulated Glass: Lifetime against seal breakage
 - b. Laminated Glass: 5 years against delamination

PART 2 PRODUCTS

2.01 VINYL WINDOW ASSEMBLIES

- A. Basis of Design: Windows are based on the JELD-WEN®'s Vinyl Windows.

B. Substitutions: Engineer approved equal.

C. Window Fabrication:

1. Double Hung Windows:

- a. Frame: Fusion welded corners.
- b. Sash: Fusion welded corners.
- c. Glass: Mounted using silicone glazing compound or glazing tape.

D. Frames: Jamb Depth: Double Hung Windows: 3 9/16 inch (90.5mm)

E. Sash Thickness: Double Hung Windows: 1 1/8 inch (28.6mm)

F. Exterior Trim, Jamb and Frame Accessories: Provide exterior trim, jamb and frame accessories to incorporate vinyl window into metal building system.

G. Weather stripping: Double Hung Windows: .290" fin pile

H. Hardware:

- 1. Balance: Block and Tackle System.
- 2. Sliding System: Standard, Nylon Rollers and Guides.
- 3. Lock: Style Cam-Lock. Finish: As selected by Owner from Standard available colors.
- 4. Secondary Vent Stop: Provide Secondary Vent Stop.

I. Glazing for Windows

- 1. Strength: Annealed glass.
- 2. Glazing Type: Insulated Glass
 - a. Two panes of glass utilizing a continuous roll formed stainless steel and dual seal sealant.
 - b. Overall Nominal Thickness: 3/4 inch.
 - c. Glass Coating: Low-E.

J. Insect Screens

- 1. Material: Charcoal Fiberglass screen cloth (18 by 16 mesh) set in painted roll formed aluminum frame.
- 2. Frame Finish: Color match window frame extrusion.

PART 3 EXECUTION

3.01 GENERAL

- A. Install windows in accordance with manufacturer's installation guidelines and recommendations.

3.02 EXAMINATION

- A. Inspect window prior to installation.
- B. Inspect rough opening for compliance with window manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.03 PREPARATION

- A. Prepare windows for installation in accordance with manufacturer's recommendations.

3.04 INSTALLATION

- A. Insert window into rough opening:
 - 1. Shim side jambs straight.
 - 2. Inspect window for square, level and plumb.
 - 3. Fasten window through jamb, shim and into rough opening jamb.
 - 4. Test and adjust for smooth operation of window.
 - 5. Ensure weep holes are clear of debris for proper drainage.

3.05 CLEANING

- A. Remove protective film from glass.
- B. Clean the exterior surface and glass with mild soap and water.

3.06 PROTECTION

- A. Protect installed windows from damage.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Hardware Supplier: Company specializing in supplying commercial door hardware with 2 years' experience, with AHC designation.
- B. Hardware Installer: Employ a qualified carpentry person to perform the work of this Section.

1.02 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for requirements applicable to fire rated doors and frames.
- B. Comply with provisions of Americans with Disabilities Act Accessibility Guidelines (ADAAG), ANSI A117.1, and applicable state and local requirements for accessibility, whichever is most stringent, to accommodate handicapped persons.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
 - 1. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.
- C. Submit for approval test reports.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide hardware complete with necessary screws, bolts, anchors or other fastenings for proper application of suitable size and type, and match hardware as to materials and finish.

2.02 CYLINDERS

- A. Provide cylinders for locksets, deadlocks, exit devices, and other control and locking devices indicated in Hardware Sets.
- B. Equip cylinders with appropriate rings.
- C. Finish cylinders and rings to match trim.

2.03 LOCKING AND LATCHING DEVICES

- A. Manufacturers: Refer to Drawings.
- B. Bored Locksets and Latch sets: ANSI A156.13, Grade 2.
- C. Acceptable Products: Refer to Drawings.
- D. Backset: 2-3/4 inches.
- E. Latch Bolt: Two-piece anti-friction, 3/4 inch throw.
- F. Strike: ANSI standard 4-7/8 inch height, 1-1/4 inch curved lip.
- G. Trim lever and rose: Refer to schedule at end of section.

2.04 EXIT DEVICES

- A. Acceptable Manufacturers: Refer to Drawings.
- B. Basis for Design; Acceptable Products: Refer to Drawings.
- C. Standards: ANSI A156.3, Grade 1.
- D. UL listed for "Fire Exit Hardware" at labeled assemblies.
- E. Touch Bar: Modern design, recessed to provide proper clearance at door openings, full width of door.
- F. Dogging Feature: Equip for keyed cylinder at non-label assemblies.

2.05 SURFACE MOUNTED CLOSERS

- A. Acceptable Manufacturers: Refer to Drawings.
- B. Acceptable Products: Refer to Drawings.

C. Standard: ANSI A156.4, Grade 1.

D. Required Features: Manufacturer's standard cast iron or cast aluminum construction.

1. Regular or parallel arm mounting.
2. Rack and pinion construction with compression spring, fully hydraulic.
3. Closing speed and latching speed controlled by independently operated valves.
4. Adjustable spring power allowing adjustment up to 50 percent in field to suit individual door conditions.
5. Adjustable back check for interior and exterior units.
6. Maximum operating force of 8.5 pounds for exterior doors, 5 pounds for interior doors, and 15 pounds for label doors.
7. Size as recommended by manufacturer for door size and weight.
8. Hold open and dead stop features where indicated in Hardware Sets.
9. Accessories: Manufacturer's standard full size non-metallic cover.
10. Furnish with necessary arms, tracks, brackets, plates, shoes, and other accessories to suit door and frame conditions.
11. Finish accessories to match cover.

2.06 HINGES

A. Acceptable Manufacturers: Refer to Drawings.

B. Butt Hinges:

1. Comply with ANSI A156.1 and A156.7.
2. Five knuckle design with square corners.
3. Full mortise type.
4. Flat button tip and matching plug.
5. Non-removable pins for out-swinging exterior doors and for interior reverse bevel doors equipped with locking device; safety stud also acceptable. Non-rising pin for other doors
6. Non-ferrous construction at locations exposed to exterior atmosphere.
7. Heavy weight for doors 3'-4" width and over and for fire rated doors over 8'-0" height. Standard weight at other doors
8. Anti-friction or ball bearing type for doors equipped with closers.
9. Anti-friction or ball bearing type for doors (3'-0") width and over which are not equipped with closers.
10. Plain bearing type for doors less than 3'-0" width which are not equipped with closers.

C. Minimum Number Hinges:

1. Doors 5'-0" or less in height: One pair.

2. Doors over 5'-0" and not over 7'-6": 1-1/2 pair.
3. Doors over 7'-6": One for each additional 2'-6" height or fraction thereof.
4. Dutch doors: 2 pair.

D. Minimum Size and Gage:

1. Doors 3'-0" width or less: 4-1/2 by 4-1/2 inches, 0.134 gage
2. Doors over 3'-0" up to 3'-4): 5 by 4-1/2 inches, 0.146 gage.
3. Doors over 3'-4": 5 by 4-1/2 inches, 0.190 gage.
4. Fire rated doors over 8'-0" height: Sized as indicated above, except not less than 0.180 gage.

2.07 PUSH/PULL TRIM AND PLATES

A. Acceptable Manufacturers: Refer to Drawings.

B. Pulls and Push Plates:

1. Acceptable Product: Refer to Drawings.

C. Protection Plates:

1. Type: Stainless steel, square corner design, 0.050 inch thickness.
2. Size: When mounted on push side of door, 1 inch less than door width at pair of doors and 2 inches less than door width at single doors. When mounted on pull side of door, 1 inch less than door width.
3. Kick Plates: Beveled 3 edges, 12 inch height unless indicated otherwise in Hardware Sets.
4. Armor Plates: Beveled 3 edges, 42 inch height unless indicated otherwise in Hardware Sets.
5. Mop Plates: Beveled 3 edges, 4 inch height.

2.08 MISCELLANEOUS HARDWARE

A. Acceptable Manufacturers: Refer to Drawings.

B. Lock Guards: Prime coated steel, equivalent to Ives 184.

C. Silencers:

1. Type: Preformed neoprene or rubber.
2. Location and quantities:
 - a. Pairs of Doors: Two at header.
 - b. Single Doors: Three at strike jamb.
 - c. Weatherstripped Doors: Not required.

