



AMERICAN NATIONAL
STANDARD

ANSI/ASTM A 74 - 75

Endorsed by the
Cast Iron Soil Pipe Institute
American Association State
Highway and Transportation Officials Standard
AASHTO No.: M 263-77

Standard Specification for CAST IRON SOIL PIPE AND FITTINGS¹

This Standard is issued under the fixed designation A 74; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal.

NOTE—Figures 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29, 30, 32, 38, and 39 were editorially corrected in February 1976.

1. Scope

1.1 This specification establishes standards covering material, principal dimensions, and dimensional tolerances for extra heavy and service cast iron soil pipe and fittings, in accordance with general needs of producers, distributors, and users and to serve as a basis for common understanding between purchasers and sellers. Through certification, the purchaser may receive advance assurance that the provisions of this standard are fulfilled.

1.2 This specification covers pipe and fittings of the following patterns and, when so designated, may apply to any other patterns that conform with the requirements given herein.

1.2.1 Pipe:

Extra heavy, 5 ft (1.5 m) and 10 ft (3.0 m) lengths	Tables 1, 3
Service, 5 ft and 10 ft lengths	2, 3
Outside dimensions (for detailing)	Appendix

1.2.2 Fittings:

¼ bends; long ¼ bends	4, 5
Long low-hub ¼ bends	6
¼ bends, low heel; high heel	7, 8
¼ bends, short sweep; long sweep	9, 10
¼ bends, reducing long sweep	11
½ bends	12
¾ bends	13
¾ bends; long ¾ bends	14, 15
⅞ bends	16
Y branches	17
Y branches, cleanout on main	18
Y branches, cleanout on branch	19
Y branches, inverted	20
Y branches, combination ¼ bends, single	21
Y branches, combination ¼ bends, double	22
Y branches, combination ¼ bends, cleanout	23
Y branches, upright	24
Sanitary T branches, single	25

Sanitary T branches, double	26
Sanitary T branches, cleanout	27
Tapped sanitary T branches, single	28
Tapped sanitary T branches, double	29
T branches, single and double	30
Tapped T branches, single	31
Tapped T branches, double	32
Horizontal twin tapped T	33
T branches, cleanout	34
Vent branches, single	35
Offsets, ¼ bend	36 to 40
Double hubs	41
Long double hubs	42
Reducers	43
Increases	44, 45, 46
S traps	47
¾ S traps	48
P-traps	49
Deep seal P traps	50
Running traps	51
Screw plugs (brass)	52
Blind plugs	53
Iron-body ferrules	54
Side inlets	Fig. 41
Closet bends	55
Tapping bosses	56

NOTE 1—The values stated in U.S. customary units are to be regarded as the standard.

2. Materials and Manufacture

2.1 The pipe and fittings shall be iron castings suitable for installation and service in drainage, waste, vent, and sewer lines, and shall meet all applicable requirements and tests given herein.

2.2 The castings shall be made of gray cast iron, produced by an established commercial method that provides adequate control over chemical and physical properties. The castings shall be sound, true to pattern, and of com-

¹ This specification is under the jurisdiction of ASTM Committee A-4 on Iron Castings.

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compact close grain which permits drilling and cutting by ordinary methods. The interior surface shall be reasonably smooth and free from defects which would make the castings unfit for the use for which they are intended.

3. Chemical Requirements

3.1 The material shall conform to the following requirements as to chemical composition in accordance with ASTM Specification A 126, for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.²

Class A (Regular gray iron)

Phosphorus, max, percent	0.75
Sulfur, max, percent	0.15

3.2 If sulfur does exceed the above limit, it shall not exceed one fourth of the percentage of manganese content. Silicon and carbon shall be present in sufficient amounts to produce gray cast iron as indicated by the appearance of fractured surfaces.

4. Physical Requirements

4.1 *Mechanical Tests for Cast Iron*—When requested, tests shall be made to determine mechanical properties of the cast iron used in the manufacture of cast iron soil pipe and fittings. Either transverse (flexure) test bars, or tension test specimens may be employed.

4.1.1 *Transverse Bend Test*—The breaking load shall be not less than 1750 lb (7800 N), and the deflection at the point of application of the load shall be not less than 0.20 in. (5.1 mm).

4.1.2 *Tensile Strength Test*—The tensile strength shall be not less than 21 000 psi (140 MPa).

4.2 *Pressure Tests for Pipe*—Pipe shall withstand an internal pressure applied by one of the following methods either before or after coating:

4.2.1 Hydrostatic pressure at 50 psi (350 kPa).

4.2.2 Air pressure at 15 psi (100 kPa) with pipe submerged in water.

4.2.1 Pipe shall show no defects under the test.

5. Dimensions and Permissible Variations

5.1 *Pipe*:

5.1.1 Single-hub pipe shall have a hub at one end and a spigot at the other. Double hub

pipe shall have a hub at each end. Hubs shall have lead grooves. Spigot end may be either with a bead or plain end, and inner end of hub may be either with or without a centering recess, all combinations of which shall make a satisfactory leakproof joint. Hub and barrel shall be cast in one piece (see Fig. 1).

