PLAINTIFF'S EXHIBIT
JMMC-249

ASA
A 21.2-1939

American Standard

SPECIFICATIONS

for

CAST IRON PIT CAST PIPE FOR WATER OR OTHER LIQUIDS

Approved by
American Standards Association
December, 1939

SPONSORS

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New England Water Works Association

AMERICAN ENGINEERING AND INDUSTRIAL STANDARDS

Approved by New England Water Works Association September 12, 1939

Distributed by
AMERICAN WATER WORKS ASSOCIATION
Incorporated
500 Fifth Avenue, New York 18, N.Y.

Users of this document should make reference to "American Recommended Practice Manual for the Computation of Strength and Thickness of Cast Iron Pipe (A.S.A., A21.1-1939)" for complete information concerning the conditions which various thicknesses of pipe are designed to meet. The foreword of the Manual also contains a statement regarding the history of the specifications and references to other related documents.

AMERICAN STANDARD SPECIFICATIONS
for
CAST IRON PIT CAST PIPE FOR WATER OR OTHER LIQUIDS

This specification covers cast iron pit cast pipe for water or other liquids. Pit cast pipe are pipe cast vertically with dry sand molds and cores.

Sect. 2-1. Description of Pipe. The pipe shall be made with bell and spigot ends, plain ends or such other type of ends as may be agreed upon at the time of purchase. Pipe with bell and spigot ends shall conform accurately to the dimensions given in Table 1. Pipe with other types of ends shall comply with the dimensions agreed upon but in all other respects shall fulfill the specifications hereinafter given. Pipe shall be straight and shall be true circles in section, with their inner and outer surfaces concentric. They shall be at least 12 ft. in nominal laying length, except as provided for cut pipe in Sect. 2-10.

Sect. 2-2. Casting of Pipe. The pipe shall be cast in dry sand molds in a vertical position. Pipe 16 inches or less in diameter shall be cast with the bell end up or down as specified in the proposals. Pipe 18 inches or more in diameter shall be cast with the bell end down. The pipe 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.

Sect. 2-3. Quality of Iron.

(a) All pipes shall be made of cast iron of good quality, and of such character and so adapted in chemical composition to the thickness of the pipe to be cast, that the iron in the pipe shall be strong, tough, resilient, of even grain and soft enough for satisfactory

drilling and cutting and it shall comply with the physical specifications given in Sect. 2-16, 2-17 and 2-18. The metal shall be remelted in a cupola or other suitable furnace.

(b) The iron in the pipe shall not contain more than 0.90 per cent of phosphorus nor more than 0.10 per cent of sulphur. Samples for chemical analysis shall be taken by drilling completely through from skin to skin each of the acceptance test specimens; but not to exceed three specimens per heat.

Sect. 2-4. Quality of Castings. The pipe shall be smooth, free from scales, lumps, blisters, sand holes and defects of every nature which unfit them for the use for which they are intended. No plugging, filling, burning-in or welding will be allowed except as permitted by the purchaser.

Sect. 2-5. Foundry Records.

(a) Casting.—A record of the melting and pouring temperatures of the iron shall be furnished the purchaser if requested.

(b) Chemical analyses shall be made by the manufacturer from each heat to determine total carbon, manganese, phosphorus, sulphur and silicon; duplicate copies of test reports shall be furnished the purchaser on request.

Sect. 2-6. Marking Pipe. Every pipe shall have distinctly cast upon it the initials of the maker's name. When cast especially to order, each pipe larger than 4-inch may 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:

1940	1940	1940
1	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 have dimensions as indicated below.

Diameters of Pipe, Inches, Inclusive	Height of Letter, Inches	Relief, Inch
3 to 10	$\frac{3}{4}$	$\frac{3}{32}$
12 to 20	$1\frac{1}{4}$	$\frac{3}{32}$
24 & larger	$1\frac{3}{4}$	$\frac{1}{8}$

The weight and the class shall be conspicuously painted in white in the inside or outside of each pipe after the coating has become hard.

Sect. 2-7. Inspection by Purchaser.

(a) *Definition of Word "Purchaser."* Wherever the word "Purchaser" is used herein it shall be understood to mean the actual purchaser of the pipe or his authorized agents acting within the scope of the duties entrusted to them.

(b) *Power of Purchaser to Inspect.* The purchaser shall have free access at all times to all parts of any manufacturing plant which concern the manufacture of articles to be made for him. He may inspect the material, the pattern work, molding, casting, coating and lining of the pipe. The forms, sizes, uniformity and conditions of all pipe herein referred to shall be subject to his inspection and approval, and he may reject, without subjection to hydrostatic test, any pipe which is not in conformity with the specifications or drawings. Any pipe rejected shall be marked "rejected" and any marks pertaining to the purchaser shall be chipped or erased from such pipe.

