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**1. TYPES OF PIPE**

- a. The various types of pipe are shown on the drawings or specified in the supplemental specifications. Sanitary sewer pipe shall be designed for air testing.
- b. All sewer pipe used in this work shall meet the current requirements of the American Society for Testing and Materials (ASTM), or American Water Works Association, as follows:
  - (1) ABS Composite (Truss) Pipe - ASTM D-2680
  - (2) ABS Solid Wall Plastic Pipe - ASTM D-2751, SDR 23.5
  - (3) PVC Composite (Truss) Pipe - ASTM D-2680
  - (4) PVC Solid Wall Plastic Pipe - ASTM D-3034, SDR 26 or 35
  - (5) PVC Solid Wall Plastic Pipe - ASTM D-2665, Sch. 40
  - (6) Reinforced Concrete Sewer Pipe - ASTM C76 with Type I, IA, IP, II or IIA Cement
  - (7) Ductile Iron Pipe - AWWA C 104/A 21, 4, Class 54
  - (8) High Density Polyethylene Pipe - ASTM F714, ASTM D 3350, material cell classification 345434C, material designation PE 3408 (Plastic Pipe Institute)
- c. All pipes shall have class and date of manufacture conspicuously marked on each length by the manufacturer. In addition, the lot number shall similarly be marked on all concrete and reinforced concrete pipe.
- d. One or more types of sewer pipe and joint have been shown on the plans. Unless otherwise specified, any of the type of sewer pipe or joints listed below may only be used upon approval of the Engineer, provided the pipe strength is equal to or exceeds that of the pipe shown on the plans.

**2. CONCRETE PIPE**

- a. Reinforced Concrete Pipe ASTM C76 with Type I, IA, IP, II or IIA Cement, Wall Thickness B
  - (1) Reinforced concrete pipe, unless otherwise specified, shall conform to the current specifications of ASTM Designation C76 - Reinforced Concrete Sewer Pipe. Pipe up to and including thirty-six (36) inches in diameter shall be accepted on the basis of 3-edge bearing tests, material tests and inspection of manufactured pipe for defects and imperfections. The test specimen pipe which exceeds the ASTM specified minimum 0.01 inch crack requirement by 20%, without cracking, may be accepted for use. Manufactures shall supply certifications of conformance to ASTM standards for cement, steel reinforcement and aggregates for the concrete pipe may be accepted in lieu of performance testing by the testing laboratory.

Absorption tests will be waived provided the test 0.01 inch crack load exceeds the ASTM minimum 0.01 crack load by 20%, without cracking; otherwise, absorption tests will be conducted as set forth in the current applicable ASTM standards. Inspection shall include checking for the proper amount and placement of steel reinforcement. The bell and tongue of each pipe shall be gauged for conformance to the manufacturer's dimension and tolerance for the particular joint configuration supplied.
  - (2) Pipe larger than thirty-six (36) inches in diameter shall be accepted on the same basis as set forth in the proceeding paragraph except that in lieu of 3-edge bearing tests, the design concrete strength may be tested by performing compression tests on either standard rodded concrete cylinders or cylinders compacted and cured in like manner as the pipe or, where permitted by the Engineer, on cores drilled from the wall of the pipe.

**2. CONCRETE PIPE** (continued)

b. Reinforced Concrete Low-Head Pressure Pipe ASTM C361

Reinforced concrete pressure pipe, when specified, shall conform to ASTM Designation C361 - Reinforced Concrete Low-Head Pressure Pipe. Acceptability of the pipe in all diameters and classes shall be determined by the results of 3-edge bearing tests, hydrostatic pressure, and joint leaking tests, and by inspection during and after manufacture to determine whether the pipe conforms to the applicable ASTM Standards as to design and freedom from defects. Certificate of conformance to ASTM Standards by the supplier of cement, steel reinforcement and aggregates for concrete pipe may be accepted in lieu of performance tests by the testing laboratory.

c. Concrete Pipe Joints

Joints for concrete pipe noted above in a. and b., unless otherwise specified, shall be modified tongue and groove joints and shall conform to ASTM C361 with the following stipulations and exceptions:

- (1) Gaskets shall be synthetic rubber only. Natural rubber gaskets are not acceptable.
- (2) Gaskets shall conform to the requirements of ASTM C361.
- (3) The Engineer must approve alternate joint designs.