5.1.2 Single-hub pipe shall be of 5-ft (1.5-m) and 10-ft (3.0-m) nominal laying lengths. The laying length shall be as shown in Fig. 3 and shall be within the tolerances on laying length specified in Table 3. Double hub pipe shall be of the same over-all length as single-hub pipe of the same size. Its laying length shall be 5 ft minus the telescoping length (dimension Y), or 10 ft minus the telescoping length (dimension Y). Other dimensions shall be as specified in Tables 1 and 2 as applicable, and be within the tolerances specified in Table 3. The dimensions shall apply to pipe before any coating is applied.

5.1.3 Pipe shall be straight to the extent that any deflections in the barrel of a 5-ft length of pipe shall not exceed $\frac{1}{4}$ in. (6.4 mm) for sizes 4 in. and larger, and shall not exceed $\frac{3}{16}$ in. (7.9 mm) for smaller sizes; for 10-ft lengths, deflections in the barrel shall not exceed $\frac{1}{2}$ in. (12.7 mm) for sizes 4 in. and larger, nor exceed $\frac{5}{8}$ in. (15.9 mm) for smaller sizes.

5.2 *Fittings*:

5.2.1 *Dimensions of Fittings*—All fittings shall conform to the dimensions specified for hub and spigot ends in Tables 1 and 2, as applicable. Fittings of the patterns specified herein shall conform to the applicable dimensions in Tables 4 to 56 inclusive, and to the tolerances in Table 3. Other patterns (Note 2) shall conform to Tables 1 and 2, as applicable, for hub and spigot dimensions, and for wall thickness throughout, and to dimension R', Tables 25 and 28, for the minimum radius of any drainage inlets that such fittings may provide. All fittings shall have spigot ends of sufficient length to provide adequate room for making leakproof joints. All dimensions given herein shall apply to fittings before any coating is applied.

NOTE 2—Such as, for example, fittings known in the trade as "specials," when designated as being in conformity with this standard.

² *Annual Book of ASTM Standards*, Part 2.

5.2.2 Water Seal and Traps—Traps shall have water seals as follows:

Trap Size, in. (mm)	Minimum Water seal, in. (mm)
2 (50)	2 (50)
3 to 6 (80 to 150), incl	2½ (64)
8 to 12 (200 to 300), incl	3 (80)
15 (380)	3½ (89)

5.2.3 Ends of Fittings—Hubs shall have lead grooves, the spigot end may be either with or without a bead, and the inner end of hub may be either with or without a centering recess, all combinations of which shall make a satisfactory joint. Tapped openings shall conform to 5.2.4.

5.2.4 Pipe Threads—Screw plugs and tapped openings in fittings shall have American Standard taper pipe threads. The threads shall be in accordance with the American National Standard for Pipe Threads, B2.1, or with the National Bureau of Standards Handbook 28; Screw Thread Standards for Federal Services, of the current issue.

5.2.5 Internal threads shall be chamfered at the entering end approximately to the major diameter of the thread, at an angle of approximately 45 deg with the axis of the thread, and the entering end of external threads shall be similarly chamfered approximately to the minor diameter of the thread, for easy entrance in making a joint and for protection of the thread. The chamfer shall be concentric with the thread and shall be included in measurements of thread length.

6. Method of Specifying Fittings

6.1 Method of Specifying Sizes of Fittings of More than One Size—The sizes are designated by the order of listing, as follows:

6.1.1 Branch and tapped fittings:

6.1.1.1 Size of run (Note 3), and

6.1.1.2 Size of branch.

6.1.2 Reducers, increasers, and offset fittings:

6.1.2.1 Size of inlet or run (Note 3),

6.1.2.2 Size of outlet or offset distance and

6.1.2.3 Length, if supplied in more than one length.

NOTE 3—The run is that portion of the fitting which forms part of the main drain, waste or vent line. The spigot end is ordinarily the outlet.

6.2 Method of Specifying Hand of Fittings with Side Inlets and Outlets—When placed in

the position described below, if the side inlet or outlet appears on the right, it is a right-hand fitting; if on the left, it is a left-hand fitting.

6.2.1 Bends and Offsets—Place the fitting with hub facing toward the observer and the spigot end lower than the hub.

6.2.2 Branch Fittings—Place the branch toward the observer and the spigot end lower than the hub.

6.2.3 Traps—Place in the position in which the trap is installed, with the hub toward the observer.

6.2.4 The fittings shown in Fig. 2 have right-hand inlet or cleanout. Left-hand fittings have these openings on the side opposite to that shown.

7. Coating

7.1 The pipe and fittings shall be uniformly coated with coal tar pitch, or similar material suitable for the purpose, that is adherent, not brittle, and without a tendency to scale. The coating shall be evenly and smoothly applied to all surfaces except threaded openings.

8. Sampling

8.1 Chemical analyses shall be made regularly and at sufficiently close intervals for adequate determinations of the significant chemical constituents of the cast iron. Drillings for analyses may be taken from test ingots, broken test specimens, or from castings.