(c) *Manufacturer to Furnish Men and Material.* The manufacturer shall provide all tools, testing equipment, materials, labor and facilities necessary for the required testing, inspection and weighing of the pipe at the foundry.

(d) *Report of Purchaser's Inspection.* The purchaser shall make written report daily at the foundry office of all pipe rejected, noting causes for rejection.

Sect. 2-8. Inspection and Certification by Manufacturer. Should the purchaser have no inspector at the works, the manufacturer shall, if required by the purchaser, furnish a sworn statement that the inspection and all of the tests have been made as specified, this statement to contain the results of all specified tests.

Sect. 2-9. Pipe to Be Delivered Sound. All the pipe must be delivered in all respects sound and comformable to these specifications. The inspection shall not relieve the manufacturer of any of his obligations in this respect, and any defective pipe which may have passed the purchaser 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 manufacturer shall not be held liable for pipe found to be cracked after they have been accepted at the agreed point of delivery, unless there shall be unmistakable evidence that the casting was originally defective or damaged before acceptance. Care shall be taken in handling the pipe not to injure the coating or lining and no pipe or other material

of any kind shall be placed in the pipe during transportation or at any other time after they have received the coating or lining.

Sect. 2-10. Cut Pipe. Defective spigot ends on pipe may be cut off in a manner which will produce a square end. Cut pipe shall be shipped with plain ends or shall have an iron or steel band shrunk into a groove or welded securely on the pipe, as may be agreed upon at time of purchase. Not more than 8 per cent of the total number of pipe of each size shall be cut, and no cut pipe shall be furnished which is less than 11 ft. 0 in. in laying length, unless it has been used by purchaser's order for strip and ring tests in which case a length of not less than 10 ft. 0 in. shall be accepted.

Sect. 2-11. Tolerances or Maximum Permitted Variations from Standard.

(a) *Tolerances in Diameter of Pipe and Sockets.* Outside diameters of pipe barrels and spigot beads and diameters of sockets shall be kept as nearly as practicable to the specified dimensions. They shall be tested with circular gauges. Tolerances or maximum permitted variations from standard dimensions are listed below:

Nominal Diameter in Inches	Tolerance, Plus or Minus, in Inches
3 to 16	.06
18, 20 & 24	.08
30, 36 & 42	.10
48	.12
54	.15
60	.15

(b) *Tolerances in Thickness.* The tolerances, or maximum permitted variations from standard in thickness of pipe and in dimensions of bells are listed below:

Nominal Diameter in Inches, Inclusive	Tolerance, Plus or Minus, in Inches
3 to 8	.07
10 to 24	.08
30 to 60	.10

NOTE: In pipe barrel thickness, tolerances .02 inch greater than those listed above shall be permissible over areas not exceeding 8 inches in length in any direction.

(c) *Allowable Percentage of Variation in Weight.* The weight of no single pipe shall be less than the nominal tabulated weight by more than 5% for pipe 16 inches or less in diameter, and 4% for pipe more than 16 inches in diameter. The total excess weight to be paid for on orders of 25 tons or more shall not exceed 2% of the nominal weight, and on orders less than 25 tons shall not exceed 5% of the nominal weight. An order is hereby defined as including all the pipe ordered under the terms of a specific contract or purchase order or a single order placed under the terms of a standing contract.

Sect. 2-12. Cleaning and Inspecting. All pipe shall have gates, fins and other roughnesses chipped or ground off and shall be thoroughly cleaned, checked as to dimensions and also subjected to a careful surface inspection, a hammer test, and a rolling test, before being coated or lined.

Sect. 2-13. Hydrostatic Test. Each pipe shall be subjected to a hydrostatic proof test. This test may be made either before or after the tar dip or the priming coat for bituminous enamel has been applied but shall be made before the cement mortar lining, bituminous enamel lining, or any other special lining has been applied to pipe for which such a lining is specified.

The pipe shall be under the test pressure for at least one-half minute, and while under pressure shall be subjected to a hammer or shock test. Any pipe showing defects by leaking, sweating, or otherwise, shall be rejected. The test pressures shall be in accordance with the table on the following page.

Sect. 2-14. Weighing. Each length of pipe shall be weighed and the weight and class plainly marked on the outside or inside of the bell or spigot end. Pipe which is to be lined with cement mortar or coated on the inside or outside, or both, with bituminous enamel or other special material shall be weighed before the application of such a lining or coating. If desired by the purchaser, pipe not lined or coated with cement mortar, bituminous enamel or other special material shall be weighed after delivery and the weights so ascertained shall be used in the final settlement, provided such weighing is done by a legalized weigh master. Unless otherwise stated in the contract, a ton shall be 2,000 lb. avoirdupois.

