

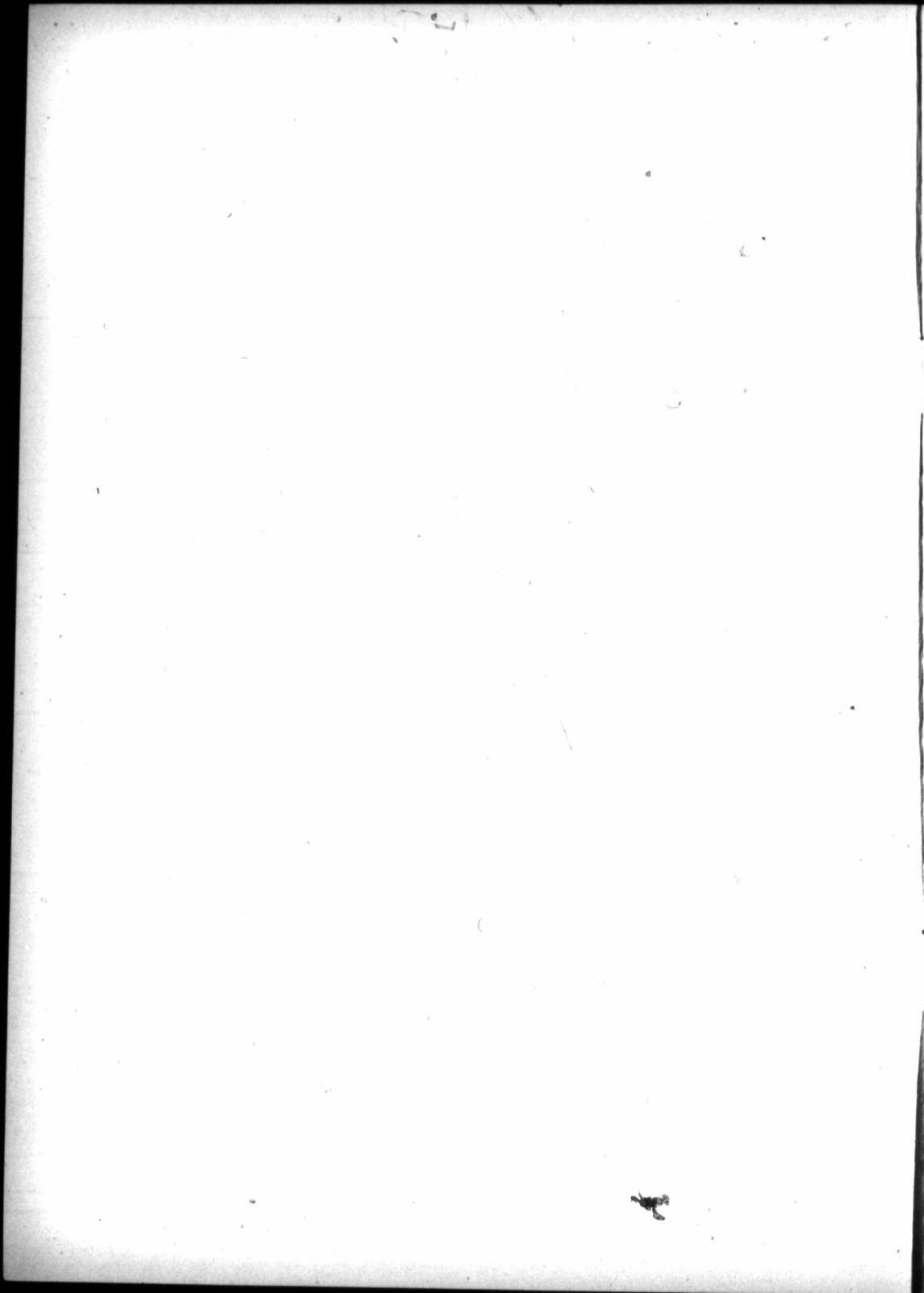
AMERICAN WATER WORKS ASSOCIATION

SPECIFICATIONS FOR CAST IRON  
WATER PIPE AND SPECIAL  
CASTINGS

REPORT OF COMMITTEE ON WATER  
WORKS STANDARDS

PRESENTED AT ANNUAL MEETING

TORONTO, ONT., JUNE, 1907



AMERICAN WATER WORKS ASSOCIATION  
REPORT  
OF  
Committee on Water Works Standards  
ON  
SPECIFICATIONS FOR CAST IRON  
WATER PIPE



American Water Works Association :

GENTLEMEN—Your Committee on Water Works Standards has devoted about all of its efforts the past year to an attempt at standardizing the several specifications for cast iron water pipe, so as to produce if possible a single specification for such material that can be agreed upon and adopted by all of those who buy and use water pipe, and all of those who manufacture and sell such pipe.