9. Number of Tests and Retests

9.1 Sample lengths of pipe shall be taken for pressure test, unless each length is required to be tested. When sample lengths are tested, the samples shall be taken at substantially regular intervals in the course of production so as to be representative of the material delivered, and shall consist of at least 20 percent of the lengths produced in each size. For every sample found defective, four or more additional samples shall be taken. Each additional sample shall be representative of the same material as that of the defective sample, and shall withstand the pressure test without showing defects.

10. Test Methods

10.1 Transverse Bend Test—The transverse

bend test shall be performed in accordance with the requirements of ASTM Method A 438, Transverse Testing of Gray Cast Iron.² The test bar shall be 1.2 in. in diameter by 21 in. in length, and loaded at a point midway between supports 18 in. apart.

10.2 Tensile Strength Test—The tensile strength shall be determined in accordance with ASTM Method E 8, Tension Testing of Metallic Materials,³ using Specimen 2, Fig. 16, Standard Test Specimen for Cast Iron.

11. Certification

11.1 Upon request of the purchaser, the manufacturer shall be prepared to certify that his product conforms to the requirements of this specification.

12. Inspection

12.1 Inspection and Test by the Manufacturer—Pipe and fittings shall be thoroughly inspected by the manufacturer before shipment. The manufacturer shall make all tests as specified herein, and the results of the tests shall be furnished to the purchaser upon request in accordance with mutually acceptable arrangements. On the sample pieces selected for inspection, the inside diameter of the hub and barrel and the outside diameter of the spigot end shall be checked by suitable gages.

Fittings shall be suitably inspected for soundness and brittleness.

12.2 Inspection and Test by the Purchaser—Inspection and tests may be made by the purchaser at the place of manufacture. The manufacturer shall provide, without charge, all reasonable facilities needed to determine that the material is in accordance with this specification.

13. Marking

13.1 Each length of pipe and each fitting shall be plainly marked with the manufacturer's initials or registered trademark by which he can be readily identified, and with letters to indicate the proper classification, as follows:

XH	Extra Heavy
SV	Service

The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation. The marking shall be cast on fittings and shall be located away from the spigot end so as not to interfere with proper joining upon installation.

³ *Annual Book of ASTM Standards*, Parts 6, 7, and 10.

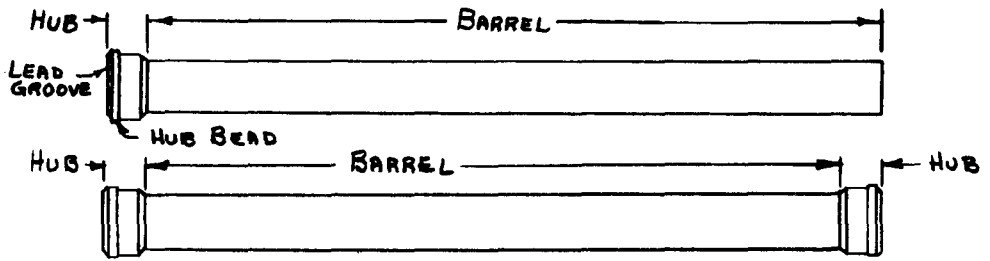


FIG. 1 Single Hub and Double Hub Cast Iron Soil Pipe.

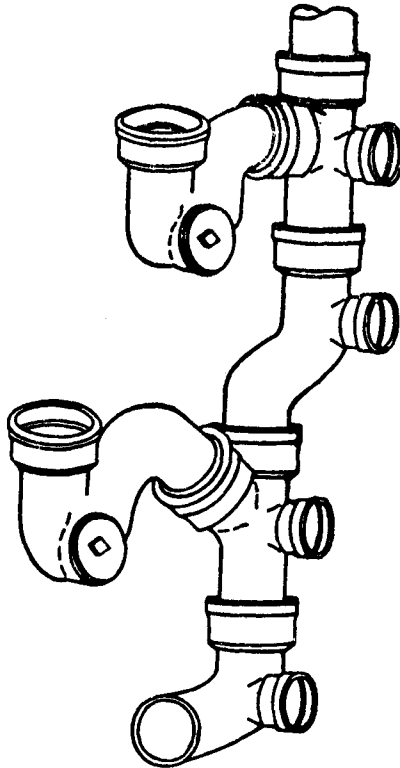


FIG. 2 Fittings with Right Hand Inlet or Cleanout.

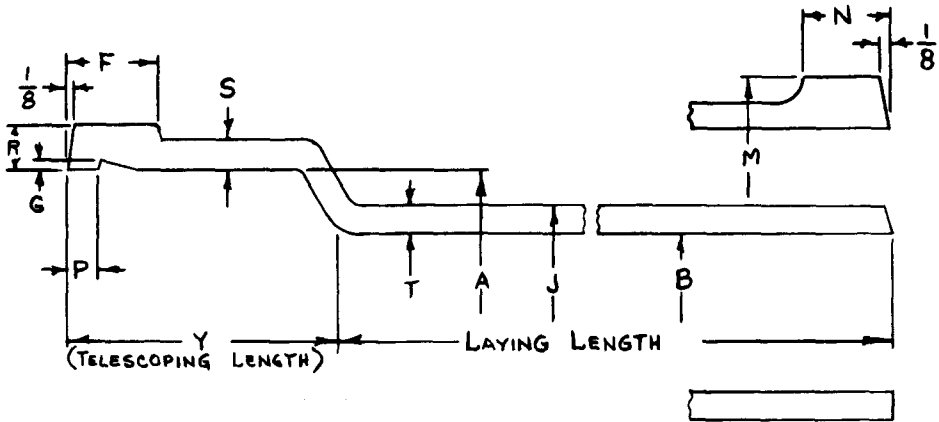


FIG. 3 Extra-Heavy and Service Cast Iron Soil Pipe.