2.09 WEATHERSTRIPPING, SEALS AND THRESHOLDS

A. Acceptable Manufacturers and Products: Refer to Drawings.

B. Thresholds:

1. Type: Extruded aluminum.
2. Size: 5 inch width, 1/2 inch height.

C. Weather stripping:

1. Type: Extruded aluminum with neoprene bulb.

D. Sweep Strips:

1. Type: Extruded aluminum with neoprene seal.

E. Door Bottom Seals:

1. Type: Extruded aluminum housing with polyurethane seal.

F. Rain Drips:

1. Type: Extruded aluminum.

G. Astragals:

1. Type: Steel, prime coated.

2.10 DOOR STOPS

A. Acceptable Manufacturers: Refer to Drawings.

B. Provide door stops at each door leaf, except not required at doors equipped with overhead stops/holders, or doors equipped with closers having dead stop feature.

C. Door stops consist of floor stops or wall stops to prevent doors from striking building components or equipment.

D. Wall Stops:

1. Equipped with expandable anchor for use at gypsum board/stud or with machine screw and expansion shield for use at concrete or masonry walls.

E. Floor Stops:

1. Equip with machine screw and expansion shield, and appropriate riser where scheduled for areas indicated to receive carpet or thresholds.

2.11 KEYING

- A. Door Locks: Keyed, master-keyed, and grand master-keyed as directed by Owner's Representative with control keying for core removable cylinders.

- B. Supply 2 keys for each lock.

- C. Provide bitting list locks.

- D. Supply keys in the following quantities:

1. 10 master keys.
2. 10 construction keys.

E. FINISHES

F. Finishes:

1. US32D brushed stainless steel, unless noted otherwise in schedule.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hardware plumb, level, and true to line in accordance with manufacturer's templates, Section 01600, and Project conditions.

- B. Install fire rated hardware in accordance with NFPA 80.

- C. Where cutting and fitting is required on substrates to be field painted or similarly finished, install, fit, remove and store hardware prior to finishing. Reinstall hardware after finishing operations are completed.

- D. Do not install surface mounted items until finishes have been completed on substrate.

- E. Reinforce attachment substrates as necessary for installation and operation.

- F. For substrates which are not factory prepared for hardware:

1. Mortise work to correct size and location without gouging, splintering or

causing irregularities in exposed finish work.

2. Fit faces of mortised components snug and flush without excessive clearance.

- G. Set thresholds at exterior doors in bed of sealant. Remove excess sealant.

3.02 ADJUSTING

- A. Check and adjust each operating hardware item to ensure correct operation and function.
- B. Ensure weather stripping and seals do not inhibit closing and positive latching of door.
- C. Lubricate moving or operating components as recommended by hardware manufacturer. Use graphite type lubrication if none other is recommended.
- D. Replace defective materials or units which cannot be adjusted to operate as intended. Reinstall items found improperly installed.
- E. Prior to date of Substantial Completion, readjust and re-lubricate hardware items as necessary.

3.03 SCHEDULE

- A. Refer to Drawings

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.

1.02 SUBMITTALS

- A. Product data: For each glass product and glazing material indicated.

1. Manufacturer's product literature and applicable technical bulletins.
2. Insulating glass certification report.
3. Safety glazing certification reports.

- B. Samples: For the following products, in the form of at least 12-inch square Samples for glass.

1. Each color of tinted float glass.
2. Each type of patterned glass.
3. Coated vision glass.
4. Ceramic-coated spandrel glass.
5. Insulating glass for each designation indicated.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Single firm with minimum 5 years' successful experience in the fabrication of glass.

1. Glass of type required for this project must be a certified safety glazing product listed with the Safety Glazing Certification Council by firm, where applicable.
2. Glass of type required for this project must be a certified product listed with the Insulating Glass Certification Council by firm, where applicable.

- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

C. Glass standards:

1. ASTM specification C1048 for glass.
2. ASTM specification C1036 for glass.

D. Safety Glazing: Materials complying with testing requirements of Consumer Products Safety Commission 16 CFR 1201 Category II, and American National Standards Institute ANSI Z97.1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency indicated below:

1. Insulating Glass Certification Council (IGCC).

1.04 WARRANTY

A. Manufacturer's warranty on insulating glass: Manufacturer's standard warranty agreeing to replace, or credit insulating glass units due to failure of hermetic seal under normal use that is attributed to the manufacturing process, and not due to handling, installing, protecting, and maintaining practices contrary to manufacturer's instructions.

1. Warranty period: Manufacturer's standard warranty for 10 years from date of manufacture.

PART 2 PRODUCTS

2.01 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent, flat), Quality q3 (glazing select), class as indicated in glass schedule.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent, flat), Quality q3 (glazing select), class as indicated.

1. Fabrication process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless furnace dimensional constraints prevent so.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses as recommended by the float glass manufacturer.

3. Provide Kind FT (fully-tempered) float glass in place of annealed where safety glass is indicated.
- C. Ceramic-Coated spandrel glass: ASTM C 1048, Condition B (spandrel glass, one-surface ceramic coated), Type I (transparent, flat), Quality q3 (glazing select), class as indicated in glass schedule.
- D. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units or ASTM E 2190.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses as recommended by the float glass manufacturer.
 2. Provide Kind FT (fully-tempered) float glass in place of annealed where safety glass is indicated.
 3. Sealing system: Dual seal, with primary and secondary sealants as follows:
 - a. TPS - Butyl-based thermoplastic edge seal and structural silicone.
 4. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: TPS – Thermoplastic warm-edge spacer system.
 - b. Desiccant: Molecular sieve matrix
 - c. Corner Construction: Seamless bent corners with one straight-edge tapered joint.

2.02 FLAT GLASS MATERIALS

- A. Float Glass: annealed: ASTM C 1036
1. Glass: thickness, type, tint: as indicated.
- B. Float Glass: heat-treated: ASTM C 1048
1. Kind: Heat-strengthened.
 - a. Glass: thickness, type, tint: as indicated.
 2. Kind: Fully-tempered.
 - a. Glass: thickness, type, tint: as indicated.

2.03 INSULATING-GLASS UNITS

- A. Insulating-glass units.
1. Overall unit thickness: as indicated.
 2. Outboard lite:
 - a. Glass thickness: as selected.
 - b. Glass type: as selected.

3. Interspace content:
 - a. Thickness: as indicated.
 - b. Content: as selected.
4. Inboard lite:
 - a. Glass thickness: as selected.
 - b. Glass type: as selected.

2.04 CERAMIC-COATED SPANDREL

A. Ceramic-coated spandrel glass

1. Glass substrate:
 - a. Glass thickness: as selected
 - b. Glass type: as selected.
2. Coating: Ceramic frit paint.
 - a. Color: as selected from manufacturer's standard colors.
 - b. Custom color: as matched from sample.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. General contractor and glazing contractor shall examine all areas, substrates and conditions where glass door assemblies are to be installed. Do not proceed with any work until satisfactory conditions exist for proper installation of all materials.
- B. Clean glazing channels and other framing members receiving glass immediately before glazing.

3.02 GLAZING

- A. General: Comply with written instructions of manufacturers of glass, sealant, gasket, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
 1. Glazing channel dimensions, as indicated on drawings, shall provide necessary bite on glass, minimum edge and face clearance, and adequate sealant thicknesses, with reasonable tolerances.
 2. Protect glass edges from damage during handling and installation. Remove damaged glass from project site and legally dispose of off project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance.

- B. Follow industry best practices, published guidelines of the Glass Association of North America, and applicable manufacturer's recommendations for proper tape, gasket, sealant, and lock-strip glazing.

3.03 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove non-permanent labels, and clean surface.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come in contact with glass, remove them immediately as recommended by the glass manufacturer.
- C. Examine glass surface adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stain: remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of project not more than four days before date scheduled for inspections that establish date of substantial completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.02 RELATED SECTIONS

- A. Section 15190 - Mechanical Identification.
- B. Section 16195 - Electrical Identification.