We can hardly hope that the specifications and tables which we herewith present will be universally adopted without some debate and perhaps some slight modifications, but we feel, from careful comparisons and close examination of the principal standard specifications, numbering three, now in existence, that we have at least produced a reasonable result, and one that can be adopted, as it now appears, not only without any loss, but also with mutual benefit to all concerned.

Respectfully submitted,

CHAS. A. HAGUE, Chairman.  
THEODORE A. LEISEN.  
W. D. FRENCH.

# AMERICAN WATER WORKS ASSOCIATION.

## STANDARD SPECIFICATIONS FOR CAST IRON WATER PIPE AND SPECIAL CASTINGS.

### DESCRIPTION OF PIPES.

SECTION 1. The pipes shall be made with hub and spigot joints, and shall accurately conform to the dimensions given in Tables No. 1 and 2. They shall be straight, and shall be true circles in section, with their inner and outer surfaces concentric, and shall be of the specified dimensions in outside diameter. They shall be at least 12 feet in length, exclusive of socket. For pipes of each size from 4 inches to 24 inches in diameter, inclusive, there shall be two standards of outside diameter, and for each larger size four standards of outside diameter.

Four pipes from 4 inches to 16 inches in diameter, inclusive, one class of special castings shall be furnished with all classes of pipes, made from Class D pattern. For pipes from 18 inches to 24 inches in diameter, inclusive, Class B special castings shall be furnished with pipes of Classes A and B; and Class D special castings with pipes of Classes C and D; the former to be stamped "AB" and the latter to be stamped "CD." For pipes 30 inches in diameter and larger, four classes of special castings shall be furnished, one for each class of pipe, and shall be stamped with the letter of the class to which they belong.

All pipes having the same outside diameter shall have the same inside diameter at both ends. The inside diameter of the lighter pipes for each standard outside diameter shall be gradually increased for a distance of about 6 inches from each end of the pipe so as to obtain the required standard thickness and weight for each size and class of pipe.

Pipes whose thickness and weight are intermediate between the classes in Table No. 2 shall be made of the same outside diameter as the next heavier class. Pipes whose thickness and weight are less than shown by Table No. 2 shall be made of the

same outside diameter as the Class A pipes; and pipes whose thickness and weight are more than shown by Table No. 2 shall be made of the same outside diameter as the Class D pipes.

ALLOWABLE VARIATION IN DIAMETER OF PIPES AND  
SOCKETS.

SECTION 2. Especial care shall be taken to have the sockets of the required size. The sockets and spigots will be tested by circular gauges, and no pipe will be received which is defective in joint room from any cause. The diameters of the sockets and the outside diameter of the bead ends of the pipes shall not vary from the standard dimensions by more than .06 of an inch for pipes 16 inches or less in diameter; .08 of an inch for 18-inch, 20-inch and 24-inch pipes; .10 of an inch for 30-inch, 36-inch and 42-inch pipes; .12 of an inch for 48-inch, 54-inch and 60-inch pipes.

ALLOWABLE VARIATION IN THICKNESS.

SECTION 3. For pipes whose standard thickness is less than 1 inch the thickness of metal in the body of the pipe shall not be more than .08 of an inch less than the standard thickness, and for pipes whose standard thickness is 1 inch or more the variation shall not exceed .10 of an inch, except that for spaces not exceeding 8 inches in length in any direction, variations from the standard thickness of .02 of an inch in excess of the allowance above given shall be permitted.

For special castings of standard patterns a variation of 50 per cent. greater than allowed for straight pipe shall be permitted.

DEFECTIVE SPIGOTS MAY BE CUT.

SECTION 4. Defective spigot ends on pipes 12 inches or more in diameter may be cut off in a lathe and a half-round wrought-iron band shrunk into a groove cut in the end of the pipe. Not more than 12 per cent. of the total number of accepted pipes of each size shall be cut and banded, and no pipe shall be banded which is less than 11 feet in length, exclusive of the socket.