TABLE 1 Dimensions of Hubs, Spigots, and Barrels for Extra-Heavy Cast Iron Soil Pipe and Fittings, in.^a
NOTE—1 in. = 25.4 mm; 1 ft = 0.3 m.

Size ^b	Inside Diameter of Hub ^c	Outside Diameter of Spigot ^{c, d}	Outside Diameter of Barrel ^c	Telescoping length ^c	Inside Diameter of Barrel ^c	Thickness of Barrel ^c
	A	M	J	Y	B	T
2	3.06	2.75	2.38	2.50	2.00	0.19
3	4.19	3.88	3.50	2.75	3.00	0.25
4	5.19	4.88	4.50	3.00	4.00	0.25
5	6.19	5.88	5.50	3.00	5.00	0.25
6	7.19	6.88	6.50	3.00	6.00	0.25
8	9.50	9.00	8.62	3.50	8.00	0.31
10	11.62	11.13	10.75	3.50	10.00	0.37
12	13.75	13.13	12.75	4.25	12.00	0.37
15	17.00	16.25	15.88	4.25	15.00	0.44

Size ^b	Thickness of Hub		Width of Hub Bead ^{c, f}	Width of Spigot Bead ^{c, f}	Distance from Lead Groove to End, Pipe and Fittings ^c	Depth of Lead Groove	
	Hub Body	Over Bead				G (min)	G (max)
	S (min)	R (min)	F	N	P		
2	0.18	0.37	0.75	0.69	0.28	0.10	0.13
3	0.25	0.43	0.81	0.75	0.28	0.10	0.13
4	0.25	0.43	0.88	0.81	0.28	0.10	0.13
5	0.25	0.43	0.88	0.81	0.28	0.10	0.13
6	0.25	0.43	0.88	0.81	0.28	0.10	0.13
8	0.34	0.59	1.19	1.12	0.38	0.15	0.19
10	0.40	0.65	1.19	1.12	0.38	0.15	0.19
12	0.40	0.65	1.44	1.38	0.47	0.15	0.19
15	0.46	0.71	1.44	1.38	0.47	0.15	0.19

^a See Fig. 3.

^b Nominal inside diameter.

^c For tolerances see Table 3.

^d Laying length, all sizes—Single hub 5 ft 0 in.; Double hub 5 ft 0 in. less Y, 5-ft lengths; single hub 10 ft 0 in.; Double hub 10 ft 0 in. less Y, for 10 ft lengths.

^e If a bead is provided on the spigot end, M may be any diameter between J and M.

^f Hub ends and spigot ends can be made with or without draft, and spigot ends can be made with or without spigot bead.

TABLE 2 Dimensions of Hubs, Spigots, and Barrels for Service Cast Iron Soil Pipe and Fittings, in.^a
 NOTE—1 in. = 25.4 mm; 1 ft = 0.3 m.

Size ^b	Inside Diameter of Hub ^c	Outside Diameter of Spigot ^{c, e}	Outside Diameter of Barrel ^c	Telescoping Length ^c	Inside Diameter of Barrel ^c	Thickness of Barrel ^c
	<i>A</i>	<i>M</i>	<i>J</i>	<i>Y</i>	<i>B</i>	<i>T</i>
2	2.94	2.62	2.30	2.50	1.96	0.17
3	3.94	3.62	3.30	2.75	2.96	0.17
4	4.94	4.62	4.30	3.00	3.94	0.18
5	5.94	5.62	5.30	3.00	4.94	0.18
6	6.94	6.62	6.30	3.00	5.94	0.18
8	9.25	8.75	8.38	3.50	7.94	0.23
10	11.38	10.88	10.50	3.50	9.94	0.28
12	13.50	12.88	12.50	4.24	11.94	0.28
15	16.75	16.00	15.62	4.25	15.00	0.31

Size ^b	Thickness of Hub		Width of Hub Bead ^{c, f}	Width of Spigot Bead ^{c, f}	Distance from Lead Groove to End, Pipe and Fittings ^c	Depth of Lead Groove	
	Hub Body	Over Bead					
	<i>S</i> (min)	<i>R</i> (min)				<i>G</i> (min)	<i>G</i> (max)
2	0.13	0.34	0.75	0.69	0.28	0.10	0.13
3	0.16	0.37	0.81	0.75	0.28	0.10	0.13
4	0.16	0.37	0.88	0.81	0.28	0.10	0.13
5	0.16	0.37	0.88	0.81	0.28	0.10	0.13
6	0.18	0.37	0.88	0.81	0.28	0.10	0.13
8	0.19	0.44	1.19	1.12	0.38	0.15	0.19
10	0.27	0.53	1.19	1.12	0.38	0.15	0.19
12	0.27	0.53	1.44	1.38	0.47	0.15	0.19
15	0.30	0.58	1.44	1.38	0.47	0.15	0.19

^a See Fig. 3.

