SECTION 707 - METAL PIPE

707.01 Ductile Iron Pipe.

(A) Cast Iron Pipe and Fittings for Sewer System. Cast iron pipe (Class 150) and fittings, and special castings (Class 250) shall be of bell and spigot or flanged type and shall conform to AWWA's requirements for Cast Iron Pipe and Special Fittings.

Exterior and interior of pipe shall be completely covered with one coat of coal tar paint.

Flange bolts in contact with sewage or sludge shall be of stainless steel or bronze.

(B) Ductile Iron Pipe, Fittings and Special Castings for Water System.

(1) General. Ductile iron pipe shall be mechanical joint, push-on joint, or flanged joint type and of class specified. Pipe lengths shall be longer than 16 feet and shorter than 20 feet.

Fittings and special castings shall conform to AWWA C111.

Fittings and special castings of either mechanical or flanged joint shall be caulked. Fittings and special castings shall be of class equal to ductile iron pipe specified in contract documents. Fittings and special castings shall be bell (without spigot or plain ends). Sleeves shall be without centering or butt ring.

If AWWA C111 does not cover fittings or special castings, shop drawings or manufacturer's specifications shall be submitted to Engineer for acceptance before casting. Two copies of accepted shop drawings shall be submitted to Engineer.

Ductile iron pipe shall be cast centrifugally in metal or sand-lined molds in accordance with AWWA C151.
Standard dimensions of ductile iron pipe shall conform to Table 707.01-1 - Ductile Pipe Dimensions.

<table>
<thead>
<tr>
<th>Pipe Sizes (Inches)</th>
<th>Class</th>
<th>Thickness (Inch)</th>
<th>Outside Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>52</td>
<td>0.28</td>
<td>3.96</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
<td>0.29</td>
<td>4.80</td>
</tr>
<tr>
<td>6</td>
<td>52</td>
<td>0.31</td>
<td>6.90</td>
</tr>
<tr>
<td>8</td>
<td>52</td>
<td>0.33</td>
<td>9.05</td>
</tr>
<tr>
<td>10</td>
<td>52</td>
<td>0.35</td>
<td>11.10</td>
</tr>
<tr>
<td>12</td>
<td>52</td>
<td>0.37</td>
<td>13.20</td>
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<tr>
<td>16</td>
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<td>0.40</td>
<td>17.40</td>
</tr>
<tr>
<td>18</td>
<td>52</td>
<td>0.41</td>
<td>19.50</td>
</tr>
<tr>
<td>20</td>
<td>52</td>
<td>0.42</td>
<td>21.60</td>
</tr>
<tr>
<td>24</td>
<td>52</td>
<td>0.44</td>
<td>25.80</td>
</tr>
<tr>
<td>30</td>
<td>52</td>
<td>0.47</td>
<td>32.00</td>
</tr>
<tr>
<td>36</td>
<td>52</td>
<td>0.53</td>
<td>38.30</td>
</tr>
<tr>
<td>42</td>
<td>52</td>
<td>0.59</td>
<td>44.50</td>
</tr>
</tbody>
</table>

(2) **Interior Lining.** Cement mortar lined pipes, fittings, and special castings, except sleeves and plugs, shall conform to AWWA C104. Except thickness of lining shall conform to Table 707.01-2 - Thickness of Lining.

<table>
<thead>
<tr>
<th>Pipe Size (Inches)</th>
<th>Lining Thickness (Inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-12</td>
<td>1/16</td>
</tr>
<tr>
<td>14-24</td>
<td>3/32</td>
</tr>
<tr>
<td>30-48</td>
<td>1/8</td>
</tr>
</tbody>
</table>
Interior linings shall have tapered ends and shall be sealed with bituminous seal coat.

(3) **Exterior Coating.** Pipes, fittings, and special castings shall be coated on exterior surfaces with coal tar base paint that:

(a) Dries to hard, tough, durable film.

(b) Effectively resists abrasion and peeling due to handling, transportation, and installation of pipe.

(c) Does not crack or check due to loss or evaporation of ingredients.