In case the length of a pipe differs from 12 feet, the standard weight of the pipe given in Table No. 2 shall be modified in accordance therewith.

SPECIAL CASTINGS.

SECTION 5. All special castings shall be made in accordance

with the cuts and the dimensions given in the tables forming a part of these specifications.

The diameters of the sockets and the external diameters of the spigot ends of the special castings shall not vary from the standard dimensions by more than .08 of an inch for castings 16 inches or less in diameter; .10 of an inch for 18-inch, 20-inch and 24-inch pipes; .13 of an inch for 30-inch, 36-inch and 42-inch pipes, and .16 of an inch for 48-inch, 54-inch and 60-inch pipes.

The flanges on all manhole castings and manhole covers shall be faced true and smooth, and drilled to receive bolts of the sizes given in the tables. The contractor shall furnish and deliver all bolts for bolting on the manhole covers, the bolts to be of the sizes shown on plans, and made of the best quality of mild steel, with hexagonal heads and nuts, and sound, well-fitting threads.

#### MARKING.

SECTION 6. Every pipe and special casting shall have distinctly cast upon it the initials of the maker's name. When cast especially to order, each pipe and special casting larger than 4-inch shall also have cast upon it figures showing the year in which it was cast and a number signifying the order in point of time in which it was cast, the figures denoting the year being above and the number below, thus:

1907.	1907.	1907.
I	2	3

etc., also any initials, not exceeding four, which may be required by the purchaser. The letters and figures shall be cast on the outside and shall be not less than 2 inches in length and  $\frac{1}{8}$  of an inch in relief for pipes 8 inches in diameter and larger. For smaller sizes of pipes the letters may be 1 inch in length. The weight and the class letter shall be conspicuously painted in white on the inside of each pipe and special casting after the coating has become hard.

#### ALLOWABLE PERCENTAGE OF VARIATION IN WEIGHT.

SECTION 7. No pipe shall be accepted the weight of which shall be less than the standard weight by more than 5 per cent. for pipes 16 inches or less in diameter, and 4 per cent. for pipes more than 16 inches in diameter, and no excess above the standard weight of more than the given percentages for the several sizes shall be paid for. The total weight to be paid for shall not exceed

for each size and class of pipe received the sum of the standard weights of the same number of pieces of the given size and class by more than 2 per cent.

No special casting shall be accepted the weight of which shall be less than the standard weight by more than 10 per cent. for pipes 12 inches or less in diameter, and 8 per cent. for larger sizes, and no excess above the standard weight of more than the above percentages for the several sizes will be paid for. These variations apply only to castings made from the standard patterns.

#### QUALITY OF IRON.

SECTION 8. All pipes and special castings shall be made of cast iron of good quality, and of such character as shall make the metal of the castings strong, tough and of even grain, and soft enough to satisfactorily admit of drilling and cutting. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be remelted in a cupola or air furnace.

#### TESTS OF MATERIAL.

SECTION 9. Specimen bars of the metal used, each being 26 inches long by 2 inches wide and 1 inch thick, shall be made without charge as often as the engineer may direct, and, in default of definite instructions, the contractor shall make and test at least one bar from each heat or run of metal. The bars, when placed flatwise upon supports 24 inches apart and loaded in the center, shall for pipes 12 inches or less in diameter support a load of 1,900 pounds and show a deflection of not less than .30 of an inch before breaking, and for pipes of sizes larger than 12 inches shall support a load of 2,000 pounds and show a deflection of not less than .32 of an inch. The contractor shall have the right to make and break three bars from each heat or run of metal, and the test shall be based upon the average results of the three bars. Should the dimensions of the bars differ from those above given, a proper allowance therefor shall be made in the results of the tests.

#### CASTING OF PIPES.

SECTION 10. The straight pipes shall be cast in dry sand molds in a vertical position. All pipes shall be cast with the hub end down.

The pipes shall not be stripped or taken from the pit while showing color of heat, but shall be left in the flasks for a sufficient

length of time to prevent unequal contraction by subsequent exposure.

#### QUALITY OF CASTINGS.

SECTION 11. The pipes and special castings shall be smooth, free from scales, lumps, blisters, sand holes and defects of every nature which, in the opinion of the engineer, unfit them for the use for which they are intended. No plugging or filling will be allowed.