1.03 REFERENCES

- A. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- B. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.
- C. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.
- D. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
- E. NSF (National Sanitation Foundation). Standard 60 or 61.
- F. ICRI (International Concrete Repair Institute)

1.04 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide data on all finishing products and special coating.
- C. Samples: Submit samples, illustrating range of colors and textures available for each surface finishing product scheduled. Colors shall be selected by the

owner.

- D. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention, and treatment.
- E. Materials in contact with potable water shall be NSF approved.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable local code for flame and smoke rating requirements for finishes.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required

otherwise by manufacturer's instructions.

- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers - Paint, Primers, Sealers, Field Coatings

1. Tnemec Company, Inc.
2. Sherwin Williams
3. Or Engineer Approved Equal

B. Substitutions: Under provisions of Section 01600.

2.02 MATERIALS

- A. The Contractor shall submit for review by the Engineer, all paints and procedures prior to shop or field painting of any item or structure. The products of Tnemec Company, 800-890-7580 are listed to establish a standard of quality. Products of other manufacturers may be submitted for approval by the engineer. Submittals must include product data, MSDS and ASTM performance criteria for evaluation by the engineer.

- B. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

- D. Patching Materials: Latex filler.

- E. Fastener Head Cover Materials: Latex filler.

2.03 FINISHES

- A. Refer to schedule at end of section for surface finish and color schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 01039.
- B. Verify that surfaces, substrate conditions are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.
 - 5. Concrete Floors: 8 percent.

3.02 PREPARATION

- A. All unpainted metal surfaces, prior to painting, shall first be thoroughly cleaned of all rust, mill scale, grease, oils, mud, dirt and other foreign matter. Cleaning shall be accomplished through the use of wire brushes, chisels, hammers, or washing with water or benzene, as is necessary or as directed. Sand blasting in an approved manner at point of manufacture is required on structural steel and rough steel castings or forgings, however, no sand blasting on or near mechanical or electrical equipment after assembly or installation will be permitted. Sand blasting, where specified "in field" shall be applied at job site before material and equipment is erected.
- B. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- C. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- D. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based compatible sealer or primer.
- E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- F. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear

water. Verify required acid-alkali balance is achieved. Allow to dry.

- G. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- H. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- J. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- M. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- N. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- O. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.

- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand wood and metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.
- H. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- I. Coverage is square feet per gallon, per coat. The minimum dry mil thickness per coat (MDMTC) shall be as indicated.

3.04 COLOR CODE

- A. In order to establish standards for colors and shades specified, these are identified by reference to the catalog numbers of a particular manufacturer, but without intent to particularize the products of that manufacturer. Colors used shall be similar and equal to the Master Color Card as furnished by the Tnemec Company, Incorporated, and numbers of the following schedule refer to this chart.
- B. The Contractor shall paint all new pipe lines, pipe line insulation and equipment with colors as specified. All stripes shall be painted as called for and shall be two (2) inches wide, and except for safety guards shall be spaced four (4) feet on centers.

PAINTING COLOR CODE FOR PIPING

<u>Piping</u>	<u>Color Scheme</u>	<u>WTP</u>	<u>WWTP</u>
1. Cold water (potable)	Blue	X	X
2. Hot water	Blue w/white bands	X	X
3. Air	Green	X	X
4. Natural gas	Red	X	X
5. Sewage gas	Red w/white bands		X
6. Air and gas mixture	Red w/green band	X	
7. Steam	Yellow	X	X
8. Condensate return	Yellow w/black bands	X	X
9. Hot water heat supply	Yellow w/red bands	X	X
10. Hot water heat return	Yellow w/green bands	X	X

11. Boiler stacks/ vents	Aluminum	X	X
12. Chemical	Orange	X	X
13. Drain, waste & sanitary	Brown	X	
14. Raw water,			
settled water	Gray	X	
15. Filtered water	Blue w/gray bands	X	
16. Filter or Press backwash waste			
or return	Light Brown	X	
17. Sludge recirculation	Brown w/white bands	X	
18. Sewage and drains	Gray		X
19. Sludge or slurry	Brown		X
20. Plant effluent			
(non-potable)	Gray w/blue bands	X	X
21. Valve Boxes (Top)	Same as piping color	X	X

Selections of colors for any finish surface not otherwise defined shall be coordinated and approved by the Owner. Painting codes of existing lines shall be coordinated with Owner.

3.05 PREPARATION OF SURFACES

- A. Refinishing of existing metal surfaces, prior to painting, shall be cleaned of all loose paint, rust or other oxidation, grease, oils, dirt and other material detrimental to poor adherence of new coating(s) to the surface being refinished. Surface preparation shall be done in accordance with recommendation of the coating manufacturer.
- B. All masonry surfaces, prior to painting, shall be thoroughly cleaned of all dirt, dust, curing compounds, oils and other foreign matter. If paint manufacturer requires etching of concrete surfaces prior to painting, surfaces shall be treated with a ten (10) percent muriatic acid solution in approved manner.
- C. It is the intent of these specifications that new cast iron pipe and valves to be installed should receive one (1) shop coat of the primer specified under Line 3 of the Painting Guide. Before field priming, the surfaces must have all loose rust and scale removed.
- D. The following specifications shall be adhered to when preparing surfaces:
 1. Metal
 - a. Submerged: SSPC-SP-10 Near White Blast
 - b. Non-Submerged: SSPC-SP-3 Power Tool Cleaning
 - c. Non-Submerged Exposed to Splash, Fumes, etc.: SSPC-SP-6 Commercial Blast

- d. Galvanized: SSPC-SP-1 Solvent Cleaning
- 2. Concrete
 - a. Submerged: SSPEC-SP-7 Brush-Off Blast or Acid Etch to Achieve Medium Grade Sandpaper Texture.

E. All surfaces, concrete or metal, shall be clean and dry at the time of application of paint coating, and at a temperature of not less than fifty (50) degrees Fahrenheit.

3.06 APPLICATION

- A. No painting shall be performed when the temperature is below fifty (50) degrees F, upon wet, damp or frosty surfaces, in wet, foggy weather; nor in damp atmosphere such as occurs in tunnels, galleries or elsewhere except by permission of the Engineer and in the manner that the Engineer may approve. Sufficient heating and ventilating shall be provided at the Contractor's expense to keep the atmosphere and surfaces to be painted dry and warm until the paint has hardened. Any painting found to be defective shall be scraped off and repainted as the Engineer may order. Previous coats of paint must dry before the addition of new coats, which in general, will be according to the manufacturer's recommendations in warm weather, and long in cold, damp weather, or in cold damp location. Before acceptance of the work all damaged surfaces of paint shall be cleansed and repainted or touched up as ordered by the Owner. All paint shall be applied in strict conformance with manufacturer's specifications. Each coat of paint shall be tinted to make it distinguishable from proceeding coats.

3.07 PROTECTION

- A. During the construction period, all electrical, mechanical and other equipment, apparatus and surfaces shall be protected from paint drippings by means of tarpaulins, burlap, wooden housings or other approved means of protection. After equipment, apparatus and piping has been erected and tested, or when ordered by the Engineer and just prior to the acceptance of the work, it shall be given the final coats of paint as herein provided.

3.08 SHOP PAINTING

- A. Shop painting shall be performed to the extent and as required under the various other items of this contract. If not there particularized, it is intended generally that all exposed metal surfaces shall be given a minimum of one (1) protective coat of paint varnish or rust protective material which shall be compatible with and is acceptable to the approved manufacturer of the herein specified field paint.

3.09 FIELD PAINTING OF NEW WORK

- A. The general color schemes for the new structures are to be selected by the Owner except that all piping and machinery shall be painted according to color code as specified and in accordance with the above Paint Schedule.

3.10 MATERIAL / SYSTEM SCHEDULE

- A. In order to establish standards for the coating of various surfaces subjected to different conditions, a painting guide (material/system schedule) is herein set up which shall be specified under various sections of these specifications as the intent of this Contract in regard to surface finishes and corrosion protection.
- B. Where commercial blasted "in field", apply first finish coat on same day. No primer required.