Paint shall be processed with permanently elastic and non-volatile flux. Paint shall have no tendency for further shrinkage from loss or evaporating of such flux after paint film has become thoroughly dry and hard. Surface to be painted shall be clean and dry, and free from grease, oil, sand, and other foreign matter.

(4) **Mechanical Joint Pipes and Fittings.** Joints of mechanical joint pipe and fittings shall conform to AWWA C111, Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.

Gaskets shall be vulcanized crude rubber of first-grade plantation rubber.

Mechanical joint fittings shall conform to AWWA C111.

Bolt holes shall straddle vertical centerline of fittings and special castings.

(5) **Push-On Joint Pipes and Fittings.** Push-on joint shall conform to AWWA C111. Plain end of pipe shall have slight taper to ease its sliding to fit gasket when joint is made.

Fittings for push-on joint pipe shall be either caulked or mechanical joint fittings.

(6) **Flanged Joint Pipes and Fittings.** Flanged pipes with laying length of 36 inches or less, and fittings and special castings shall have integral flanges and shall be sand-cast. Flanged pipes with laying length greater than 36 inches shall have one integral flange and other flange screwed tight on pipe until pipe end projects beyond flange. Flange pipe shall be machined flush with flange.
707.01

Flanges shall be faced and drilled in accordance with Class 150 Pipe or ANSI B16b Class 250 or Class 250 Pipe.

Gaskets shall conform to the following:

(a) "Full face" 1/16-inch thick duck-inserted rubber packing.

(b) Garlock No. 19, "half face" 1/8-inch thick "FLANGE TYPE" gasket.

Bolts shall be "Cor-ten", "Mayari" or zinc-coated steel machine bolts with cut threads and American Standard heavy hexagon heads.

Nuts shall be "Cor-ten", "Mayari" or zinc-coated American Standard heavy cold-punched hexagon nuts.

Flanged joints shall be verified for their total flange thickness. Bolts shall not protrude more than 1/8 inch beyond nut. Bolts that protrude more than 1/8 inch, shall be machine cut, and bolt end shall be zinc coated before installation.

Flanged fittings shall be Class 150 or Class 250 and fittings shall conform to AWWA C111.

707.02 Corrugated Metal Pipe and Pipe Arch. Metal pipe and pipe arch shall be made from aluminum or zinc coated steel. Shop-formed elliptical culvert and shop-strutted culvert shall be in accordance with contract documents. Corrugated zinc coated steel pipe and pipe arch shall conform to AASHTO M 36 and this section. Corrugated aluminum pipe and pipe arch shall conform to AASHTO M 196 and this section.

Metal end sections and special sections such as elbows shall conform to AASHTO specification for base metal, coating, fabrication, sampling, sheet manufacturers' certified analysis, sheet thickness, workmanship, and repair of coating.

Ends of individual Type IR pipes or pipes whose corrugations are essentially rectangular ribs projecting outward from pipe wall to form 2-2/3 inch by 1/2 inch annular corrugation extending at least 2 corrugations from pipe end shall be rerolled.

Field joints for each type of corrugated metal pipe shall provide circumferential and longitudinal strength to maintain pipe alignment, prevent separation of pipe, and prevent infiltration of side fill material. Coupling bands shall be either one or two piece construction and shall conform to AASHTO specification.
and acceptable by Engineer in accordance with joint performance criteria of AASHTO Specification for Highway Bridge, Division II Section 23 and identified as "Standard Joints".

Coupling bands for corrugated metal pipe shall be less than two standard thicknesses smaller than connecting pipe thickness. Corrugated pipe shall be larger than 0.075 inch and corrugated steel pipe shall be larger than 0.079 inch.

Pipe with rerolled ends having at least two 2-2/3 inch by 1/2 inch corrugations at each end with or without upturned flange shall be connected with accepted annular coupling bands for pipe of same diameter and wall thickness and having 2-2/3 inch by 1/2 inch corrugation.

707.03 Bituminous Coated Corrugated Metal Pipe and Pipe Arch. Culverts and coupling bands shall conform to AASHTO M 190 for specified sectional dimensions, sheet thicknesses, and type of bituminous coating. Coupling bands shall be fully coated with bituminous material. Culverts shall be shop-formed elliptical culvert and shop-strutted culvert.

