

## 700 MATERIAL DETAILS

Materials shall conform to the stated requirements and/or the requirements of the referenced specifications including modifications as noted.

*Copies of all Supplemental Specifications referenced in this section are on file with the City of Columbus Transportation Division.*

### 707 - STEEL AND ALUMINUM

**Acceptance.** Corrugated Metal Pipe meeting the requirements of 707.01, 707.02, 707.03, 707.04, 707.05, 707.07, 707.09, 707.13, 707.14, 707.21, 707.22 and 707.23 may be accepted for shipment to and immediate use in construction projects, by manufacturer's certification, at the option of the Contractor, when requested by a manufacturer and agreed to by both the requesting manufacturer and the Department. The procedure for this type of acceptance is set forth in Supplement 1019 on file in the office of the Director.

**707.01 Metallic Coated Corrugated Steel Conduits and Underdrains.** These conduits and underdrains shall have a corrugation depth of 1/2 inch (3.2 mm) or 1/4 inch (6.4 mm) and shall conform to AASHTO M 36 with the following additions:

7.7.1 Helical Corrugated Pipe. 12-inch (305 mm) diameter and larger, shall have at least two annular corrugations at each end of each pipe length.

Sheet thickness 8.1.2. The minimum wall thickness (coated) of steel pipe and pipe-arches shall be as follow:

<b>Pipe</b>		<b>Pipe-Arch</b>		
<b>Diameter inches (mm)</b>	<b>Wall Thickness inches (mm)</b>	<b>Size inches (mm)</b>		<b>Wall Thickness inches (mm)</b>
6 (152)	0.052 (1.32)			
8 (203)	0.064 (1.63)			
10 (254)	0.064 (1.63)			
12 (305)	0.064 (1.63)			
15 (381)	0.064 (1.63)	17 x 13	(431x330)	0.064 (1.63)
18 (457)	0.064 (1.63)	21 x 15	(533x381)	0.064 (1.63)
21 (533)	0.064 (1.63)	24 x 18	(610x457)	0.064 (1.63)
24 (610)	0.064 (1.63)	28 x 20	(711x508)	0.064 (1.63)
27 (686)	0.064 (1.63)			
30 (762)	0.064 (1.63)	35 x 24	(889x610)	0.064 (1.63)
33 (838)	0.064 (1.63)			
36 (882)	0.064 (1.63)	42 x 29	(1067x736)	0.064 (1.63)

42 (1067)	0.064 (1.63)	49 x 33	(1244x838)	0.079 (2.01)
48 (1219)	0.064 (1.63)	57 x 38	(1448x965)	0.109 (2.77)
54 (1371)	0.079 (2.01)	64 x 43	(1625x1092)	0.109 (2.77)
60 (1524)	0.109 (2.77)	71 x 47	(1803x1194)	0.138 (3.51)
66 (1676)	0.138 (3.51)	77 x 52	(1956x1321)	0.168 (4.27)
72 (1829)	0.138 (3.51)	83 x 57	(2108x1448)	0.168 (4.27)
78 (1981)	0.168 (4.27)			
84 (2133)	0.168 (4.27)			

Minus tolerances shall be in accordance with AASHTO M 218, M 274, or M 289.

**Table 1 - Pipe Requirements**

<b>Nominal Inside Minimum Diameter in. (mm)</b>	<b>Corrugation Depth Nominal in. (mm)</b>	<b>Width of Lap in. (mm)</b>
27 (686)	1/2 (13)	2 (50)
33 (838)	1/2 (13)	2 (50)

8.3.2.1 The minimum number of longitudinal rows of perforations shall be 4.

Coupling Bands. 9.1 Coupling bands shall have annular corrugations.