- C. Material / System Schedule shall be as follows:

Substrate			
Exposure	Surface Preparation	System Type	
		Coats	DFT, mils
Steel, Structural, Tanks, Pipe and Equipment			
- Exterior Exposed	SSPC-SP6 / NACE 3	Epoxy / Polyurethane Primer 1 Omnithane Interm. N69 Epoxoline II Finish 73 Endura-Shield Total DFT	2.5 to 4.0 2.0 to 3.0 2.0 to 5.0 6.5 to 12.0
- Interior Exposed	SSPC-SP6 / NACE 3 (2 ct.)	Epoxy/Epoxy Shop Primer 1 Omnithane Finish N69 Epoxoline II Total DFT	2.5 to 4.0 3.0 to 5.0 8.5 to 14.0
- Immersion	SSPC-10 / NACE 2	Epoxy / Epoxy / Epoxy Primer 1 Omnithane Interm. N140 Pota-Pox Finish N140 Pota-Pox Total DFT	2.5 to 4.0 4.0 to 10.0 4.0 to 10.0 10.5 to 24.0
- Immersion w/H ₂ S	SSPC-10 / NACE 2	Moist-cured Polyurethane Primer 1 Omnithane Interm. 446 Perma-Shield Finish 446 Perma-Shield Total DFT	2.5 to 3.5 7.0 to 10.0 7.0 to 10.0 16.5 to 23.5
- Below Grade	SSPC-10 / NACE 2	Epoxy / Coal Tar Epoxy Primer 46H Tneme-Tar Finish 46H Tneme-Tar Total DFT	3.0 to 5.0 14.0 to 20.0 17.0 to 25.0

Factory Primed Steel			
- Exterior Exposed	Clean and dry	Epoxy / Polyurethane	
		Primer (Unknown)	Factory
		Interm. 135 Chembuild	3.0 to 5.0
		Finish 73 Endura-Shield	2.0 to 3.0
		Total DFT (added)	5.0 to 8.0
- Interior Exposed	Clean and dry	Epoxy/Epoxy	
		Primer 135 Chembuild	3.0 to 5.0
		Finish N69 Epoxoline II	2.0 to 3.0
		Total DFT (added)	5.0 to 8.0
Galvanized Steel & Non-Ferrous Metal – Pipe & Miscellaneous Fabrications			
- Exterior Exposed	Varies based on Substrate SSPC-SP16	Epoxy / Polyurethane	
		Primer 27 Typoxy	2.0 to 5.0
		Finish 73 Endura-Shield	2.0 to 3.0
		Total DFT	4.0 to 8.0
- Interior Exposed	Varies based on Substrate SSPC-SP16	Epoxy/Epoxy	
		Primer N69 Epoxoline II	2.0 to 3.0
		Finish N69 Epoxoline II	2.0 to 3.0
		Total DFT	4.0 to 6.0
- Immersion Potable Water	Varies based on Substrate SSPC-SP16	Epoxy / Epoxy	
		Primer N140 Pota-Pox	3.0 to 5.0
		Finish N140 Pota-Pox	4.0 to 6.0
		Total DFT	7.0 to 11.0
Ductile or Cast Iron – Pipe, Pumps & Valves			
- Exterior Exposed	Per manufacturer's recommendations NAPF 500-03	M.C. Urethane / Epoxy / Polyurethane	
		Primer 1 Omnithane	2.5 to 4.0
		Intermed. N69 Epoxoline II	4.0 to 6.0
		Finish 73 Endura-Shield	2.0 to 3.0
		Total DFT	8.5 to 13.0
- Below Ground / Immersion	Per manufacturer's recommendations	Epoxy / Coal Tar Epoxy	
		Primer 1 Omnithane	2.5 to 4.0
		Finish 46H Tneme-Tar	14.0 to 20.0
		Total DFT	16.5 to 24.0
- Interior Exposed / Immersion Potable Water	Per manufacturer's recommendations NAPF 500-03	M.C. Urethane / Epoxy / Epoxy	
		Primer 1 Omnithane	2.5 to 4.0
		Finish N140 Pota-Pox (2 ct.)	4.0 to 6.0
		Total DFT	10.5 to 16.0
Wood			
- Interior Exposed	Clean and Dry	Alkyd or Waterborne Acrylic	
		Epoxy/Acrylic or Alkyd	
		Primer 36-603 Undercoater	1.0 to 3.5
	(2 ct.)	Finish 1029 Enduratone	2.0 to 3.0
		Total DFT	5.0 to 9.5

PVC (where specifically scheduled)				
- Exterior Exposed	Scarify	Epoxy / Polyurethane		
		Primer N69 Epoxoline II	2.0 to 3.0	
		Finish 73 Endura-Shield	2.0 to 3.0	
		Total DFT	4.0 to 6.0	
- Interior Exposed / Immersion Potable Water	Per manufacturer's recommendations	Epoxy / Epoxy		
		Primer N140 Pota-Pox	2.0 to 3.0	
		Finish N140 Pota-Pox	2.0 to 3.0	
		Total DFT	4.0 to 6.0	
Insulated Pipe				
- Interior / Exterior Exposed	Clean and dry	Acrylic / Acrylic		
		Primer 1029 Enduratone	2.0 to 3.0	
		Finish 1029 Enduratone	2.0 to 3.0	
		Total DFT	4.0 to 6.0	
Concrete & Masonry – Precast, Poured-in-Place & Dense CMU				
- Exterior Exposed	SSPC-SP13/NACE 6 Clean and dry ICRI CSP3	Waterborne Acrylate / Waterborne Acrylate		
		Primer 156 Enviro-Crete	4.0 to 6.0	
		Finish 156/157 Enviro-Crete	4.0 to 9.0	
		Total DFT	8.0 to 15.0	
- Below Grade	SSPC-SP13/NACE 6	Coal Tar Epoxy		
		Finish 46H Tneme-Tar	14.0 to 20.0	
		Total DFT	14.0 to 20.0	
- Immersion Potable Surfacers?	SSPC-SP13/NACE 6 ICRI CSP 5 215 or 218	Epoxy / Epoxy		
		Primer N140 Pota-Pox	4.0 to 6.0	
		Finish N140 Pota-Pox	4.0 to 6.0	
		Total DFT	8.0 to 12.0	
- Immersion, H ₂ S Vapor Exposure >25 PPM H ₂ S	SSPC-SP13/NACE 6	Modified Polyamine Epoxy		
		Primer 218 MortarClad	1/32" to 1/4"	
		Finish 436 Perma-Shield FR	50.0 to 60.0	
		Total DFT	Nom. 1/8"	
- Interior Exposed	SSPC-SP13/NACE 6 ICRI CSP3	Epoxy / Epoxy		
		Primer N69 Epoxoline II	4.0 to 6.0	
		Finish N69 Epoxoline II	4.0 to 6.0	
		Total DFT	8.0 to 12.0	
Interior Gypsum Wallboard				
- Interior Exposed	Clean and Dry	Vinyl Acrylic / Waterborne Acrylic Epoxy		
		Primer 51-792 PVA	1.0 to 2.0	
	(2 ct.)	Finish 1029 Enduratone	4.0 to 6.0	
		Total DFT	9.0 to 14.0	

Concrete Floors			
- Light Traffic Low Impact	SSPC-SP13/NACE 6 ICRI CSP4, CSP5	Epoxy / Epoxy	
		Primer 201 Epoxoprime	6.0 to 8.0
		Interm. 280 Tneme-Glaze	6.0 to 8.0
		Finish 280 Tneme-Glaze	6.0 to 8.0
		Total DFT * or 281	18.0 to 24.0
- Mod. Chemical Functional	SSPC-SP13/NACE 6 Double Broadcast	Epoxy / Agg. Filled Epoxy / Epoxy	
		Primer 201Epoxoprime	6.0 to 8.0
		Interm. 239 Chem-Tread	1/8"
		Finish 282 Tneme-Glaze	6.0 to 8.0
		Total DFT	Nom. 1/8"
Concrete & Masonry – Porous CMU & Concrete			
- Exterior Exposed	SSPC-SP13/NACE 6	Acrylic / Acrylic / Acrylic	
		Primer 130 Envirofill	filler
		Interm.156 Enviro-Crete	4.0 to 8.0
		Finish 156/157 Enviro-Crete	4.0 to 8.0
		Total DFT	8.0 to 16.0
- Mod. Chemical Functional	SSPC-SP13/NACE 6	Epoxy / Epoxy	
		Primer	filler
		Intermediate	4.0 to 6.0
		Finish	4.0 to 6.0
		Total DFT	8.0 to 12.0

3.11 DRESDEN, OHIO WWTP PAINTING SCHEDULE

A. Concrete and Masonry

1. New interior concrete and masonry walls, floors and ceilings – Screen/Press Building.
2. Existing interior concrete floors – Operation Building and Pump Building (Main Level)
3. Existing interior masonry walls – Operation Building and Pump Building (Main Level)
4. New interior masonry walls – Pump Building (Main Level)

B. Metal

1. All exposed new and existing exterior steel, ductile iron and cast iron including structural steel, ductile or steel pipe and valves, pipe supports and hangers, floor stands, exposed steel and cast iron associated with equipment, and floor boxes, hydrants, etc.
2. All exposed new interior steel and structural steel, cast iron including steel pipe and valves, pipe supports and hangers, floor stands and floor boxes, etc.