Sect. 2-15. Linings and Exterior Coatings. Any lining or coating which is to be applied to the pipe, shall be specified in the agreement made at time of purchase. Separate specifications for the following linings and coatings have been or will be provided in

TABLE OF PRESSURES FOR HYDROSTATIC TESTS

Nominal Diameter of Pipe, Inches	Barrel Thickness, Inches From	To	Test Pressures, Lb. per sq.in.
3 to 12	All Thicknesses		400
14	.50	.70	300
14	.71	.85	350
14	.86	1.20	450
16	.55	.75	300
16	.76	.95	350
16	.96	1.25	450
18	.60	.80	300
18	.81	1.00	350
18	1.01	1.35	450
20	.65	.85	250
20	.86	1.05	350
20	1.06	1.45	450
24	.70	.90	200
24	.91	1.00	300
24	1.01	1.60	400
30	.85	1.05	200
30	1.06	1.30	300
30	1.31	1.75	400
36	.95	1.15	200
36	1.16	1.45	300
36	1.46	1.95	350
42	1.05	1.35	200
42	1.36	1.60	300
42	1.61	1.75	350
48	1.15	1.50	200
48	1.51	1.90	300
48	1.91	2.05	350
54	1.30	1.55	200
54	1.56	1.80	250
54	1.81	2.05	300
54	2.06	2.25	350
60	1.35	1.75	200
60	1.76	2.05	250
60	2.06	2.30	300
60	2.31	2.40	350

Note: Unless otherwise arranged between the manufacturer and the purchaser, pipe thicker than those listed in the above table shall be tested at the highest pressures listed for the given diameter.

connection with these specifications for pipe:

1. Cement Mortar Lining (A21.4–1939)
2. Coal Tar Dip (in preparation)
3. {Bituminous Enamel Lining / Bituminous Enamel Exterior Coating}

Sect. 2-16. Tests of Material. The acceptability of iron used in cast iron pipe as regards physical characteristics shall be determined by the testing of bars cast from the same iron as the pipe, or, if specified by the purchaser, by the testing of Talbot strips and/or rings cut from the pipe as described in Sect. 2-18. Such strip and/or ring tests shall be paid for by the purchaser at prices to be agreed upon. In any case the test bars shall be made and tested and results given to the purchaser if requested. The smallest pipe on which ring tests may be required is the 6-inch. The observations and the computed results hereinafter required shall be recorded and if requested reported to the purchaser.

Sect. 2-17. Test Bars.

(a) *Dimensions.* Test bars shall be 2 inches wide, 1 inch thick, and not less than 26 inches long. Individual test bars may vary as much as 2 per cent from standard width, or standard thickness, or both, but the patterns and molding practice shall be such that the errors shall in general not exceed 1 per cent.

(b) *Methods of Casting.* The bars shall be cast vertically in well-faced, dry sand molds provided with suitable pouring basin and mounted on a suitable refractory foundation. Metal for the bars shall be obtained by using a small heated ladle taking its metal from the main ladle from which the pipe is to be poured and after all alloys and other additional metal, except cast iron pipe for cooling, have been added to the main ladle and become melted. The bars shall not be removed from the mold before they have cooled to 500°F.

(c) *When Cast and to What Pipe Applicable.* Except as hereinafter provided for special cases, one pair of test bars of the metal used shall be cast with iron from the first ladle, another pair with iron from the approximately middle ladle, and a third pair with iron from the last ladle of iron taken during a day's run or heat from the cupola in which the iron for the pipe is melted. If the heat lasts for more than 6 hours, then additional pairs of bars shall be cast at approximately uniform intervals so as to give an extra pair of bars for each 3 hours during which the heat lasts in excess of 6 hours.

In case the charging of the cupola is to be changed one or more times during the day's run or heat in order to produce a different iron, the time of taking test bars shall be varied in such a way as to obtain representative tests of the iron at least at the beginning and end of each period during which the iron is intended to be constant in quality; and in case such period exceeds four hours additional pairs of bars shall be taken at such times as will provide a pair of bars for each two hours during which this special mixture is used. At least one bar from each pair shall be broken, but the manufacturer shall have the right to break both bars in which case the better bar shall be taken as representative. Bars showing flaws in fracture may be disregarded.

(d) *Test Bar Requirements to Indicate Acceptable Iron; Retests may be made at Contractor's Option using Talbot Strips and/or Rings.* In order that the iron shall be acceptable the average results from the single bars representing the respective pairs of bars cast during the heat or period shall comply with the requirements hereinafter specified and, in addition, no representative bar shall be more than 5 percent below the minimum requirements in either corrected breaking load or corrected deflection. In case the test bars do not measure up to these requirements the manufacturer may make one or more Talbot strip tests and/or ring tests of specimens cut from such of the pipe as may be agreed upon as best representing the iron at the time when the deficient test bars were cast. In the absence of the purchaser the manufacturer may select the pipe from which rings and/or strips shall be cut. The results from these rings and/or strips shall be kept as a foundry record available to any purchaser who requires a report of tests on the 2-inch by 1-inch bars. Any Talbot strip tests or ring tests made under this provision shall be at the expense of the manufacturer. If these supplementary Talbot strip tests and/or ring tests do not meet the requirements, the pipe cast in that heat or period, or such a part thereof as may be agreed to by the purchaser, shall be rejected.