Special sections, such as elbows and flared end sections, shall conform to AASHTO M 190. Special sections shall have same sheet thickness as joining culvert. Invert shall be paved and coated as specified in contract documents.

707.04 (Unassigned)

707.05 (Unassigned)

707.06 Structural Aluminum Plate for Pipe. Material for structural aluminum plate pipe and pipe arch shall conform to AASHTO M 219. Steel nuts and bolts, and aluminum and steel materials shall not be mixed.

707.07 (Unassigned)

707.08 Structural Steel Plate for Pipe, Pipe Arch, and Arch. Structural steel plate pipe, pipe arch and arch shall conform to AASHTO M 167 and below.

If circular structural steel plate pipe is used and elongation is specified, plates may be shaped elliptically at factory. If using factory elongated plates, they shall be elongated to provide increase of 5 percent in vertical diameter of pipe culvert after assembly. Each plate shall be marked for proper assembly.

Plates with bolt holes of proper size shall be furnished such that they can be fastened together longitudinally and transversely. Except for abutment plates for part circular culverts, plates shall be punched such that they can be interchangeable in erection process. Bolt holes for longitudinal seams shall be staggered in rows 2 inches apart. One row shall have holes punched in valley and other in crest of each corrugation along both edges of each plate. Bolt holes in longitudinal seam shall
707.08
not exceed diameter of bolt by more than 1/8 inch. Bolt holes for transverse seams
shall be punched less than 12 inches on centers along both edges of each plate.
Bolt holes in special abutment plates for part circular culverts shall be punched,
when required. No hole shall be closer than 1-3/4 times diameter of bolt measured
from center of hole to edge of plate.
707.09  (Unassigned)
707.10  Zinc-Coated Pipe and Fittings.

(A)  **Steel Pipe.** Steel pipe shall be hot-dipped zinc-coated welded and
seamless steel, standard weight pipe (Schedule 40) according to ASTM A
53.

(B)  **Miscellaneous Fittings and Appurtenances.** Corporation stops
shall conform to Subsection 707.11 - Copper Service Pipe and
Appurtenances.

Curb stops shall conform to Subsection 707.11 - Copper Service Pipe
and Appurtenances.

Bushings and plugs shall be zinc-coated malleable iron.

Caps, couplings, crosses, elbows, tees, reducers and extension
sleeves shall be standard beaded zinc-coated malleable iron.

Unions shall be zinc-coated malleable iron with ground joints.

Nipples shall be standard zinc-coated steel, threaded at both ends.

707.11  Copper Service Pipe and Appurtenances.

(A)  **Copper Service Pipe.** Copper service pipe shall be soft temper
Type K and conform to ASTM B 88. Copper service pipe up to and
including 1 inch shall be furnished in 40 or 60-foot coils. Copper service
pipe 1-1/4 inches and larger shall be furnished in 20-foot lengths.

(B)  **Fittings.** Fittings of cast bronze or wrought copper shall conform to
ANSI B16.18. Cast bronze shall conform to ASTM B 62. Wrought copper
fittings of commercially pure copper shall conform to ASTM B 251.

(C)  **Nipples.** Nipples shall be same quality as copper pipe.

(D)  **Corporation Stops.** Corporation stops shall have tapered threads for
use with Mueller tapping machines with threads on inside to fit Mueller
tapping machine screw plugs and with dimensions in Table 707.11-3 –
Corporation Stop Dimensions.
TABLE 707.11-3 - CORPORATION STOP DIMENSIONS

<table>
<thead>
<tr>
<th>Corporation Stops (Inch)</th>
<th>Waterway (Inch)</th>
<th>I.P.T. Outside (Inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1-1/4</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/2</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2-1/2</td>
</tr>
</tbody>
</table>

Metal composition of corporation stop shall conform to ASTM B 62.

Corporation stops shall withstand test pressure of 200 pounds per square inch. Waterways shall be round throughout corporation stops.

(E) **Stopcocks.** Stopcocks shall conform to ASTM B 62. Minimum acceptable weight of complete fitting shall exceed 95 percent of average weight.