3. All new and existing submerged ferrous metal such as screen or post aeration equipment, clarifiers, bar screen housing, baffles, supports, structural steel, etc. Galvanized metal shall be touched up where it has been cut or scratched.
4. All exposed new and existing exterior mechanical equipment: pumps, motors, etc. shall receive one final coat with shop coat.
5. All exposed new and existing interior mechanical equipment: pumps, motors, etc.
6. All new and existing interior mechanical equipment: pumps, motors, etc.
7. New and existing exterior ductile iron pipe, fittings, valves, etc., not buried.
8. New and existing interior ductile iron pipe, fittings, valves, etc.
9. All new and existing electrical conduit exposed along painted surfaces.

C. Miscellaneous Surfaces

1. Ceilings – Operation and Pump Building (Main Level)

END OF SECTION

SECTION 10421

BRONZE PLAQUE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bronze Plaque identifying project facilities.

1.02 RELATED SECTIONS

- A. Section 07700 - Masonry System.

1.03 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit layout of sign in size illustrating type, style, letter font and method of attachment.
- D. Submit for FINAL REVIEW a full size rubbed copy prior to casting.

1.04 SUBMITTALS FOR INFORMATION

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturers Installation Instructions: Include installation template and attachment devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 - 1. Leeds Aluminum Letters, Inc., Leeds, AL 35094
 - 2. Matthews International Corp., Pittsburgh, PA 15226
 - 3. Metal Arts, Mandan, ND 58554
 - 4. Or approved equal.

2.02 SIGNS

A. Bronze Tablet:

1. Character Color: White Bronze with raised letters.
2. Background Color: Pebble surface.
3. Character Font: Helvetica upper and lower case.
4. Size: Shall be large enough to list municipal officials, Engineer and Contractors. Minimum dimension: No less than 24" x 24".
5. Edges: Square.
6. Mounting: Embedded Screwed with concealed fasteners.

2.03 ACCESSORIES

- A. Mounting Hardware: Brass screws and accessories.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Coordinate installation location with Owner.

END OF SECTION

SECTION 10525

FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Certifications

1. Conform to NFPA-10 requirements for extinguishers.
2. Provide units conforming to ANSI/UL 711 and ANSI/UL 92.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following or approved equal:

1. JL Industries.
2. Larsens Manufacturing Co.
3. Or Equal.

B. Substitutions: Submit under provisions of Section 01600.

2.02 FIRE EXTINGUISHERS

A. Multi-purpose dry chemical type U.L. 299, (ammonium phosphate), with pressure gauge.

1. Capacity: 10.0 lbs.
2. U.L. Rating: 4A:60B:C

B. Mounting bracket: Manufacturer's standard.

2.03 FINISHES

A. Extinguisher: Red enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install using skilled workmen in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 11135

MECHANICALLY CLEANED BAR SCREEN

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. This section includes furnishing and installing one (1) mechanical cleaned fine bar screen to be installed indoors with controls in compliance with the following specification and as shown on the Drawings.
2. All equipment supplied under this section shall be furnished by or through a single Screening System Supplier who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the screening components. The Screen Supplier shall have the sole responsibility for the coordination and performance of all components of the screenings system with the performance and design criteria specified herein.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions, and sections in Division 1 of these Specifications.
 - a. Section 05530 - Grating and Floor Plates
 - b. Section 09900 - Painting and Finishes
 - c. Section 11280 - Valves
 - d. Section 16170 - Process Control Panels and Hardware

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and have at least 25 installations of the specified model of bar screen that have been in successful operation at similar installations and with a minimum of a five (5) year history of satisfactory production acceptable to the Owner. References shall be made available upon request.
- B. The Mechanically Cleaned Bar Screens shall be fully assembled and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of four (4) hours of run time. The Contractor, Engineer, Owner, or the Owner's representative reserve the right to witness the shop

test. A minimum two (2) week notice shall be provided prior to the test to allow for travel coordination.

- C. Qualification of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper installation of the work in this Section.
- D. Data from three (3) separate tests proving compliance of the screen with the "Paint Filter Test" as described in EPA Publication SW 486 Method 9095.

1.03 FABRICATION

- A. Structural steel used in the fabricated parts shall conform to the requirements of "Standard Specifications for Steel for Bridges and Buildings," A.S.T.M. Designation A-36. All shop welding shall conform to the latest standards of the American Welding Society.
- B. Fabricated assemblies shall be shipped in convenient sections permitted by carrier regulations and properly match-marked for ease of field installation.

1.04 SUBMITTALS AND SUBSTITUTIONS

- A. Comply with pertinent provisions of Section 01300.
- B. The following product data shall be submitted in accordance with the approved Construction Schedule required in Section 01310 of these Specifications:
 - 1. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
 - 2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 3. Full scale field test data demonstrating the performance required in this Section of the Specifications. If such data is not available, the Contractor shall be responsible for running performance tests at start-up. The specified performance must be met before the equipment is accepted. All testing costs shall be borne by the Contractor.
- C. Upon completion of this portion of the Work, as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

- D. To be selected as an approved equal a submittal showing compliance with these specifications shall be submitted ten (10) days before bid opening. Selected equipment manufacturers will be added by addendum.

1.05 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01600.

1.06 WARRANTY

- A. Manufacturer shall provide a written one year standard warranty from the date of substantial completion to guarantee that there shall be no defects in material or workmanship in any item supplied.
- B. Manufacturer shall warrant for the period of five (5) years all rotating parts of the Mechanically Cleaned Bar Screen including the gear motor, bearing, drive head, and the link system including the links, castings, pins and retaining rings. Manufacturer warrants that these components shall be replaced if damaged or defective in the normal use of the equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of these Specifications and Drawings, manufacturers offering Screens which may be supplied for the work include the following:
 - 1. Duperon Corporation, Saginaw MI Model FlexRake Stainless Steel Link driven, Front Cleaning, Front Return with Duperon Corporation WC3.A1.5 (3/4 HP Motor) Washer Compactor
 - 2. Or equal.
- B. To be selected as an approved equal a submittal showing compliance with these specifications shall be submitted ten (10) days before bid opening. Selected equipment manufacturers will be added by addendum.
 - 1. The design and layout shown on the drawings are based on the Manufacturer listed above. If equipment other than that of the Manufacturer shown is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the CONTRACTOR wishing to make the substitution to submit with the request a revised drawing of the mechanical equipment and basin layouts acceptable to the ENGINEER.
 - 2. Changes in architectural, structural, electrical, mechanical and plumbing requirements for the substitution shall be the responsibility of

the CONTRACTOR wishing to make the substitution. This shall include the cost of redesign by ENGINEER or ENGINEER'S SUBCONSULTANTS. Any additional cost incurred by affected subcontractors shall be the responsibility of the CONTRACTOR and not the OWNER. Any such changes to the plans shall be stamped by a professional engineer registered the State of Ohio.