#### CLEANING AND INSPECTION.

SECTION 12. All pipes and special castings shall be thoroughly cleaned and subjected to a careful hammer inspection. No casting shall be coated unless entirely clean and free from rust, and approved in these respects by the engineer immediately before being dipped.

#### COATING.

SECTION 13. Every pipe and special casting shall be coated inside and out with coal-tar pitch varnish. The varnish shall be made from coal tar. To this material sufficient oil shall be added to make a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.

Each casting shall be heated to a temperature of 300° F. immediately before it is dipped, and shall possess not less than this temperature at the time it is put in the vat. The ovens in which the pipes are heated shall be so arranged that all portions of the pipe shall be heated to an even temperature. Each casting shall remain in the bath at least five minutes.

The varnish shall be heated to a temperature of 300° F. (or less if the engineer shall so order), and shall be maintained at this temperature during the time the casting is immersed.

Fresh pitch and oil shall be added when necessary to keep the mixture at the proper consistency, and the vat shall be emptied of its contents and refilled with fresh pitch when deemed necessary by the engineer. After being coated the pipes shall be carefully drained of the surplus varnish. Any pipe or special casting that is to be recoated shall first be thoroughly scraped and cleaned.

#### HYDROSTATIC TEST.

SECTION 14. When the coating has become hard, the straight pipes shall be subjected to a proof by hydrostatic pressure and,



if required by the engineer, they shall also be subjected to a hammer test under this pressure.

The pressure to which the different sizes and classes of pipes shall be subjected are as follows:

	20 Inch Diameter and Larger. Pounds Per Sq. In.	Less Than 20 Inch Diameter. Pounds Per Sq. In.
Class A Pipe.....	150	300
Class B Pipe.....	200	300
Class C Pipe.....	250	300
Class D Pipe.....	300	300

#### WEIGHING.

SECTION 15. The pipes and special castings shall be weighed for payment under the supervision of the engineer after the application of the coal-tar pitch varnish. If desired by the engineer, the pipes and special castings shall be weighed after their delivery and the weights so ascertained shall be used in the final settlement, provided such weighing is done by a legalized weighmaster. Bids shall be submitted and a final settlement made up on the basis of a ton of 2,000 pounds.

#### CONTRACTOR TO FURNISH MEN AND MATERIALS.

SECTION 16. The contractor shall provide all tools, testing machines, materials and men necessary for the required testing, inspection and weighing at the foundry of the pipes and special castings; and, should the purchaser have no inspector at the works, the contractor shall, if required by the engineer, furnish a sworn statement that all of the tests have been made as specified, this statement to contain the results of the tests upon the test bars.

#### POWER OF ENGINEER TO INSPECT.

SECTION 17. The engineer shall be at liberty at all times to inspect the material at the foundry, and the molding, casting and coating of the pipes and special castings. The forms, sizes, uniformity and conditions of all pipes and other castings herein referred to shall be subject to his inspection and approval, and he may reject, without proving, any pipes or other casting which are not in conformity with the specifications or drawings.

#### INSPECTOR TO REPORT.

SECTION 18. The inspector at the foundry shall report daily

to the foundry office all pipes and special castings rejected, with the causes for rejection.

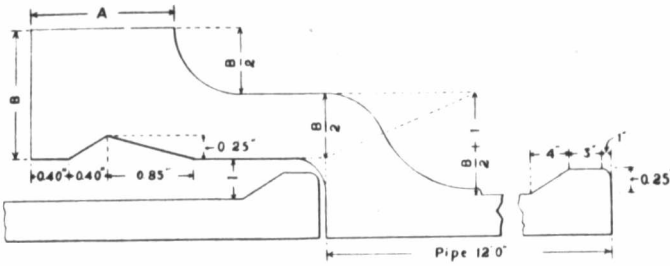
CASTINGS TO BE DELIVERED SOUND AND PERFECT.

SECTION 19. All the pipes and other castings must be delivered in all respects sound and conformable to these specifications. The inspection shall not relieve the contractor of any of his obligations in this respect, and any defective pipe or other castings which may have passed the engineer at the works or elsewhere shall be at all times liable to rejection when discovered until the final completion and adjustment of the contract, provided, however, that the contractor shall not be held liable for pipes or special castings found to be cracked after they have been accepted at the agreed point of delivery. Care shall be taken in handling the pipes not to injure the coating, and no pipes or other material of any kind shall be placed in the pipes during transportation or at any time after they receive the coating.