Stopcock shall have raised boss on head or groove cut into head to show open and closed positions of stopcock.

Net area of opening through stopcock shall exceed areas specified in contract documents.

Taper on plug of stopcock shall be about 1-5/8 inches per foot.

Stopcocks shall have suitable markings showing manufacturer.

Contractor shall submit testing results of stopcocks for inspection and acceptance by Engineer.

Stopcocks shall be tested to hydrostatic pressure of 200 pounds per square inch and shall operate satisfactorily without leakage at that pressure. Test shall be made before easing stopcocks. Stopcock may be covered with film of light oil during test.

Contractor shall select 10 percent at random from each size and each lot for hydrostatic testing by Contractor. Contractor shall notify Engineer two working days prior to performing hydrostatic testing.
Contractor shall select one or more samples per lot of each size. Engineer will use samples for checking dimensions, taper, weight, general appearance, workmanship, and checking analysis of metal composition.

Contractor shall submit two copies of test results to Engineer.

(F) **Solder and Flux.** Solder shall be 1/8-inch diameter and shall contain not more than 0.2 percent lead.

Flux shall conform to Federal Specifications O-F-506C, Type I, Form A Paste.

Solder and flux shall be delivered in their original containers.

(G) **Service Clamps.** Service clamps with metal composition of bronze shall conform to ASTM B 62 or Type 304 stainless steel. Saddles, straps, nuts, and washers shall be compatible material.

Service clamps shall have single or double straps. Double strap service clamps shall be used for taps larger than 1-1/2 inches off 8-inch mains and smaller, or 1 inch off 12-inch mains. For mains larger than 12 inches, only double strap service clamps shall be used.

Bronze service clamps shall be used in corrosive soil. Saddles, straps, nuts, and washers shall be bronze. For cast iron pipe, service clamps shall be non-corrosive material that is compatible with cast iron.

Service clamps with outlets tapped shall have tapered threads of size specified. Clamps shall have neoprene gaskets. Ductile iron clamps shall be painted with tar and base paint.

707.12 **Spiral Rib Metal Pipe.**

(A) **Spiral Rib Steel Pipe.** Spiral rib steel pipe shall be zinc coated conforming to AASHTO M 36 and Subsection 707.02 - Corrugated Metal Pipe and Pipe Arch except corrugation and fabrication requirements.

Spiral rib steel pipe shall have continuous helical rib and continuous helical lock seam with rib spaced midway between seams. Ribs shall be:

1. 3/4 inch wide by 1 inch high at 11-1/2 inches on centers.
2. 3/4 inch wide by 3/4 inch high at 7-1/2 inches on centers.
3. 3/4 inch wide by 5/8 inch high at 12 inches on centers (SRP-II).

Maximum size diameter for SRP-II pipe shall be 42 inches.
Continuous helical lock seam shall be fabricated according to AASHTO M 36 and Subsection 707.02 - Corrugated Metal Pipe and Pipe Arch.

(B) **Spiral Rib Aluminum Pipe.** Spiral rib aluminum pipe shall conform to AASHTO M 196 and Subsection 707.02 - Corrugated Metal Pipe and Pipe Arch except corrugation and fabrication requirements.

Spiral rib aluminum pipe shall have three continuous helical ribs and continuous helical seam. Ribs shall be:

1. 3/4 inch wide by 1 inch high at 11-1/2 inches on centers.
2. 3/4 inch wide by 3/4 inch high at 7-1/2 inches on centers.
3. 3/4 inch wide by 5/8 inch high at 12 inches on centers (SRP-II).

Maximum size diameter for SRP-II pipe shall be 30 inches. Continuous helical lock seam shall be fabricated in accordance with AASHTO M 196 and Subsection 707.02 - Corrugated Metal Pipe and Pipe Arch.

707.13 **Spiral Rib Coupling Band.** Coupling bands shall conform to Subsection 707.02 - Corrugated Metal Pipe and Pipe Arch and AASHTO M 196 for aluminum pipe and AASHTO M 36 for steel pipe.

**END OF SECTION 707**