2.02 BAR SCREEN BASIS OF DESIGN

- A. The Screen shall be a front-cleaning type with multiple rakes to clean the debris from the bar rack on the upstream side. Back-cleaned screens and single-rake screens are not acceptable. Wall seals shall be supplied and attached to the side frames to seal the area between the screen and channel walls.
- B. The Screen shall have at least 0.5 scrapers below water level at any one time and shall have a rated volume of debris removal capacity at high and low speeds. Those capacities shall be at least 9 cubic feet per hour at low speed and 39 cubic feet per hour at high speed.
- C. The bars shall be shaped to reduce the pass through of solids and shall limit the headloss through the screen in both clean water and wastewater.
- D. The Screen shall be designed to run continuously (24/7).
- E. The equipment shall have multiple scrapers on the bar screen at one time cleaning continuously from bottom to top, the entire width of the bar screen. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance and increase product life. Units which have single raking arms or that require cycle times shall not be allowed.
- F. Designs employing the use of endless moving media or cables and hydraulic cylinders to remove debris from the channel shall not be allowed
- G. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level or above. No part of the drive system including sprockets shall be located below the water surface at maximum design flow unless such a design also employs a pivot system that would allow the screen to be rotated out of the channel for maintenance. Such a system would require structural evidence that there would be no adverse stress to the equipment while lifting out of the channel.
- H. The fine screen shall be designed and built to withstand maximum possible static and hydraulic forces exerted by the liquid to the screen. All

structural and functional parts shall be sized for the loads encountered during the screening, conveying and pressing operations. All submerged components and all components of the fine screen in contact with the screened solids shall be of 304 stainless steel construction.

I. Design Conditions:

1. Normal daily flow	0.40 mgd
2. Maximum daily design flow	1.0 mgd
3. Peak hourly flow design	1.4 mgd
4. Channel width	3'-0"
5. Effective bar screen width	2'-0"
6. Channel depth	16'-6"
7. Discharge height	5'-0"
8. Maximum water level	1'-3"
9. Bar spacing (clear opening)	0.25"
10. Maximum clean water headloss	4"
11. Maximum wastewater headloss	8"
12. Liquid level sensing system	1 upstream ultrasonic meter, water resistant

J. Data for Indoor Installation:

1. Ceiling clearance height:	14 feet
2. Roof Opening available:	No
3. Door Opening Size:	Rolling 12 ft. x 12 ft.
4. Installation Area Classification:	Cl. 1, Div. 1, Gr. D after start up
5. Washer Compactor:	Yes (as Alternate)

2.03 DETAILED COMPONENT SPECIFICATIONS

- A. Bar Screen Assemblies. Unless noted otherwise materials of construction shall be 304-type stainless steel. A stainless steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and assure that the raking mechanism reaches the bottom of the screen to prevent debris accumulation. The bar screen assembly shall be shipped in one piece.

1. Screen Bars: Bars shall be 316L stainless steel and be teardrop shaped with a Hydraulic coefficient shape factor of 0.76 and the minimum dimensions of 0.25 inch x 0.75 inch x 0.13 inch. Bars shall be individually replaceable without welding.
2. Side Fabrication: The screen framework shall be bent plate with a minimum 3/16 inch cross section. Horizontal members shall be stainless steel bent plate or stainless steel pipe. Support members and frame shall adequately support the bar screen based on site specific requirements.

3. Dead Plate: Dead plate shall be 0.25 inch thick stainless steel. The dead plate shall be flat and true; span the entire width of the unit; and transition from bar screen to discharge point.
 4. Discharge Chute: The discharge chute shall be 11 gauge, 304 stainless steel, minimum. The discharge chute shall be bolted to the dead plate and shall be designed to allow debris to be transferred from discharge point into the debris containment.
 5. Link Slides: The link slide assembly shall be provided per manufacturer standard design and shall be constructed of UV stable UHMW PE rollers and 304 stainless steel supports and components.
- B. Return Guide/Closeouts: Return guide/Closeouts shall be 304 stainless steel and shall assure proper alignment of scrapers as they enter the bar screen and assure that there is no space wider than the clear opening between bars to prevent passage of larger solids than allowed through the screen.
- C. Debris Blade: A 304 stainless steel and UV Stable UHMW-PE debris blade assembly, which does not require a separate drive, shall be installed to assist in removing debris from the scraper on the bar screen unit as recommended by the manufacturer. Hydraulic, shock or spring controlled debris blade mechanisms are not acceptable.
- D. Screen Enclosure: A 14 gauge #4 brushed satin finish 304 stainless steel enclosure shall be installed to cover the screen above the operating deck level. Front enclosure shall have removable panels for access to equipment. Removable panels shall be 16-gauge stainless steel and shall be provided with knurled knobs for "no tool required" access. Alignment notches shall be included to support repositioning of removable panels. The top of the front enclosure shall include a knock out for a customer site option to install a 6-inch pipe stub. (The option of connecting to the site's exhaust system, to provide a positive air exchange from interior of enclosure, by Others.) Rear enclosure shall have hinged removable doors and shall be secured with a lift-slide-latch handle. Rear removable door shall include an integral viewing door that shall be secured with a lift-slide-latch handle to provide access for a quick look inside.
- E. Link System: the link system shall be passivated stainless steel castings and have a minimum ultimate strength of 60,000 lbs. with a minimum cross section of 1.5 inches and weighing a minimum of 4.5 lbs. each. Parts must meet ASTM A380 specification for surface finish.
1. 304 stainless steel system includes 302 stainless steel retaining rings and 304 stainless steel pins.
- F. Scrapers: Scrapers shall be spaced 21 inches apart or spaced so that

there at least 0.5 scrapers under water at any one time. To provide long product life the scraper shall move at no greater speed than 30 inches per minute at standard operating speed of ½ rpm allowing for approximately one debris discharge per minute. Staging Scrapers and Thru Bar Scrapers shall be a maximum ratio of 3:1 per manufacturer recommendations. At least one scraper every 84 inches shall fully penetrate the bar screen, cleaning all three sides of the bars as well as through to the cross members in openings of 0.25, 0.375, and 0.50 inches.

1. Staging Scrapers: Staging scrapers shall be one inch thick x 4 inches x screen width UV Stable UHMW-PE with a serrated edge.
2. Thru Bar Scrapers: Thru bars scrapers shall be minimum 0.375 inch thick x 5 inches x screen width 304 stainless steel.

G. Drive Head: The Drive head shall be located at the top of the bar screen.

1. Drive Unit: Each bar screen unit shall operate independently and shall have its own drive unit and driven components.
 - a. Drive Sprockets shall be coated ASTM A48, CL40 cast iron with ASTM A536 80-55-06 ductile cast iron end castings.
 - b. Drive Shaft shall be AISI 1018 steel.
 - c. Gearbox shall be shaft-mounted, right angle type and include spiral bevel gearing. The output shaft speed shall be controlled by a vector type inverter or per rake manufacturer's recommendation. It shall have at least a 1.52 or greater service factor based on machine torque requirements. The gearbox shall not be vented to the outside atmosphere. The gearbox shall be grease filled. Oil filled gearboxes are not allowed.
 - d. The motor shall be AC induction type, high efficiency, inverter duty, 3 phase 480 volt and mounted to the gear reducer. The motor shall be ½ HP, designed for 1800 RPM base speed and rated Class I, Groups C & D, Class II Groups F & G environments. The motor shall have an EPNV enclosure, NEMA design B with a 56C frame size. Service factor shall be 1.0 or greater, Class F insulation and be optimized for IGBT type inverters. The motor must be UL listed and designed for continuous operation.
 - e. Motor shall have built in, normally closed, thermostat to protect from overheating that is to be field wired to corresponding terminal in control panel for redundant (ambient) overload protection.
 - f. All drive head components shall be of components available in the United States.
2. Bearing: bearing shall be greased ball bearing type, non-self-aligning, sealed and lubricated and shall have a 24 day, 7 day a week, 360 day a year L10 life of 20 years when in compliance with stated O&M recommendations. Non-sealed bearings are not acceptable.
3. Speed Reducer: Reducer shall be a double-reduction, cycloidal style

and shall comply with all applicable AGMA standards. The speed reducer shall be capable of a 4/1 speed range with variable output speeds between 0.50 to 2.2 output torque of 11.417 in.lb. And have a gear ratio of 809:1.

- H. Standard Coating: All non-stainless bar screen components shall be coated in strict accordance with the paint manufacturer's specification. Surface Preparation shall be done in accordance with SSPC-SP-10 f Tnemec as follow: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT, Intermediate Coat series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements. Types and thickness of paint coat will be more conservative of this and the specification found in Section 09900.