DEFINITION OF THE WORD "ENGINEER."

SECTION 20. Wherever the word "engineer" is used herein it shall be understood to refer to the engineer or inspector acting for the purchaser and to his properly authorized agents, limited by the particular duties intrusted to them.

TABLE NO. 1



General Dimensions of Pipes and Special Castings.

Nominal Diam. Inches.	CLASSES.	Actual Outside Diam. Inches.	DIAM. OF SOCKETS.		DEPTH OF SOCKETS.		A.	B.
			Pipe. Inches.	Special Castings. Inches.	Pipe. Inches.	Special Castings. Inches.		
4	A-B	4.80	5.60	5.70	3.00	4.00	1.50	1.90
4	C-D	5.00	5.80	5.70	3.00	4.00	1.50	1.90
6	A-B	6.90	7.70	7.80	3.00	4.00	1.50	1.40
6	C-D	7.10	7.90	7.80	3.00	4.00	1.50	1.40
8	A-B	9.05	9.85	10.00	3.50	4.00	1.50	1.50
8	C-D	9.30	10.00	10.00	3.50	4.00	1.50	1.50
10	A-B	11.10	11.90	12.10	3.50	4.50	1.50	1.50
10	C-D	11.40	12.20	12.10	3.50	4.50	1.50	1.50
12	A-B	13.20	14.00	14.20	3.50	4.50	1.50	1.60
12	C-D	13.50	14.30	14.20	3.50	4.50	1.50	1.60
14	A-B	15.30	16.10	16.35	3.50	4.50	1.50	1.70
14	C-D	15.65	16.45	16.35	3.50	4.50	1.50	1.70
16	A-B	17.40	18.40	18.60	4.00	5.00	1.75	1.80
16	C-D	17.80	18.80	18.60	4.00	5.00	1.75	1.80
18	A-B	19.25	20.25	20.40	4.00	5.00	1.75	1.90
18	C-D	19.50	20.50	20.40	4.00	5.00	1.75	1.90
20	A-B	21.30	22.30	22.50	4.00	5.00	1.75	2.00
20	C-D	21.60	22.60	22.50	4.00	5.00	1.75	2.00
24	A-B	25.40	26.40	26.60	4.00	5.00	2.00	2.10
24	C-D	25.80	26.80	26.60	4.00	5.00	2.00	2.10
30	A	31.60	32.60	32.60	4.50	5.00	2.00	2.30
30	B	32.00	33.00	33.00	4.50	5.00	2.00	2.30
30	C	32.40	33.40	33.40	4.50	5.00	2.00	2.30
30	D	32.80	33.80	33.80	4.50	5.00	2.00	2.30
36	A	37.80	38.80	38.80	4.50	5.00	2.00	2.50
36	B	38.30	39.30	39.30	4.50	5.00	2.00	2.50
36	C	38.80	39.80	39.80	4.50	5.00	2.00	2.50
36	D	39.30	40.30	40.30	4.50	5.00	2.00	2.50
42	A	44.00	45.00	45.00	5.00	5.00	2.00	2.80
42	B	44.50	45.50	45.50	5.00	5.00	2.00	2.80
42	C	45.10	46.10	46.10	5.00	5.00	2.00	2.80
42	D	45.70	46.70	46.70	5.00	5.00	2.00	2.80
48	A	50.20	51.20	51.20	5.00	5.00	2.00	3.00
48	B	50.80	51.80	51.80	5.00	5.00	2.00	3.00
48	C	51.40	52.40	52.40	5.00	5.00	2.00	3.00
48	D	52.00	53.00	53.00	5.00	5.00	2.00	3.00
54	A	56.40	57.40	57.40	5.50	5.50	2.25	3.20
54	B	57.10	58.10	58.10	5.50	5.50	2.25	3.20
54	C	57.80	58.80	58.80	5.50	5.50	2.25	3.20
54	D	58.50	59.50	59.50	5.50	5.50	2.25	3.20
60	A	62.60	63.60	63.60	5.50	5.50	2.25	3.20
60	B	63.40	64.40	64.40	5.50	5.50	2.25	3.20
60	C	64.20	65.20	65.20	5.50	5.50	2.25	3.20
60	D	65.00	66.00	66.00	5.50	5.50	2.25	3.20

TABLE NO. 2.