(e) *Method of Testing.* The bars shall be broken as beams by placing them flatwise on supports 24 inches apart and applying the load at the center of the span. The breaking load and the corresponding deflection shall be observed and recorded.

(f) *Correcting Observed Breaking Loads and Deflections.* The bars shall be measured at the point of application of the load and the results corrected to standard 2 inch by 1 inch cross section by the

conventional beam formula as follows:

Corrected breaking load = observed breaking load multiplied by $\frac{2}{bd^2}$

Corrected deflection at breaking = observed deflection at breaking multiplied by d

where b = measured width and

d = measured depth

of the bar at point of application of load

In the formulae above the deflection and all dimensions are in inches.

(g) *Requirements as to Strength and Deflection of 2 inch by 1 inch Bars.* In order to indicate acceptable metal, the corrected breaking loads and deflections of the representative 2 inch by 1 inch test bars for a given heat or period interpreted as provided in paragraph (d) above, shall comply with such of the following tabulated requirements as pertain to the thickness range within which fall the particular pipes which are under consideration.

TABLE OF MINIMUM CORRECTED BREAKING LOADS & DEFLECTIONS

Metal Thickness of Pipe, Inch	Minimum Center Breaking Load, Pounds	Minimum Center Deflection at Breaking, Inch
Below .61	1900	.30 + .0001 (Breaking Load − 1900)
.61 to .90	2000	.30 + .0001 (Breaking Load − 2000)
.91 to 1.60	2200	.30 + .0001 (Breaking Load − 2200)
1.61 to 2.50	2300	.30 + .0001 (Breaking Load − 2300)

Note: For thicknesses exceeding 2.50 inches the form of test specimen and the test requirements shall be as agreed upon in the purchase contract.

Sect. 2-18. Talbot Strip Tests and Ring Tests.

(a) *Dimensions.* Rings shall have a length equal to half the nominal diameter of the pipe unless the diameter exceeds 24 inches, in which case the length of ring shall be 12 inches. Strips shall be not less than 11 inches long and for 24-inch and larger pipe may be cut from the least stressed portions of rings (see Sect. 2-18 (d) after the rings have been broken. The end 2 inches of the pipe shall not be included in ring or strip.

Note: To make both ring and strip tests on a pipe will therefore require at the least (on 6 inch pipe) 16 inches of pipe, at the most (on 20 inch pipe) 23 inches of pipe, and on pipe larger than 20 inches, 14 inches of pipe.

(b) *Method of Sampling.* The purchaser who has expressly specified Talbot strip tests and/or ring tests as acceptance tests of the

pipe may select at random from each run, or heat, one or more pipe from which test specimens are to be cut. In the absence of the purchaser or his representative, the pipe from which test specimens are to be taken may be selected by the manufacturer. If the purchaser should wish to test the uniformity of a run or heat, he may divide it into two or more periods and have a separate set of acceptance tests for pipe in each period.

(c) *Defective Specimens; Retests.* If any test specimen shows defective machining or obvious lack of continuity of metal, it shall be discarded and replaced by another specimen selected by the purchaser. If the test specimens first selected fail to meet the requirements specified hereinafter and the purchaser permits a retest, at least twice the number of specimens that failed shall be selected by the purchaser for retest from a pipe cast in the same run or period. In case a ring from a pipe 24 inches in diameter or larger fails to

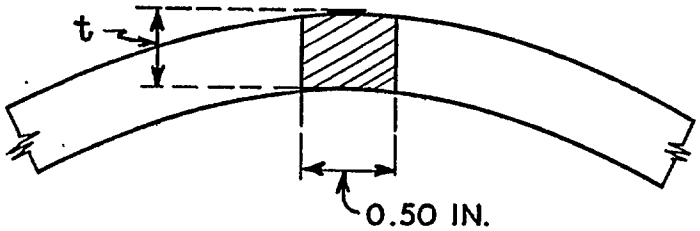


FIG. 1. Position from which Talbot Strip Is Cut

meet specifications, the purchaser may accept strip tests, two specimens to be cut from the failed ring at points of low stress as described in Sect. 2-18 (d). In any case of retest the pipe cast during the run or period shall be acceptable only when all retest specimens meet the requirements. All retests shall be made at the expense of the manufacturer.