9.2 Coupling bands shall not be more than two nominal sheet thicknesses thinner than the thickness of the pipe to be connected. For pipes 48 inch (1219 mm) diameter and smaller, the coupling band shall not be thinner than 0.052 inch (1.3 mm) nominal sheet thickness. For pipes 54 inch (1371 mm) diameter through 84 inch (2133 mm) diameter, the coupling band shall not be thinner than 0.064 inch (1.6 mm) nominal sheet thickness. For pipe diameters over 36 inches (882 mm), coupling bands shall have at least one annular corrugation that indexes into the inboard corrugation of each pipe section joined.

**707.02 Metallic Coated Corrugated Steel Conduits (1-Inch Corrugations).**  
These conduits shall conform to AASHTO M 36 with the following additions:

7.7.1 Helical corrugated pipe shall have at least two annular corrugations at each end of each pipe length.

Sheet thickness 8.1.2. The minimum wall thickness (coated) of steel pipe and pipe-arches shall be as follows:

<b>Pipe</b>		<b>Pipe-Arch</b>	
<b>Diameter inches (mm)</b>	<b>Wall Thickness inches (mm)</b>	<b>Size inches (mm)</b>	<b>Wall Thickness inches (mm)</b>

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36 (882)	0.064 (1.63)	40 x 31 (1016x787)	0.109 (1.63)
42 (1067)	0.064 (1.63)	46 x 36 (1168x882)	0.109 (1.63)
48 (1219)	0.064 (1.63)	53 x 41 (1346x1041)	0.109 (1.63)
54 (1371)	0.064 (1.63)	60 x 46 (1524x1168)	0.109 (1.63)
60 (1524)	0.064 (1.63)	66 x 51 (1676x1295)	0.109 (1.63)
66 (1676)	0.064 (1.63)	73 x 55 (1854x1397)	0.109 (1.63)
72 (1829)	0.064 (1.63)	81 x 59 (2057x1498)	0.079 (1.63)
78 (1981)	0.064 (1.63)	87 x 63 (2210x1600)	0.079 (1.63)
84 (2133)	0.064 (1.63)	95 x 67 (2413x1702)	0.079 (1.63)
90 (2286)	0.064 (1.63)	103 x 71 (2616x1803)	0.109 (1.63)
96 (3438)	0.079 (2.01)	112 x 75 (2845x1905)	0.109 (1.63)
102 (2591)	0.079 (2.01)	117 x 79 (2972x2006)	0.109 (1.63)
108 (2743)	0.109 (2.77)	128 x 83 (3251x2108)	0.138 (1.63)
114 (2895)	0.109 (2.77)	137 x 87 (3480x2210)	0.138 (1.63)
120 (3048)	0.109 (2.77)	142 x 91 (3607x2311)	0.168 (1.63)

Minus tolerances shall be in accordance with AASHTO M 218, M 274 or M 289. Coupling Bands 9.1 Coupling bands shall not be lighter than 0.064 inch (1.63 mm) and shall have at least one annular corrugation that indexes into the inboard corrugations of each pipe section joined.

**707.03 Structural Plate Corrugated Steel Structures.** Structural plate pipe, pipe-arch and arch structures shall conform to AASHTO M 167, with the following exceptions:

12. Accessories. Assembly bolts may be galvanized by an electrolytic process.

**707.04 Precoated, Galvanized Steel Culverts.** These conduits and coupling bands shall conform to AASHTO M 245, with additions as per 707.01 and 707.02. The precoated, galvanized steel sheets shall conform to AASHTO M 246, Type B. The polymeric coating shall be 10 mils (250 µm) on the interior and 10 mils (250 mm) on the exterior.

**707.05 Bituminous Coated Corrugated Steel Pipe and Pipe Arches with Paved Invert (1/2-Inch (13 mm) Corrugations).** These conduits and coupling bands shall conform to 707.01 and to AASHTO M 190, Type B half bituminous coated with paved invert or Type C fully bituminous coated with paved invert.

**707.07 Bituminous Coated Corrugated Steel Pipe and Pipe Arches (1 Inch (25 mm) Corrugations).** These conduits and coupling bands shall conform to 707.02 and to AASHTO M 190, Type B half bituminous coated with paved invert or Type C fully bituminous coated with paved invert.