Standard Thicknesses and Weights of Cast Iron Pipes.

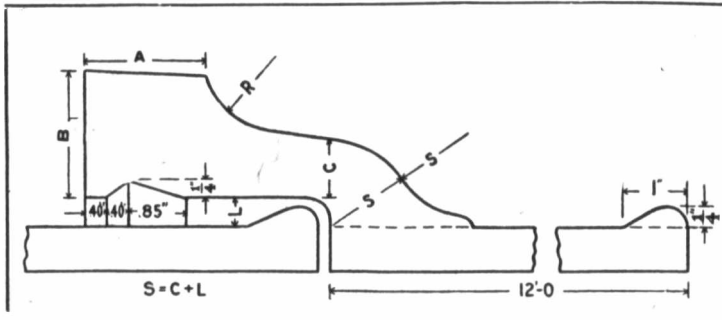
Nominal Diam. Inches.	CLASS A. 100 FT. HEAD. 43 LBS. PRESSURE.			CLASS B. 200 FT. HEAD. 86 LBS. PRESSURE.			CLASS C. 300 FT. HEAD. 130 LBS. PRESSURE.			CLASS D. 400 FT. HEAD. 173 LBS. PRESSURE.			Nominal Diam. Inches.
	Thick- ness, Inches.	Weight, Lbs., Per Length.		Thick- ness, Inches.	Weight, Lbs., Per Length.		Thick- ness, Inches.	Weight, Lbs., Per Length.		Thick- ness, Inches.	Weight, Lbs., Per Length.		
		Foot.	Length.		Foot.	Length.		Foot.	Length.		Foot.	Length.	
4	.41	20.0	240	.45	21.7	260	.48	23.3	280	.52	25.0	300	4
6	.44	30.5	370	.49	33.3	400	.52	35.8	430	.57	38.3	460	6
8	.47	42.9	515	.52	47.5	570	.57	52.1	625	.63	56.8	670	8
10	.50	56.7	680	.56	63.3	700	.63	70.8	800	.70	78.9	850	10
12	.53	71.5	870	.61	80.8	970	.69	89.9	1,050	.77	100.0	1,150	12
14	.57	91.5	1,080	.66	101.3	1,220	.75	115.9	1,300	.83	127.6	1,400	14
16	.60	108.3	1,300	.70	124.2	1,400	.80	142.5	1,710	.90	158.3	1,900	16
18	.63	136.6	1,520	.75	148.3	1,780	.86	170.0	2,040	.97	191.6	2,300	18
20	.66	146.6	1,780	.79	174.1	2,060	.92	201.6	2,430	1.04	229.1	2,750	20
24	.72	190.8	2,320	.88	231.6	2,780	1.03	270.0	3,240	1.16	306.8	3,670	24
30	.81	269.1	3,230	1.01	329.1	3,950	1.20	391.6	4,700	1.34	448.7	5,385	30
36	.90	355.8	4,270	1.13	442.5	5,310	1.37	533.3	6,400	1.56	625.0	7,500	36
42	1.00	461.6	5,560	1.27	580.8	6,970	1.53	696.6	8,300	1.78	825.0	9,500	42
48	1.10	590.8	6,970	1.40	731.6	8,780	1.67	883.3	10,600	1.96	1050.0	12,000	48
54	1.20	716.6	8,600	1.54	908.3	10,900	1.90	1125.0	13,500	2.23	1333.8	16,000	54
60	1.30	858.3	10,300	1.70	1108.3	13,300	2.10	1375.0	16,500	2.38	1583.3	19,000	60

12 feet in length exclusive of Sockets.

TABLE NO. 3.

General Dimensions of Pipe.

FOR FIRE LINES AND OTHER HIGH-PRESSURE SERVICE.