^b Nominal inside diameter.

^c For tolerances see Table 3.

^d Laying length, all sizes—Single hub 5 ft 0 in.; Double hub 5 ft 0 in. less *Y*, for 5-ft lengths; single hub 10 ft 0 in.; Double hub 10 ft 0 in. less *Y*, for 10 ft lengths.

^e If a bead is provided on the spigot end, *M* may be any diameter between *J* and *M*.

^f Hub ends and spigot ends can be made with or without draft, and spigot ends can be made with or without spigot bead.

TABLE 3 Tolerances for Extra-Heavy and Service Cast Iron Soil Pipe and Fittings, in.^a

NOTE 1—The tolerances set forth in Table 3 are intended for pipe and fittings designed for use with lead and oakum joints; however, these same tolerances may apply to pipe and fittings designed for use with a compression type gasket joint.

NOTE 2—1 in. = 25.4 mm.

Size ^b	Inside Diameter of Hub	Outside Diameter of Spigot ^c	Outside Diameter of Barrel	Inside Diameter of Barrel	Thick- ness of Barrel	Tele- scoping Length	Laying Length			
	A	M	J	B	T	Y	Pipe, 5-ft Lengths	Pipe, 10-ft Lengths	Fittings	
									Regular	Extra Long ^d
2	±0.06	+0.06	±0.09	±0.09		±0.06	± ¹ / ₄	± ¹ / ₂	± ¹ / ₈	± ¹ / ₁₆
3	+0.09	+0.09	±0.09	±0.09		±0.06	± ¹ / ₄	± ¹ / ₂	± ¹ / ₈	± ¹ / ₁₆
4	-0.06	+0.09	±0.09	±0.09	+0.06	±0.06	± ¹ / ₄	± ¹ / ₂	± ¹ / ₈	± ¹ / ₁₆
	+0.09				-0.03					
5	-0.06	+0.09	±0.09	±0.09		±0.06	± ⁵ / ₁₆	± ³ / ₈	± ³ / ₁₆	± ³ / ₃₂
	+0.09									
6	-0.06	+0.09	±0.09	±0.09		±0.06	± ⁵ / ₁₆	± ⁵ / ₈	± ³ / ₁₆	± ³ / ₃₂
	+0.09									
8	±0.13	+0.13	±0.13	±0.13		±0.13	± ⁵ / ₁₆	± ⁵ / ₈	± ³ / ₁₆	± ³ / ₃₂
10	±0.13	+0.13	±0.13	±0.13	+0.09	±0.13	± ³ / ₈	± ³ / ₄	± ¹ / ₄	± ¹ / ₈
12	±0.13	+0.13	±0.19	±0.19	-0.06	±0.19	± ³ / ₈	± ³ / ₄	± ¹ / ₄	± ¹ / ₈
15	±0.13	+0.13	±0.19	±0.19		±0.19	± ³ / ₈	± ³ / ₄	± ¹ / ₄	± ¹ / ₈

Size	Width of Hub Bead	Width of Spigot Bead	Distance from Lead Groove to End, Pipe and Fittings
	F	N	P
2	-0.13	-0.13	±0.03
3	-0.13	-0.13	±0.03
4	-0.13	-0.13	±0.03
5	-0.13	-0.13	±0.03
6	-0.13	-0.13	±0.03
8	-0.13	-0.13	±0.07
10	-0.13	-0.13	±0.07
12	-0.13	-0.13	±0.09
15	-0.13	-0.13	±0.09

^a See Fig. 3.

^b Nominal inside diameter.

^c These tolerances apply when bead is provided on the spigot end.

^d These tolerances apply to each foot of extra-long fittings in excess of regular laying lengths specified herein.

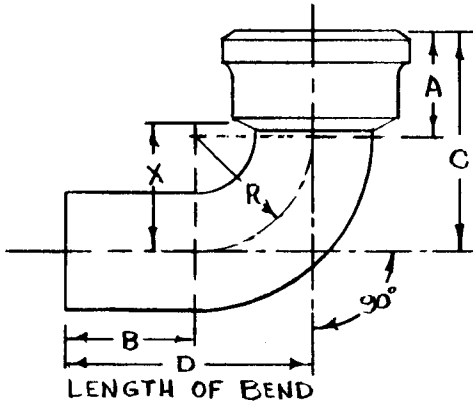


FIG. 4 One-Quarter Bend.