**707.08 Welded and Seamless Steel Pipe.** ASTM A 53, or ASTM A 139, Grade B, with the following exception:

Inspection. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the Laboratory.

**707.09 Fiber Bonded Bituminous Coated Corrugated Steel Pipe and Pipe Arches.** These conduits and coupling bands shall conform to AASHTO M 36 for base metal and 707.01 and 707.02 for fabrication where applicable. The conduits shall be formed from sheets which have been coated on both sides with a layer of asbestos or aramid fibers, applied in a sheet form by pressing them into a molten zinc bonding medium. Immediately after solidification of the zinc bonding medium, the asbestos fiber shall be thoroughly impregnated with a bituminous saturate. The finished sheets shall be free from blisters and unsaturated spots. The fiber-impregnated sheets shall then be corrugated and fabricated into pipe. After fabrication, the pipe shall be coated inside and out with a bituminous material complying with the requirements of AASHTO M 190, Type C.

**707.10 Square and Rectangular Steel Tubing.** ASTM A 501, ASTM A 500, Grade B, with the following exceptions and additions:

The tubing shall be galvanized in accordance with 711.02.

Tubular steel from all heat numbers supplied shall be tested for toughness in accordance with ASTM E 436, except as modified herein. Tubing test samples shall be taken and tested prior to delivery of the railing. The taking of the test samples shall be witnessed and the testing shall be performed by an independent test laboratory. Certified test data shall be submitted for review and approval as per 501.07.

Testing shall be done on test specimens obtained from galvanized tubing with the same heat number as that being used. Testing shall be conducted at a temperature of 0° F (-18° C) on 2 inch (50 mm) by 9 inch (228 mm) specimens supported to provide a 7 inch (178 mm) clear span. Galvanizing shall not be removed from the specimens. Three 2 inch (50 mm) by 9 inch (228 mm) test specimens shall be cut from each of the unwelded sides for a total of nine specimens. If all three unwelded sides are not large enough to remove 2 inch (50 mm) by 9 inch (228 mm) specimens, then nine specimens shall be removed from any unwelded side.

The three specimens from the side with the lowest average shear area shall be disregarded when calculating the final average shear area. If specimens were not removed from three unwelded sides, then the three specimens with the lowest average shear area shall be disregarded. The final average shear area shall then be calculated using the six remaining specimens. If the average shear area falls below 50 percent, material from the heat represented by these tests shall be rejected, except that if the average shear area is 30 percent or greater, one retest at a sampling frequency three times that of the first test, and with no samples excluded in calculating the average, will be

permitted. Materials not having a 50 percent average shear area upon retest shall be rejected.

To facilitate acceptance or rejection of the material, the manufacturer of the tubing shall, before galvanizing, identify the product with the steel heat number (or with some number that is traceable to the heat number) and his own unique identification code. The identification method shall be such that identification shall be on only 1 face of the section, be repeated at intervals no greater than 4 feet (1.2 m), and not extend into the curved surface of the tubing at the corners.

**707.13 Bituminous Lined Corrugated Steel Pipe (1/2 Inch Corrugations).** This pipe shall comply with the requirements of 707.01 and AASHTO M 190, Type D.

**707.14 Bituminous Lined Corrugated Steel Pipe (1 Inch Corrugations).** This pipe shall comply with the requirements of 707.02 and AASHTO M 190, Type D.

**707.21 Corrugated Aluminum Alloy Conduits and Underdrains.** These conduits and underdrains shall have a corrugation depth of 1/4 inch (6.4 mm), 7/16 inch (11 mm), or 1/2 inch (12.7 mm), and shall conform to AASHTO M 196 with the following additions:

**Type I Pipe 9.1 and Type II Pipe 14.1.** Helically corrugated pipe 12 inches (305 mm) in diameter and larger shall have at least two circumferential corrugations at each end of each pipe length.