Nominal Diam. Inches.	CLASSES.	Actual Outside Diam. Inches.	DIAM. OF SOCKETS.	DEPTH OF SOCKETS.	A.	B.	C.	R.	Nominal Diam. Inches.
			Pipe and Specials.	Pipe and Specials.					
6	E-F	7.22	8.02	4.00	1.50	1.75	.75	1.10	6
6	G-H	7.38	8.18	4.00	1.50	1.85	.85	1.10	6
8	E-F	9.42	10.22	4.00	1.50	1.85	.85	1.10	8
8	G-H	9.60	10.40	4.00	1.50	1.95	.95	1.10	8
10	E-F	11.60	12.40	4.50	1.75	1.95	.95	1.10	10
10	G-H	11.84	12.64	4.50	1.75	2.05	1.05	1.10	10
12	E-F	13.78	14.58	4.50	1.75	2.05	1.05	1.10	12
12	G-H	14.08	14.88	4.50	1.75	2.20	1.20	1.10	12
14	E-F	15.98	16.78	4.50	2.00	2.15	1.15	1.10	14
14	G-H	16.32	17.12	4.50	2.00	2.35	1.35	1.10	14
16	E-F	18.16	18.96	4.50	2.00	2.30	1.25	1.15	16
16	G-H	18.54	19.34	4.50	2.00	2.55	1.45	1.15	16
18	E-F	20.34	21.14	4.50	2.25	2.45	1.40	1.15	18
18	G-H	20.78	21.58	4.50	2.25	2.75	1.65	1.15	18
20	E-F	22.54	23.34	4.50	2.25	2.55	1.50	1.15	20
20	G-H	23.02	23.82	4.50	2.25	2.85	1.75	1.20	20
24	E-F	26.90	27.90	5.00	2.25	2.85	1.70	1.20	24
30	E	33.10	34.10	5.00	2.25	3.25	1.80	1.50	30
30	F	33.46	34.46	5.00	2.25	3.50	2.00	1.55	30
36	E	39.60	40.60	5.00	2.25	3.70	2.05	1.70	36
36	F	40.04	41.04	5.00	2.25	4.00	2.30	1.80	36

TABLE NO. 4.  
**Standard Thicknesses and Weights of Cast Iron Pipes.**  
 FOR FIRE-LINES AND OTHER HIGH-PRESSURE SERVICE.

Nominal Inside Diam. Inches.	CLASS E. 500 FT. HEAD. 217 LBS. PRESSURE.			CLASS F. 600 FT. HEAD. 260 LBS. PRESSURE.			CLASS G. 700 FT. HEAD. 304 LBS. PRESSURE.			CLASS H. 800 FT. HEAD. 347 LBS. PRESSURE.		
	Thick-ness, Inches.	Weight Per Length.		Thick-ness, Inches.	Weight Per Length.		Thick-ness, Inches.	Weight Per Length.		Thick-ness, Inches.	Weight Per Length.	
		Foot.	Length.		Foot.	Length.		Foot.	Length.		Foot.	Length.
6	.58	41.7	500	.61	46.3	590	.65	47.1	565	.69	49.6	565
8	.66	61.7	740	.71	65.7	790	.75	70.8	850	.80	75.0	900
10	.74	86.3	1,035	.80	92.1	1,106	.86	100.9	1,210	.92	106.7	1,280
12	.82	113.8	1,365	.89	122.1	1,466	.97	135.4	1,635	1.04	148.8	1,725
14	.90	143.0	1,735	1.00	152.4	1,845	1.07	164.0	1,980	1.16	176.7	2,060
16	.98	173.6	2,155	1.08	185.4	2,245	1.18	210.2	2,400	1.27	226.5	2,440
18	1.07	207.4	2,645	1.17	228.4	2,890	1.30	257.1	3,005	1.39	286.7	3,140
20	1.15	253.0	3,155	1.27	286.3	3,435	1.39	320.8	3,550	1.51	344.6	3,630
24	1.31	350.6	4,315	1.45	392.9	4,715	1.55	425.4	4,825	1.66	458.4	4,920
30	1.55	521.7	6,290	1.73	585.4	7,025	1.85	645.0	7,025	1.98	700.0	7,120
36	1.80	725.0	8,700	2.02	820.0	9,840	2.15	890.0	9,840	2.28	960.0	9,840

The above weights are per length to lay 12 feet, including Standard Sockets; proportionate allowance to be made for any variation.  
 For HIGH PRESSURE PIPE from 6" to 24" inclusive, one class of special castings shall be furnished for Classes E and F pipe, and one class of special castings for Classes G and H pipe. For 30" and 36" pipe, one class of special castings shall be furnished for each class of pipe.