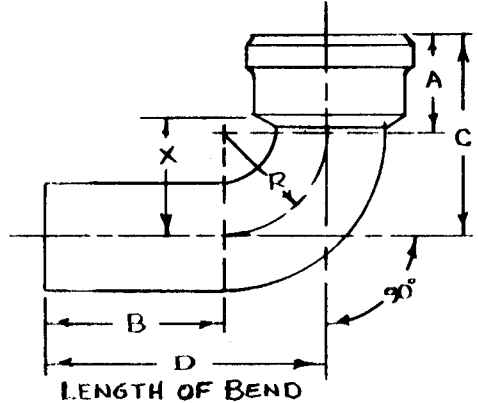


FIG. 5 Long One-Quarter Bend.

TABLE 4 One-Quarter Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2.....	2¾	3	5¾	6	3	3¾
3.....	3¼	3½	6¾	7	3½	4
4.....	3½	4	7½	8	4	4½
5.....	3½	4	8	8½	4½	5
6.....	3½	4	8½	9	5	5½
8.....	4½	5½	10½	11½	6	6¾
10.....	4½	5½	11½	12½	7	7½
12.....	5	7	13	15	8	8¾
15.....	5	7	14½	16½	9½	10¼

^a See Fig. 4.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 5 Long One-Quarter Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2 by 12.....	2¾	9	5¾	12	3	3¾
2 by 18.....	2¾	15	5¾	18	3	3¾
2 by 24.....	2¾	21	5¾	24	3	3¾
3 by 12.....	3¼	8½	6¾	12	3½	4
3 by 18.....	3¼	14½	6¾	18	3½	4
3 by 24.....	3¼	20½	6¾	24	3½	4
4 by 12.....	3½	8	7½	12	4	4½
4 by 18.....	3½	14	7½	18	4	4½
4 by 24.....	3½	20	7½	24	4	4½

^a See Fig. 5.

^b For details of hubs and spigots, see Tables 1 and 2.

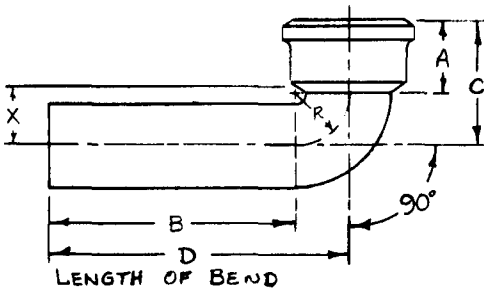


FIG. 6 Long Low-Hub One-Quarter Bends.

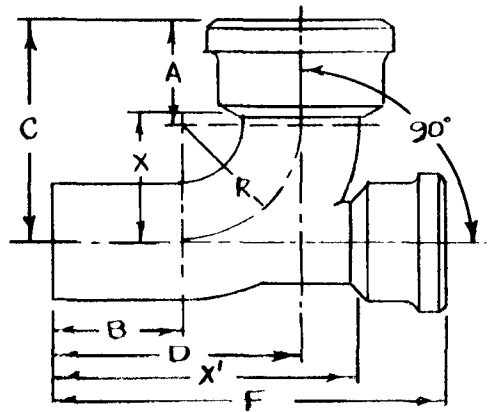


FIG. 7 One-Quarter Bends with Heel Inlet.

TABLE 6 Long Low-hub One-Quarter Bends^a

NOTE 1—Dimensions D and X are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	A	B	C	D	R	X
4 by 12.....	3	9 $\frac{1}{4}$	5 $\frac{3}{4}$	12	2 $\frac{3}{4}$	2 $\frac{3}{4}$
4 by 14.....	3	11 $\frac{1}{4}$	5 $\frac{3}{4}$	14	2 $\frac{3}{4}$	2 $\frac{3}{4}$
4 by 16.....	3	13 $\frac{1}{4}$	5 $\frac{3}{4}$	16	2 $\frac{3}{4}$	2 $\frac{3}{4}$
4 by 18.....	3	15 $\frac{1}{4}$	5 $\frac{3}{4}$	18	2 $\frac{3}{4}$	2 $\frac{3}{4}$

^a See Fig. 6.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 7 One-Quarter Bends with Heel Inlet^a

NOTE 1—Dimensions, D , X , and X' are laying lengths.

Size, in.	Dimensions in in. ^b							
	A	B	C	D	F	R	X	X'
3 by 2.....	3 $\frac{1}{4}$	3 $\frac{1}{2}$	6 $\frac{3}{4}$	7	11 $\frac{1}{2}$	3 $\frac{1}{2}$	4	9
4 by 2.....	3 $\frac{1}{2}$	4	7 $\frac{1}{2}$	8	13	4	4 $\frac{1}{2}$	10 $\frac{1}{2}$
4 by 3.....	3 $\frac{1}{2}$	4	7 $\frac{1}{2}$	8	13 $\frac{1}{4}$	4	4 $\frac{1}{2}$	10 $\frac{1}{2}$

^a See Fig. 7.

^b For details of hubs and spigots, see Tables 1 and 2.

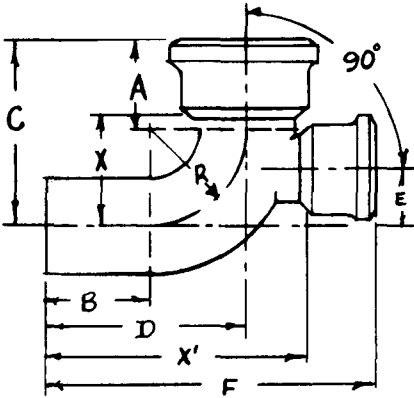


FIG. 8 High Heel One-Quarter Bends.