**Dimensions 11.1.** The minimum wall thickness of aluminum pipe and pipe-arches shall be as follows:

<b>Pipe</b>		<b>Pipe-Arch</b>	
<b>Diameter</b>	<b>Wall</b>	<b>Size</b>	<b>Wall</b>
<b>inches (mm)</b>	<b>Thickness</b>	<b>inches (mm)</b>	<b>Thickness</b>
	<b>inches (mm)</b>		<b>inches (mm)</b>
6 (152)	0.048 (1.22)		
8 (203)	0.060 (1.52)		
10 (254)	0.060 (1.52)		
12 (305)	0.060 (1.52)		
15 (381)	0.060 (1.52)	17 x 13 (431x230)	0.060 (1.52)
18 (457)	0.060 (1.52)	21 x 15 (533x381)	0.060 (1.52)
21 (533)	0.060 (1.52)	24 x 18 (610x457)	0.060 (1.52)
24 (610)	0.060 (1.52)	28 x 20 (711x508)	0.060 (1.52)
27 (686)	0.060 (1.52)		
30 (762)	0.075 (1.91)	35 x 24 (889x610)	0.075 (1.90)
36 (882)	0.075 (1.91)	42 x 29 (1067x736)	0.105 (2.67)
42 (1067)	0.105 (2.67)	49 x 33 (1244x838)	0.105 (2.67)

48 (1219)	0.105 (2.67)	57 x 38 (1448x965)	0.135 (3.43)
54 (1371)	0.105 (2.67)	64 x 43 (1625x1092)	0.135 (3.43)
60 (1524)	0.135 (3.43)	71 x 47 (1803x1194)	0.164 (4.16)
66 (1676)	0.135 (3.43)	77 x 52 (1956x1321)	0.164 (4.16)
72 (1829)	0.164 (4.16)	83 x 57 (2108x1448)	0.164 (4.16)
78 (1981)	0.164 (4.16)		
84 (2133)	0.164 (4.16)		

Minus tolerances shall be in accordance with AASHTO M 197.

Coupling Bands 19.1. Coupling bands shall not lighter than 0.060 inch (1.52 mm) nominal sheet thickness. For pipe diameters 12 inches (305 mm) and larger, coupling bands shall have at least one circumferential corrugation that indexes into the inboard corrugations of each pipe section joined.

**707.22 Corrugated Aluminum Alloy Conduits.** These conduits shall have a corrugation depth of 1 inch (25 mm), and shall conform to AASHTO M 196 with the following additions:

**Type I Pipe 9.1 and Type II Pipe 14.1.** Helically corrugated pipe shall have at least two circumferential corrugations at each end of each pipe length.

**Dimensions 11.1.** The minimum wall thickness of aluminum pipe shall be as follows:

<b>Pipe</b>	
<b>Diameter</b> inches (mm)	<b>Wall</b> <b>Thickness</b> inches (mm)
36 (882)	0.060 (1.52)
42 (1067)	0.060 (1.52)
48 (1219)	0.060 (1.52)
54 (1371)	0.060 (1.52)
60 (1524)	0.060 (1.52)
66 (1676)	0.075 (1.90)
72 (1829)	0.075 (1.90)
78 (1981)	0.075 (1.90)
84 (2133)	0.075 (1.90)
90 (2286)	0.105 (3.43)
96 (2438)	0.105 (3.43)
102 (2591)	0.105 (3.43)
108 (2743)	0.105 (3.43)
114 (2895)	0.135 (4.16)
120 (3048)	0.135 (4.16)

Minus tolerances shall be in accordance with AASHTO M 197.

Coupling Bands 19.1. Coupling bands shall not be lighter than 0.060 inch (1.52 mm) nominal sheet thickness, and shall have at least one circumferential corrugation that indexes into the inboard corrugations of each pipe section joined.

**707.23 Aluminum Alloy Structural Plate Conduits.** Aluminum alloy plates and fasteners for structural plate conduits shall conform to AASHTO M 219.