(d) *Talbot Strip Tests.* Two Talbot strips shall be machined longitudinally from each pipe selected by the purchaser for testing by this method. If ring tests are also made and the pipe are 24 inches or larger these Talbot strips may be cut from a part of the ring little stressed in the ring test, i.e., near one of the elements marked (a) in Fig. 2. (See Sect. 2-18 (e).) The strips in any case will be in cross section as indicated in Fig. 1, i.e., will have for their width the thickness of the pipe and for their thickness 0.50 inch. Their length will be the length of the ring, 12 inches; or, if

not cut from a ring, at least 11 inches. These strips shall be tested as a beam on supports 10 inches apart with loads applied perpendicularly to the machined faces at two points $3\frac{1}{2}$ inches from the supports. The breaking load and the corresponding deflection shall be observed and recorded.

The strip shall be accurately calipered at point of rupture and the modulus of rupture, R, shall be calculated by the usual beam formula which for this case reduces to the expression:

$$R = \frac{10W}{td^2}$$

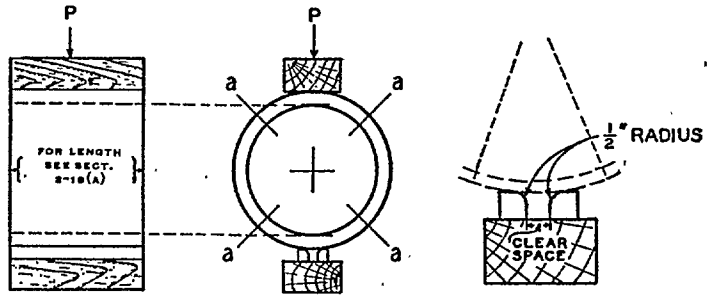


FIG. 2. Assembly for Ring Test

The secant modulus of elasticity E_s, in lb. per sq.in. shall be computed by the formula:

$$E_s = \frac{213W}{td^2y} = \frac{21.3R}{dy}$$

where R = modulus of rupture, lb. per sq.in.
E_s = secant modulus of elasticity, lb. per sq.in.
W = breaking load, lb.
d = depth of strip in inches (intended to be 0.50 in.)
t = width of strip, inches (pipe thickness)
y = deflection of strip at center at breaking load, inches.

To be acceptable a Talbot strip shall have the modulus of rupture, R, not less than 30,000 lb. per sq.in. and the secant modulus of elasticity, E_s, not more than 10,000,000 lb. per sq.in. If the results from either strip are up to the specifications the test shall be regarded as satisfactory.

(e) *Ring Tests.* Each ring shall be tested by the three-edge-bearing method as indicated in Fig. 2. The lower bearing for the

ring shall consist of two strips with vertical sides having their interior top corners rounded to a radius of approximately $\frac{1}{2}$ inch. The strips shall be of hard wood or of metal. If of metal a piece of leather belting about $\frac{3}{16}$ inch thick shall be laid over them. They shall be straight and shall be securely fastened to a rigid block with their interior vertical faces spaced at a distance apart as given in the following table:

Diam. of Pipe	Clear Space
12-inch and smaller	$\frac{1}{2}$ inch
14-inch to 24-inch inclusive	1 inch
30-inch and larger	2 inch

The upper bearing shall be a rigid wooden block, straight and true from end to end. The upper and lower bearings shall extend the full length of the outside of the ring. The ring shall be placed symmetrically between the two bearings, and the center of application of the load shall be so placed that the vertical deformations at the two ends of the ring shall be equal. If the ring is not uniform in thickness, it shall be so placed that the thick and thin portions are near the ends of the horizontal diameter. A record of the breaking load and the corresponding vertical deformation of each ring tested shall be made. In order to be acceptable the modulus of rupture computed from the formula

$$R = 0.954\,\frac{W(d+t)}{bt^2}$$

shall be not less than 31,000 lb. per sq.in., and the secant modulus of elasticity computed from the formula

$$E_s = \frac{0.225\,W(d+t)^3}{bt^3y} = \frac{0.236\,R(d+t)^2}{ty}$$

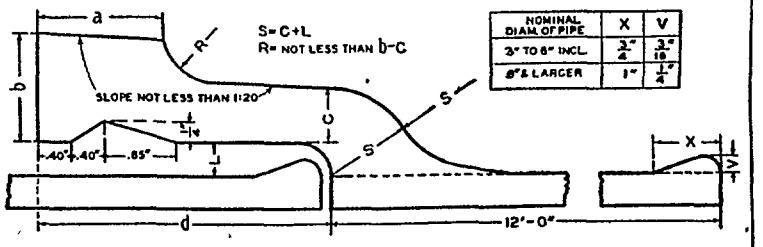
shall not exceed 15,000,000 lb. per sq.in.

b = length of ring, inches
d = average inside diameter of ring, inches
t = average thickness of metal along line of fracture, inches
y = maximum vertical deflection of ring, inches
W = breaking load, in lb.
R = modulus of rupture, lb. per sq.in.
E_s = secant modulus of elasticity, lb. per sq.in.