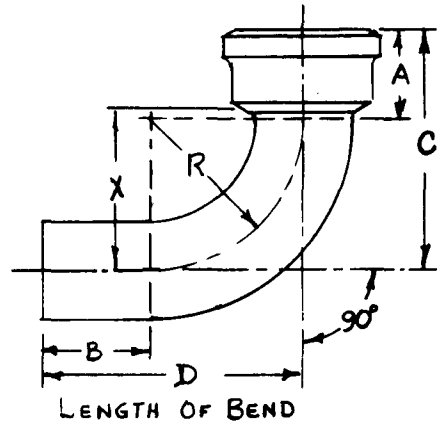


FIG. 9 Long and Short Sweep Bends.

TABLE 8 High Heel One-Quarter Bends^a

NOTE 1—Dimensions *D*, *X*, and *X'* are laying lengths.
NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b								
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>R</i>	<i>X</i>	<i>X'</i>
3 by 2.....	3¼	3½	6¾	7	2¼	11½	3½	4	9
4 by 2.....	3½	4	7½	8	2¾	13	4	4½	10½
4 by 3.....	3½	4	7½	8	2¼	13¼	4	4½	10½

^a See Fig. 8.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 9 Short Sweep Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.
NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2.....	2¾	3	7¾	8	5	5¼
3.....	3¼	3½	8¾	9	5½	6
4.....	3½	4	9½	10	6	6½
5.....	3½	4	10	10½	6½	7
6.....	3½	4	10½	11	7	7½
8.....	4½	5½	12½	13½	8	8½
10.....	4½	5½	13½	14½	9	9½
12.....	5	7	15	17	10	10½
15.....	5	7	16½	18½	11½	12¼

^a See Fig. 9.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 10 Long Sweep Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2.....	2¾	3	10¾	11	8	8¼
3.....	3¼	3½	11¾	12	8½	9
4.....	3½	4	12½	13	9	9½
5.....	3½	4	13	13½	9½	10
6.....	3½	4	13½	14	10	10½
8.....	4⅛	5½	15½	16½	11	11⅝
10.....	4⅞	5½	16⅞	17½	12	12⅞
12.....	5	7	18	20	13	13¾
15.....	5	7	19½	21½	14½	15¼

^a See Fig. 9.

^b For details of hubs and spigots, see Tables 1 and 2.

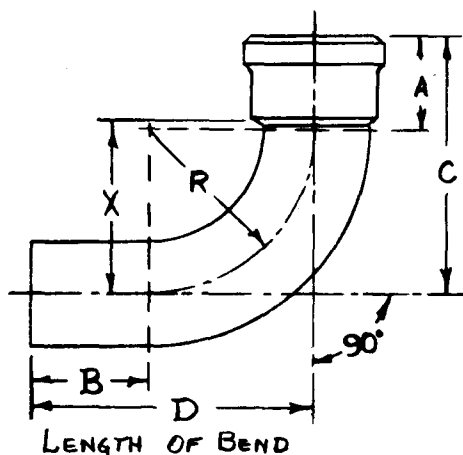


FIG. 10 Reducing Long Sweep Bends.

TABLE 11 Reducing Long Sweep Bends.^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
3 by 2	3	3½	11½	12	8½	9
4 by 3	3¼	4	12¼	13	9	9½

^a See Fig. 10.

^b For details of hubs and spigots, see Tables 1 and 2.

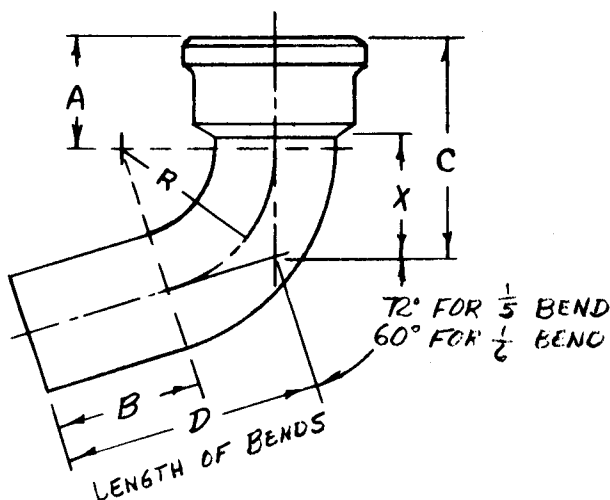


FIG. 11 One-Fifth and One-Sixth Bends.