Alternative: Any alternate products must provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.

- I. The bar screen shall be provided with a 304 stainless steel custom return guide/closeouts for by-pass, which shall be securely fastened to the frame of the bar screen and secured to the base plate as shown on the drawings.

2.04 ELECTRICAL, CONTROLS, INSTRUMENTATION

- A. General: Controls for each rake and washer compactor shall be in enclosures provided by the bar screen manufacturer. The bar screen manufacturer shall be responsible for proper sizing and function of the controls at 480 VAC, unless specified otherwise. The power to the control panel will be 480 V, 3Ø, 60 Hz.
1. Main control panels will be installed in a controlled environment out of direct sunlight and in a temperature range of 35 to 104 degrees F.
 2. Controls shall be designed to accept incoming power supply per the Drawings and shall include a step down transformer as needed to achieve 120 volts.
 3. Control panel shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified panel build facility and will be supported by the appropriate UL labeling.
 4. Controls shall be tested prior to shipment to Owner. The rake manufacturer shall verify all overload settings in the rake controller to

insure proper overload and speed settings required for the application are properly programmed.

5. Panel and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required. Refer to Section 16195.
6. Contractor shall be responsible for all field wiring and power cables between the bar screen Main Control panel and the Local Push Button Station.

B. Components:

1. Main Control Panel (Screen and Washer Compactor)
 - a. Enclosure shall be NEMA 4x 304 SSTL.
 - b. Enclosure shall not be located in an explosive environment.
 - c. Main Control panel shall be designed with a SCCR rating of 18KA at 480 VAC minimum and labeled as such, unless otherwise specified.
 - d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
2. The screen manufacturer shall provide one (1) Primary Control Panel mounted remotely and contain the following controls at a minimum:
 - a. Main circuit breaker
 - b. VFDs
 - c. Control transformer
 - d. Control power "OFF-ON" selector switch
 - e. Time clock to initiate operation
 - f. Elapsed run-time meter
 - g. Screen failure alarm light
 - h. Screen running light
 - i. Power on light
 - j. Float switch – mercury encapsulated float back up level control
3. The screen manufacturer shall provide one (1) secondary control station to be mounted at the screen rated NEMA 7 and to contain one "Hand-Off Auto" selector switch with lockout provisions in the "OFF" position. Local station shall be located within ten feet or as close to the equipment as safely possible and be field wired by the Electrical Contractor to the corresponding terminal inputs in the main control panel.
4. The bar screen mode of operation shall be controlled by the "H-O-A" selector switch and the remote pushbutton station shall include HOA, Forward/Off/Jog Reverse and E Stop buttons. In the "Hand" mode, the screen shall run continuously. In the "Auto" mode, the screen shall run by a repeat cycle timer or the level controller.
5. Relay based controls shall include the following:
 - a. Variable Frequency Drive (VFD)
 - b. Electronic torque control

- c. Hard contact SCADA interlock (s)
- d. Adjustable on/off cycle timers
- 6. Instrumentation: A separate level system shall be installed and field wired per the manufacturer's instructions. The level sensor system shall be installed in the control panel.
 - a. The level sensor system shall be a Siemens HydroRanger 200 HMI with one Ultrasonic Level Transducer for Class 1 Div. 1 hazardous environments, or equal. Transducer shall be installed upstream of the rake as shown on the Drawings and shall not have obstructions between the transducer face and the water surface. The level sensor will be configured with two level set points.
- 7. The control panel shall be equipped with an Ethernet communication modem to interface with the SCADA system. The modem shall communicate using Ethernet IP protocol. Refer to Section 16900 for detail of data points required for interface.

2.04 WASHER COMPACTOR

A. Design Features:

1. Compacting Action: Dual augers provide positive displacement action, are orientated on top of each other and rotate in opposing directions. The augers are intermeshed and are of 1 left hand and 1 right hand lead and shall have ability to rotate, 2.2 RPM in opposing directions. Compactor augers shall be designed with a limited float on top of a perforated plate, allowing them to accommodate irregular debris.
2. Washing Action: Wash port manifold is integrated prior to the compaction housing and delivers 3 to 10 GPM assuming supply pressure is 40 to 60 PSI at a ½ inch NPT connection for attaching water source utilizing filtered effluent or municipal water. Washing action is flood wash type from a single ½ inch NPT supply. Drain connection shall be 3" NPT male.
3. Operation: Washer Compactor is designed to be continuous run not requiring operator. Washer Compactor is equipped with a self-regulating, active pressure zone designed to accept non-standard wastewater debris in its original form, such as rocks, broken concrete, and metal (bolts, short pipe, etc.) up to 4 inches long. Washer Compactor shall have the ability to process multiple pieces of clothing, variable volumes of debris, and unprocessed septage or grease. Compactor moves at normal operating speed of 2.2 RPM and can run intermittently to sync with upstream equipment.

B. Components:

1. Compactor Housing: The compactor housing shall be constructed of stainless steel and be a minimum of 11 gauge and connect to 3/8 inch thick flanges.

2. Augers: Shall be of stainless steel (see table for material options available) with flights 3/8 inch and have a 4 inch flight pitch. Augers shall float mounted in a UHMW thrust and plane bearing arrangement that allows movement for accommodation of irregular debris.
3. Drive Assembly:
 - a. Each Washer Compactor unit shall operate independently and will have its own drive unit and driven components. The gearbox shall not be vented to the outside atmosphere.
 - b. The gearbox shall be grease lubricated and designed for 5 years (or 20,000 hours of operation) between recommended clean and re-grease services. The gearbox shall be right angle type and shall incorporate cycloidal and spiral bevel gearing with a total ratio of 809:1. The gear reducer output shaft speed shall be 0.5 RPM minimum – 2.2 RPM maximum and controlled by an AC Tech, vector type inverter or greater service factor based on unit torque requirements. It shall be shaft mounted utilizing the keyless Taper-Grip® bushing.
 - c. The motor shall be mounted to the gear reducer by utilizing a quill, C-Face mounting style. The gear motor shall be AC induction type, 3/4 HP, 3 phase, 60 Hz, /230/460 volt, explosion proof, inverter duty high efficiency model.
 - d. The drive assembly shall incorporate the coating system as specified herein and in Section 09900.
4. Speed Reducer: Shall have a maximum output of 2.2 RPM, 809:1 reduction ratio with 18,900 in-lb of output torque.
5. Thrust Bearings: Shall be Delrin or equivalent, self-lubricating and be capable of withstanding minimum 2000 Lb of thrust load (each auger) at 2.2 RPM for life of machine.
6. Screw supports: Shall be UHMW plane type, self-lubricating and fastened into place using stainless steel fasteners.
7. Spur Gears: Shall be 17-4 PH stainless steel.
8. Spare Parts and Special Tools:
 - a. Shall include the following:
 - 1) Plane bearing kit includes:
 - a) 2 side screw supports
 - b) 2 upper/lower screw supports
 - c) Fasteners
- C. Fabrications: All welded fabrications are to be made from stainless steel (see table for material selections). All welded connections and welding procedures shall comply with AWS "Structural Welding Code – Sheet Steel" D1.3/D1.6.
- D. Select Parts: Select power transmission parts to be made from cast iron; however, shall conform to coating as follows.

E. Discharge Bagging Device: The end of the discharge section will be equipped with a type 304 stainless steel transition piece and continuous bagging device to capture the dewatered screenings. The bagging device shall be supplied with a replaceable magazine of continuous plastic hose.

F. Standard Coating:

1. Motor Gearbox shall be coated in strict accordance with the paint manufacturer's specification. Surface Preparation shall be done in accordance with SSPC-SP-10 Near White. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT, Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.

Alternatives: Any alternate products must provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.

2. Non-metal: Parts not covered above shall be made from UHMW polyethylene.

2.05 ELECTRICAL DEVICES AND CONTROLS

A. Controls

1. Controls shall be provided by Washer Compactor manufacturer.
2. Controls shall be designed to accept 3PH 240/480 volt incoming power supply per Drawings and Specifications. Control panel power shall be 1PH/120VAC and shall include a step-down transformer to achieve 120V.
3. Controls shall be built by a UL-approved panel builder and bear the UL-approved logo. Controls shall be tested by panel builder and by the Washer Compactor manufacturer prior to shipment to owner. The Washer Compactor manufacturer shall verify all overload settings in the Washer Compactor controller to insure proper overload and speed settings required for the application are properly programmed.