**3. ABS AND PVC TRUSS PIPE**

a. Truss Pipe and Fittings shall be as described under ASTM Designation D-2680, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS), and Poly (vinyl chloride) (PVC) Composite Sewer Piping. Appendix X1 of said specification shall be as modified by the bedding requirements outlined in Section 5.

b. All pipe shall be certified by the manufacturer to meet applicable ASTM specification requirements. Certification forms, together with a report of the test results, shall be provided the inspector with pipe deliveries and copies shall be forwarded to the Engineer or Owner. Certification forms shall include project name, location, contractor and test lot number. Lot sizes shall be acceptable to the Engineer.

c. All pipe fittings shall be suitably marked to provide manufacturer's name, lot or production number. ASTM Designation, ABS, nominal diameter, and SDR number, where applicable. Fittings, however, need not contain lot or production number. Pipe shall have a "home" mark. Truss Pipe with an absence of filler material at the ends greater than one-fourth (1/4) inch deep shall be subject to rejection or acceptable repair.

d. All standard Oakland County Drain Commissioner specifications and details shall apply to this work except where covered otherwise by these supplemental specifications. Oakland County Drain Commissioner air test requirements shall be met. Drain Commissioner approved flexible manhole joints shall be used. To maintain the flexibility of the pipe materials, concrete encasement of drop connections shall not be used. Where adapters to other materials are required, only approved adapters and joints may be used. Where connections are made to existing manholes, a rubber waterstop shall be used around the pipe.

**4. ABS AND PVC SOLID WALL PIPE**

- a. PVC Pipe and Fittings shall be as described under ASTM Designation D-3034, SDR 26 or 35, ASTM D-2751, SDR 23.5, or ASTM D-2665, Sch. 40 Standard Specification for Type PSM Polyvinyl Chloride Sewer Pipe and Fittings, minimum wall thickness shall be SDR 35.
- b. ABS pipe and fittings for six (6) inch house connection sewers shall be SDR 23.5 for depths over 16', SDR 35 where the depth does not exceed 16', conforming to ASTM Designation D-2751, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- c. PVC Materials: Pipe and Fittings shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in Specification D-1784.
- d. The manufacturer to meet the applicable ASTM specification requirements shall certify all pipes. Certification forms, together with a report of the test results shall be provided the construction inspector with pipe deliveries and copies shall be forwarded to the Engineer or Owner. Certification forms shall include project name, location, contractor and test lot number. Lot sizes shall be acceptable to the Engineer.
- e. All pipe and fittings shall be suitably marked to provide manufacturer's name or trademark, lot or production number, ASTM designation, PVC cell classification, SDR number and nominal diameter. Fittings, however, need not contain lot number, cell classification or SDR number. Pipe shall have a "home mark".
- f. All standard Oakland County Drain Commissioner specifications and details shall apply to this work except where covered otherwise in the supplemental specifications. Oakland County Drain Commissioner air test requirements shall be met. Drain Commissioner approved flexible manhole joints shall be used. To maintain the flexibility of the pipe materials, concrete encasement of drop connections shall not be used. Where adapters to other materials are required, only approved adapters and joints may be used.

**5. TRUSS AND SOLID WALL PLASTIC PIPE JOINTS**

- a. Joints for truss and solid wall ABS pipe shall be sleeve coupling type "SC" chemically welded joint as specified in ASTM D-2235.
- b. Joints for truss and solid wall PVC pipe shall be of the elastomeric gasket push-on type joint as specified in ASTM D-3212. Gasket joints shall be installed in accordance with procedures specified by the pipe manufacturer. Care should be taken to insure that all joints are pushed to the full home position and held tightly in home position during any grade or line adjustments.
- c. For joint compatibility, house lead pipe material shall be the same as sewer pipe material.

**6. TRUSS AND SOLID WALL PLASTIC PIPE CUTTING AND HANDLING**

- a. Cutting of pipe lengths, where required, shall be performed by the use of tools or equipment that will provide a neat, perpendicular cut without damage to the plastic. All burrs shall be removed by the use of a file, knife or abrasive paper. Spigot ends on cut pipe shall be beveled similar to factory beveling to prevent gasket damage.
- b. Bowing or warping of plastic pipe can occur with temperature fluctuations. The Contractor shall store and protect the pipe to minimize bowing. Nominal pipe lengths of ten (10) feet, twelve (12) feet six (6) inches, or twenty (20) feet having deviations from straight greater than one (1) inch shall not be used.

**7. TESTING**

All sewer pipe and joints shall be capable of meeting the requirements of air testing and infiltration testing as set forth elsewhere in these Contract Documents.