TABLE 12 One-Fifth Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2.....	2 ³ / ₄	3	4 ¹⁵ / ₁₆	5 ³ / ₁₆	3	2 ⁷ / ₁₆
3.....	3 ¹ / ₄	3 ¹ / ₂	5 ¹³ / ₁₆	6 ¹ / ₁₆	3 ¹ / ₂	3 ¹ / ₁₆
4.....	3 ³ / ₄	4	6 ⁷ / ₁₆	6 ¹⁵ / ₁₆	4	3 ⁷ / ₁₆
5.....	3 ⁵ / ₈	4	6 ³ / ₄	7 ¹ / ₄	4 ¹ / ₂	3 ³ / ₄
6.....	3 ⁷ / ₈	4	7 ¹ / ₈	7 ⁵ / ₈	5	4 ¹ / ₈
8.....	4 ¹ / ₈	5 ¹ / ₂	8 ¹ / ₂	9 ⁷ / ₈	6	5

^a See Fig. 11.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 13 One-Sixth Bends^a

NOTE 1—Dimensions *D* and *X* are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>R</i>	<i>X</i>
2.....	2 ³ / ₄	3	4 ¹ / ₂	4 ³ / ₄	3	2
3.....	3 ¹ / ₄	3 ¹ / ₂	5 ¹ / ₄	5 ¹ / ₂	3 ¹ / ₂	2 ¹ / ₄
4.....	3 ³ / ₄	4	5 ¹⁵ / ₁₆	6 ³ / ₁₆	4	2 ¹³ / ₁₆
5.....	3 ⁵ / ₈	4	6 ¹ / ₈	6 ⁵ / ₈	4 ¹ / ₂	3 ³ / ₈
6.....	3 ⁷ / ₈	4	6 ³ / ₈	6 ⁷ / ₈	5	3 ³ / ₈
8.....	4 ¹ / ₈	5 ¹ / ₂	7 ⁵ / ₈	9	6	4 ³ / ₈
10.....	4 ³ / ₈	5 ⁵ / ₈	8 ³ / ₄	9 ³ / ₄	7	4 ¹¹ / ₁₆
12.....	5	7	9 ⁵ / ₈	11 ⁵ / ₈	8	5 ³ / ₈
15.....	5	7	10 ¹ / ₂	12 ¹ / ₂	9 ¹ / ₂	6 ¹ / ₄

^a See Fig. 11.

^b For details of hubs and spigots, see Tables 1 and 2.

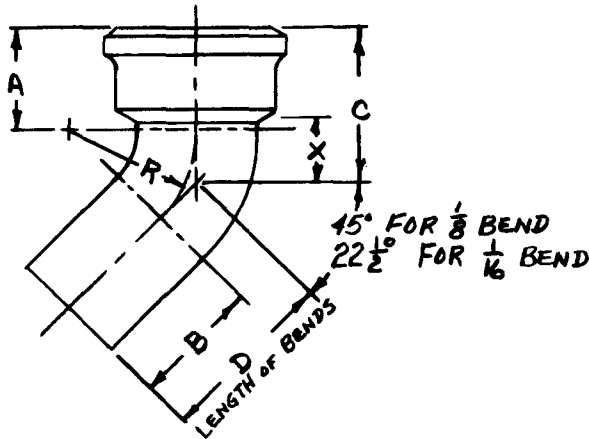


FIG. 12 One-Eighth and One-Sixteenth Bends.

TABLE 14 One-Eighth Bends^a

NOTE 1—Dimensions D and X are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	A	B	C	D	R	X
2	2¾	3	4	4¼	3	1½
3	3¼	3½	4½ ^{11/16}	4½ ^{15/16}	3½	1½ ^{15/16}
4	3½	4	5³/₁₆	5½ ^{11/16}	4	2³/₁₆
5	3½	4	5³/₈	5⁷/₈	4½	2³/₈
6	3½	4	5⁹/₁₆	6¹/₁₆	5	2⁹/₁₆
8	4½	5½	6⁵/₈	8	6	3½
10	4½	5½	7	8³/₈	7	3½
12	5	7	8⁵/₁₆	10⁵/₁₆	8	4¹/₁₆
15	5	7	8¹⁵/₁₆	10¹⁵/₁₆	9½	4¹¹/₁₆

^a See Fig. 12.

^b For details of hubs and spigots, see Tables 1 and 2.

TABLE 15 Long One-Eighth Bends^a

NOTE 1—Dimensions D and X are laying lengths.

NOTE 2—1 in. = 25.4 mm.

Size, in.	Dimensions in in. ^b					
	A	B	C	D	R	X
2 by 12	2¾	10¾	4	12	3	1½
2 by 18	2¾	16¾	4	18	3	1½
2 by 24	2¾	22¾	4	24	3	1½
3 by 12	3¼	10⁹/₁₆	4½ ^{11/16}	12	3½	1½ ^{15/16}
3 by 18	3¼	16⁹/₁₆	4½ ^{11/16}	18	3½	1½ ^{15/16}
3 by 24	3¼	22⁹/₁₆	4½ ^{11/16}	24	3½	1½ ^{15/16}
4 by 12	3½	10⁵/₁₆	5³/₁₆	12	4	2³/₁₆
4 by 18	3½	16⁵/₁₆	5³/₁₆	18	4	2³/₁₆
4 by 24	3½	22⁵/₁₆	5³/₁₆	24	4	2³/₁₆

^a See Fig. 12.

^b For details of hubs and spigots, see Tables 1 and 2.