B. Main Panel:

1. Controls for the Washer Compactor shall be integrated into the Mechanical Bar Screen main panel.

2. Main control panels require shading from the sun and shall be operated within a temperature range between 35 and 104 F. Sunshields, visors, or other structures necessary to provide shade are by others.
3. The controls shall be rated NEMA 4X, yet be located in a climate-controlled environment and be mounted per Drawings.
4. Control panel shall have an inner door pocket that includes a copy of As-Built drawings from the manufacturer, as well as any other pertinent documentation necessary to properly operate the controls.
5. The control package shall include the following and utilize the panel builder's standard component manufacturers, unless otherwise approved by the Washer Compactor manufacturer:
 - a. N4X 304 SSTL enclosure with continuous hinge, exterior, lockable door.
 - b. High voltage transformer.
 - c. HOA Selector where Hand mode shall enable the local station and Auto receives a Run signal from a remote/discrete source. When input signal is cut, the Washer Compactor shall then utilize an off-delay timer to allow debris to finish depositing.
 - d. Speed controller (based on vector drive technology), pre-programmed for speed/overload control by the panel builder and verified by the Washer Compactor manufacturer.
 - e. Dry contact input for motor thermostat to shut down equipment if motor overtemp condition occurs.
 - f. Dry contact output signals for "Run", "Start Solenoid", "Common Fault", and "In Auto" conditions.
 - g. 120 VAC output power to wash water solenoid.
 - h. Dry contact input terminals for "Remote Run", "Motor Thermostat", and remote station.
 - i. Main control power breaker with lockable, thru-door operator.
 - j. Elapsed run-time meter.
 - k. "Push-to-Test" type indicator lights for "Power On", "Forward", "VFD Fault", and "Motor Overtemp".
 - l. Phenolic label on outer door indicating equipment identification number in accordance with Section 16195.
 - m. Push/Pull E-Stop on outside of enclosure.

C. Remote Panel:

1. A NEMA 7/9 remote push button station is required to maintain equipment requirements and local safety codes.
2. The remote station shall be rated NEMA 7/9 and include H-O-A, Forward/Off/Jog Reverse, and E-Stop buttons. The remote station shall be mounted as close to the equipment as safely possible and be field-wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.

D. Sequence of Operations:

1. The controls shall enable the remote push button station installed near the Washer Compactor when in Hand mode and utilize an input signal from a remote source when in Auto mode. Upon receiving a stop signal in Auto mode, the Washer Compactor shall utilize an off-delay timer to allow debris to finish depositing.
2. The speed controller fault shall be cleared by turning off the Washer Compactor, then waiting approximately three minutes (or time designated per current UL standards) and then turning the HOA back to the desired setting. A motor overtemp fault shall clear automatically when the motor cools to be within normal operating range.

E. Miscellaneous

1. The following shall be provided by the electrical contractor and are not part of the Washer Compactor manufacturer's scope of supply:
 - a. Mounting stands
 - b. Mounting hardware
 - c. Field wiring and conduit
 - 1) VFD rated motor cable (Belden #29502 or equal) is recommended for all motors.
 - 2) Motor cables shall be less than 80 ft long unless specified otherwise.
 - d. Junction boxes
 - e. Installation
2. The field wiring shall include (but not be limited to) the following connections as applicable:
 - a. Incoming power supply to the main control panel
 - b. All required grounding of the motor and controls
 - c. Motor to the main control panel
 - 1) VFD rated motor cable (Belden #29502 or equal) is recommended for all motors.
 - 2) Motor cables shall be less than 80 ft long unless specified otherwise.
 - d. Motor thermostat to the terminal inputs in the control panel
 - e. Input and output signal wiring for remote start/stop as required by plans/specs
 - f. Remote station contacts to the corresponding terminal inputs in the main control panel

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the work of this Section.

3.03 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer. All conduit and interconnecting wiring between the primary control, secondary control station, and electrical components on the screen shall be supplied and installed by the Contractor.
- B. Anchor Bolts: Anchor bolts and nuts shall be 304 stainless steel and furnished for each item of equipment by the Contractor.
 - 1. Anchor bolt template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
 - 2. Anchor bolt sizes, quantity and requirements will be indicated on the submittal drawings. Quantity is site specific but typically each bar screen assembly requires eight to twelve 1/2" diameter x 4 1/2" long embed HILTI HAS RODS with RE-500V3 Adhesive system anchor bolts for screen anchorage and typically eight to twelve 3/8" diameter x 3-3/8" long embed HILTI HAS RODS with RE-500V3 adhesive system anchor bolts for the Return Guide/Closeouts anchorage.
- C. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.

3.04 SERVICE

- A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for Operating and maintaining the equipment. Review the contents of the operation and maintenance manual requiring submittal under Article 1.03 in this Section.
- B. The Contractor shall furnish to the Owner, through the Engineer, a written report prepared by the equipment manufacturer's field service technician certifying that:

1. The equipment has been properly installed, in accordance with manufacturer's recommendations.
2. The equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision.
3. The equipment is in accurate alignment.
4. The equipment is free from any undue stress imposed by connecting piping or anchor bolts.
5. The equipment has been operated under full load and that it operates satisfactorily and in compliance with the requirements of this section.

B. Testing:

1. After completion of installation, Contractor shall provide for testing. Testing of the Washer Compactor shall demonstrate that the equipment is operational, and that the equipment will wash, compact and deposit materials not to exceed 4 inches.
2. Testing of the bar screen shall include collecting screenings off of the discharge chute and collecting in a non-draining device for a period of at least 72 hours and the screenings shall be tested for moisture content and pass the State of Ohio Paint test
3. Bar screen equipment shall be tested by confirmed measurement of operation by level measurement in the channel. Bar screen shall initiate and terminate operation from a level measured with the level detection device supplied by the manufacturer within 0.5 inch of the set point of the device. This cycle shall be repeated at least three times for this test.

- C. The Contractor shall include with his bid the on-site service of the manufacturer's field service technician for a period of one (1) eight (8) hour day to be designated by the Engineer. This service shall be for the purpose of instruction of plant personnel.

Washer Compactor Data Sheet	
EQUIPMENT:	
Washer Compactor:	1
Bagging System	1
DESIGN SUMMARY:	
Peak Capacity:	30 cu. ft/hour (for approx. 15 minutes)
Average Capacity:	6.5 cu. ft/hour (continuous)
Water: Typical	Utilizes filtered effluent or municipal water
	Consumes 3-10 gallons per minute
	Requires 40 to 60 PSI
	½ inch NPT supply – female threads
	3 inch NPT drain – male threads
Materials of Construction:	304 SSTL
	17-4 spur gears
	Self-lubricating main auger bearings
Hopper Height (Deck to Hopper):	38"
Hopper Length (WC3A1.5 Unit):	27"
PERFORMANCE DATA:	
30%-60% dry solids	
60%-70% mass/weight reduction	
70%-80% volume reduction	
Significantly reduces odor and fecal content	
MOTOR/DRIVE:	
Motor Size:	3/4 HP
Motor Paint:	Tnemec Coating
Motor Service Factor:	1.0
Output Speed:	2.2 RPM
Speed Reducer Ratio/Output:	809:1
Speed Reducer Paint:	Tnemec Coating
SITE POWER:	
Phase/Voltage:	3 Phase (240/480 volt)
CONTROLS:	
	NEMA 4X SSTL enclosure
	Main Control Breaker
	Emergency Stop
	HOA (Auto is discreet "Run" input)
	Fwd/Jog Reverse/E-Stop push button

	station
	"Run" and "In Auto" discrete outputs
	Explosion Proof Local Stations Standard.
CONTROLS MOUNTING:	Wall
	Pedestal (By Others)
PROJECT MANAGEMENT:	
Submittal Quantity:	2-4
O&Ms Quantity:	2-4
Warranty Period:	1 Year
SHIPPING:	Partially Assembled: Shipped in Pre-Assembled Sections

END OF SECTION