**8. ALLOWABLE TYPES OF SEWER PIPE ADAPTERS**

- a. Fernco Donuts
- b. Fernco Flexible Coupling
- c. Mission Clay Band - Seal Coupling
- d. Smith-Blair Stainless Steel Repair Clamp
- e. Plant Fabricated Joint Conversion Pipe
- f. Or Approved Equal by the Engineer

**9. ALLOWABLE METHODS OF SEWER PIPE CONNECTIONS**

- a. Cast iron, cast aluminum or plastic premium joint saddle, shewer tap or equal. To be inserted in machine-drilled hole designed for the particular saddle.
- b. Taps to existing manholes shall be made by coring. The contractor shall place a KOR-N-SEAL boot (or OCDL approved equal) after coring is completed. Blind drilling will not be permitted in lieu of coring.

**10. DUCTILE IRON PIPE**

**a. Pipe**

The ductile iron pipe to be furnished, delivered and installed under this specification shall conform in all respects with the requirements of the current American National Standards Institute for "Ductile-Iron-Pipe, centrifugally cast in Metal or Sand-Lined Molds for Water or Other Liquids". The manufacturer shall furnish a sworn statement as described in ANSI/AWWA A21.52/C-151.

**10. DUCTILE IRON PIPE (continued)**

**b. Joints**

Push-on and mechanical type joints shall be in accordance with the current standard for "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings" (ANSI/AWWA A21.11/C-111). Bolts and nuts for Mechanical Joints shall be of high strength low alloy steel conforming to the characteristics listed in this standard. All bolts in contact with soil shall be cor-ten t-bolts or equal.

Flanged joints, when and where approved, shall be in conformity with the requirements of the current standard for "Ductile Iron Flanges and Flanged Fittings", Class 125, (ANSI/AWWA A21.15/C-115). Flanged faces, except stainless steel, shall be coated with a rust inhibitor immediately after drilling. Flanged joints shall be made with single piece full-face rubber gaskets 1/8 inch thick or as approved by the engineer.

Flanges shall be firmly bolted with machine, stud or tap bolts of the proper size and number meeting the requirements of ASTM A-307 Grade B. Joints made with bolts or bolt studs shall have a nut on each side. Bolt projection through nuts shall be equal, and where studs are used, bolt projection on each side of the flange shall be equal.

All nuts and bolts shall be cadmium plated or hot-dip galvanized except on stainless steel flanges shall be 316L stainless steel. All bolts shall be coated with anti-seize compound prior to assembly.

**c. Fittings**

Gray Iron Full Body Fittings - 2" through 36" Fittings shall be gray or ductile iron clay 250 minimum and in conformity with the requirements of the ANSI/AWWA A21.10/C-110 and ANSI/AWWA A21.11/C-111.

Ductile Iron Short Body Fittings - 3" through 24" Ductile Iron Fittings shall be Class 350 minimum and in conformity with the requirements of the ANSI/AWWA C153/A21.53-94 and ANSI/AWWA C111/A21.11. The working pressure rating shall be 350 p.s.i.

Coatings - Interior and exterior coatings shall conform to AWWA C-110. Cement mortar lining is not required unless specified.

Markings - The manufacturer's mark, nominal diameter of openings and the number of degrees in fractions of a circle on all bends, shall be distinctly cast on the fittings. The pressure rating shall be distinctly marked on the fitting.

**11. HIGH DENSITY POLYETHYLENE PIPE**

- a. Mainline Pipe: ASTM D 3035, SDR-11, Pressure Rating 160 psi
- b. Services: ASTM D 3035, SDR-9, Pressure Rating 200 psi
- c. Material Designation Code: PE 3408
- d. Joints: Heat Fusion Bonding, ASTM D 2657
- e. Flange Adapters – Stub Ends: Butt Heat Fusion Bonded

**12. EPOXY COATING OF PIPE AND STRUCTURES**

- a. When required, a minimum coating (or lining) of thirty (30) dry mils of coal tar epoxy shall be applied to the inner surfaces of concrete pipe, sanitary manholes or junction chambers. The Contractor, or manufacturer, shall apply the epoxy in one coat (a prime coat is also allowed) after preparing the concrete surface by sandblasting and dust removal or as otherwise recommended by the manufacturer of the epoxy. The epoxy shall be applied to dry concrete surfaces and dry cured for a minimum of seventy-two (72) hours at fifty (50) degrees F.
- b. The coal tar epoxy shall be CTE-200 manufactured by Wise Chemical Company of Pittsburgh, Pennsylvania, or equal.
- c. The Contractor shall repair any damaged or missing epoxy on precast products prior to installation.
- d. The Contract Documents shall indicate what portions of concrete pipe barrel inside surface shall be coated. Normally, the entire interior surface shall be coated.
- e. When specified, the exposed interior surface of manholes, including base and risers, shall be coated. Unless otherwise noted, the base, roof, interior walls and manhole riser sections in junction chambers shall all be coated.