The modulus of elasticity shall not be determined in rings from pipe less than 12 inches in diameter.

Table No. 1

STANDARD DIMENSIONS OF BELLS, SOCKETS, SPIGOT BEADS and OUTSIDE DIAMETERS of PIT CAST PIPE also WEIGHTS OF BELLS AND OF SPIGOT BEADS



NOMINAL DIAM. OF PIPE	X	V
3" TO 6" INCL.	$\frac{3}{4}$"	$\frac{3}{16}$"
8" & LARGER	1"	$\frac{1}{4}$"

Nominal Diam.	Thickness of pipe		Outside Diam. of Pipe	DIMENSIONS OF BELLS						Wt. of Bell	Wt. of Spigot Bead
	From	To		Diam. of Socket	Thickness of Joint L	Depth of Socket d	a	b	c		
3	.37	.45	3.80	4.60	.40	3.50	1.25	1.30	.65	19	.3
	.46	.53	3.96	4.76	.40	3.50	1.25	1.30	.65	20	.3
4	.40	.45	4.80	5.60	.40	3.50	1.50	1.30	.65	23	.3
	.46	.55	5.00	5.80	.40	3.50	1.50	1.30	.65	24	.4
6	.43	.50	6.90	7.70	.40	3.50	1.50	1.40	.70	33	.5
	.51	.60	7.10	7.90	.40	3.50	1.50	1.40	.70	34	.5
	.61	.66	7.22	8.02	.40	4.00	1.50	1.75	.75	56	.9
	.67	.74	7.38	8.18	.40	4.00	1.50	1.85	.85	62	.9
8	.46	.57	9.05	9.85	.40	4.00	1.50	1.50	.75	48	1.1
	.58	.70	9.30	10.10	.40	4.00	1.50	1.50	.75	49	1.2
	.71	.76	9.42	10.22	.40	4.00	1.50	1.85	.85	75	1.2
	.77	.85	9.60	10.40	.40	4.00	1.50	1.95	.95	84	1.2
10	.50	.60	11.10	11.90	.40	4.00	1.50	1.50	.75	58	1.4
	.61	.75	11.40	12.20	.40	4.00	1.50	1.60	.80	64	1.4
	.76	.85	11.60	12.40	.40	4.50	1.75	1.95	.95	99	1.4
	.86	.97	11.84	12.64	.40	4.50	1.75	2.05	1.05	110	1.5
12	.54	.65	13.20	14.00	.40	4.00	1.50	1.60	.80	72	1.6
	.66	.80	13.50	14.30	.40	4.00	1.50	1.70	.85	78	1.7
	.81	.94	13.78	14.58	.40	4.50	1.75	2.05	1.05	125	1.7
	.95	1.09	14.08	14.88	.40	4.50	1.75	2.20	1.20	144	1.7
14	.54	.62	15.30	16.10	.40	4.00	1.50	1.70	.85	88	1.9
	.63	.87	15.65	16.45	.40	4.00	1.50	1.80	.90	96	1.9
	.88	1.04	15.98	16.78	.40	4.50	2.00	2.15	1.15	148	2.0
	1.05	1.21	16.32	17.12	.40	4.50	2.00	2.35	1.35	183	2.0
16	.58	.67	17.40	18.40	.50	4.00	1.75	1.80	.90	114	2.1
	.68	.95	17.80	18.80	.50	4.00	1.75	1.90	1.00	128	2.2
	.96	1.13	18.16	18.96	.40	4.50	2.00	2.30	1.25	180	2.2
	1.14	1.32	18.54	19.34	.40	4.50	2.00	2.55	1.45	224	2.3
18	.63	.72	19.50	20.50	.50	4.00	1.75	1.90	.95	163	2.4
	.73	1.01	19.92	20.92	.50	4.00	1.75	2.10	1.05	154	2.4
	1.02	1.22	20.34	21.14	.40	4.50	2.25	2.45	1.40	222	2.5
	1.23	1.44	20.78	21.58	.40	4.50	2.25	2.75	1.65	283	2.5

All dimensions given in inches. All weights given in pounds.

Table No. 1 (continued)

STANDARD DIMENSIONS OF BELLS, SOCKETS, SPIGOT BEADS and OUTSIDE DIAMETERS of PIT CAST PIPE also WEIGHTS OF BELLS AND OF SPIGOT BEADS

Nominal Diam.	Thickness of pipe		Outside Diam. of Pipe	DIMENSIONS OF BELLS						Wt. of Bell	Wt. of Spigot Bead
	From	To		Diam. of Socket	Thickness of Joint L	Depth of Socket d	a	b	c		
20	.66	.82	21.60	22.60	.50	4.00	1.75	2.00	1.00	156	2.6
	.83	1.08	22.06	23.06	.50	4.00	1.75	2.30	1.15	189	2.7
	1.09	1.32	22.54	23.34	.40	4.50	2.25	2.55	1.50	260	2.8
	1.33	1.56	23.02	23.82	.40	4.50	2.25	2.85	1.75	326	2.8
24	.74	.92	25.80	26.80	.50	4.00	2.00	2.10	1.05	199	3.2
	.93	1.21	26.32	27.32	.50	4.00	2.00	2.50	1.25	250	3.2
	1.22	1.50	26.90	27.90	.50	5.00	2.25	2.75	1.70	349	3.3
	1.51	1.93	27.76	28.56	.40	5.00	2.25	3.15	1.95	489	3.4
30	.87	.92	31.74	32.74	.50	4.50	2.00	2.30	1.15	296	3.9
	.93	1.05	32.00	33.00	.50	4.50	2.00	2.30	1.15	298	3.9
	1.06	1.18	32.40	33.40	.50	4.50	2.00	2.60	1.32	351	4.0
	1.19	1.42	32.74	33.74	.50	4.50	2.00	3.00	1.50	416	4.0
	1.43	1.60	33.10	34.10	.50	5.00	2.25	3.25	1.80	557	4.0
	1.61	1.78	33.46	34.46	.50	5.00	2.25	3.50	2.00	626	4.1
36	.97	1.03	37.96	38.96	.50	4.50	2.00	2.50	1.25	383	4.6
	1.04	1.20	38.30	39.30	.50	4.50	2.00	2.80	1.40	446	4.7
	1.21	1.40	38.70	39.70	.50	4.50	2.00	3.10	1.60	512	4.7
	1.41	1.63	39.16	40.16	.50	4.50	2.00	3.40	1.80	586	4.8
	1.64	1.85	39.60	40.60	.50	5.00	2.25	3.70	2.05	770	4.8
	1.86	2.07	40.04	41.04	.50	5.00	2.25	4.00	2.30	876	4.9
42	1.07	1.15	44.20	45.20	.50	5.00	2.00	2.80	1.40	539	5.4
	1.16	1.30	44.50	45.50	.50	5.00	2.00	3.00	1.50	586	5.4
	1.31	1.57	45.10	46.10	.50	5.00	2.00	3.40	1.75	701	5.5
	1.58	1.84	45.68	46.68	.50	5.00	2.00	3.80	1.95	805	5.8
48	1.18	1.30	50.50	51.50	.50	5.00	2.00	3.00	1.50	660	6.1
	1.31	1.45	50.80	51.80	.50	5.00	2.00	3.30	1.65	745	6.2
	1.46	1.72	51.40	52.40	.50	5.00	2.00	3.80	1.95	900	6.2
	1.73	2.04	51.98	52.98	.50	5.00	2.00	4.20	2.20	1046	6.3
54	1.30	1.38	56.66	57.66	.50	5.50	2.25	3.20	1.60	855	6.9
	1.39	1.60	57.10	58.10	.50	5.50	2.25	3.60	1.80	993	6.9
	1.61	1.89	57.80	58.80	.50	5.50	2.25	4.00	2.15	1189	7.0
	1.90	2.25	58.40	59.40	.50	5.50	2.25	4.40	2.45	1391	7.1
60	1.39	1.45	62.80	63.80	.50	5.50	2.25	3.40	1.70	1021	7.6
	1.46	1.75	63.40	64.40	.50	5.50	2.25	3.70	1.90	1145	7.7
	1.76	2.15	64.20	65.20	.50	5.50	2.25	4.20	2.25	1393	7.8
	2.16	2.46	64.82	65.82	.50	5.50	2.25	4.70	2.60	1647	7.9

All dimensions given in inches. All weights given in pounds.

NOTE: Pipe for pressures greater than 200 pounds per square inch may be supplied with double lead groove if desired.

Table 2

STANDARD THICKNESSES, DIAMETERS AND WEIGHTS OF PIT CAST PIPE

Dimensions in Inches — Weights in Pounds

Nominal Diam.	Thickness Class	Thickness	Outside Diam.	Inside Diam.	Wt. of Barrel Per Ft.	Wt. of Bell	Wt. Based on 12 Ft. Length*	
							Per Length	Avg. Per Foot
1	2	3	4	5	6	7	8	9
3	1	.37	3.80	3.06	12.4	19	170	14.2
	2	.40	3.80	3.00	13.3	19	180	15.0
	3	.43	3.80	2.94	14.2	19	190	15.8
	4	.46	3.96	3.04	15.8	20	210	17.5
	5	.50	3.96	2.96	17.0	20	225	18.8
4	1	.40	4.80	4.00	17.3	23	230	19.2
	2	.43	4.80	3.94	18.4	23	245	20.4
	3	.46	5.00	4.08	20.5	24	270	22.5
	4	.50	5.00	4.00	22.1	24	290	24.2
	5	.54	5.00	3.92	23.6	24	310	25.8
6	1	.43	6.90	6.04	27.3	33	360	30.0
	2	.46	6.90	5.98	29.0	33	380	31.7
	3	.50	6.90	5.90	31.4	33	410	34.2
	4	.54	7.10	6.02	34.7	34	450	37.5
	5	.58	7.10	5.94	37.1	34	480	40.0
	6	.63	7.22	5.96	40.7	56	545	45.4
	7	.68	7.38	6.02	44.7	62	600	50.0
	8	.73	7.38	5.92	47.6	62	635	52.9
8	1	.46	9.05	8.13	38.7	48	515	42.9
	2	.50	9.05	8.05	41.9	48	550	45.8
	3	.54	9.05	7.97	45.0	48	590	49.2
	4	.58	9.30	8.14	49.6	49	645	53.8
	5	.63	9.30	8.04	53.5	49	690	57.5
	6	.68	9.30	7.94	57.5	49	740	61.7
	7	.73	9.42	7.96	62.2	75	825	68.8
	8	.79	9.60	8.02	68.2	84	905	75.4
	9	.85	9.60	7.90	72.9	84	960	80.0
10	1	.50	11.10	10.10	52.0	58	685	57.1
	2	.54	11.10	10.02	55.9	58	730	60.8
	3	.58	11.10	9.94	59.8	58	775	64.6
	4	.63	11.40	10.14	66.5	64	865	72.1
	5	.68	11.40	10.04	71.5	64	925	77.1
	6	.73	11.40	9.94	76.4	64	980	81.7
	7	.79	11.60	10.02	83.7	99	1105	92.1
	8	.85	11.60	9.90	89.6	99	1175	97.9
	9	.92	11.84	10.00	98.5	110	1295	107.9
12	1	.54	13.20	12.12	67.0	72	880	73.3
	2	.58	13.20	12.04	71.8	72	935	77.9
	3	.63	13.20	11.94	77.6	72	1005	83.8
	4	.68	13.50	12.14	85.5	78	1105	92.1
	5	.73	13.50	12.04	91.4	78	1175	97.9
	6	.79	13.50	11.92	98.4	78	1260	105.0
	7	.85	13.78	12.08	107.7	125	1420	118.3
	8	.92	13.78	11.94	116.0	125	1520	126.7
	9	.99	14.08	12.10	127.0	144	1670	139.2
	10	1.07	14.08	11.94	136.4	144	1785	148.8
14	1	.54	15.30	14.22	78.1	88	1025	85.4
	2	.58	15.30	14.14	83.7	88	1095	91.3
	3	.63	15.65	14.39	92.8	96	1210	100.8
	4	.68	15.65	14.29	99.8	96	1295	107.9
	5	.73	15.65	14.19	106.8	96	1380	115.0
	6	.79	15.65	14.07	115.1	96	1480	123.3
	7	.85	15.65	13.95	123.3	96	1580	131.7
	8	.92	15.98	14.14	135.8	148	1780	148.3
	9	.99	15.98	14.00	145.5	148	1895	157.9

*Including Bell and Spigot Bead. Calculated weight of Pipe rounded off to nearest 5 pounds.

Table 2 (continued)

STANDARD THICKNESSES, DIAMETERS AND WEIGHTS OF PIT CAST PIPE

Dimensions in Inches — Weights in Pounds

Nominal Diam.	Thickness Class	Thickness	Outside Diam.	Inside Diam.	Wt. of Barrel Per Ft.	Wt. of Bell	Wt. Based on 12 Ft. Length*	
							Per Length	Avg. Per Foot
1	2	3	4	5	6	7	8	9
14	10	1.07	16.32	14.18	160 0	183	2105	175.4
	11	1.16	16.32	14.00	172.4	183	2255	187.9
16	1	.58	17.40	16.24	95.6	114	1265	105.4
	2	.63	17.40	16.14	103.6	114	1360	113.3
	3	.68	17.80	16.44	114.1	128	1500	125.0
	4	.73	17.80	16.34	122.1	128	1595	132.9
	5	.79	17.80	16.22	131.7	128	1710	142.5
	6	.85	17.80	16.10	141.2	128	1825	152.1
	7	.92	17.80	15.96	152.2	128	1955	162.9
	8	.99	18.16	16.18	166.6	180	2180	181.7
	9	1.07	18.16	16.02	179.2	180	2335	194.6
	10	1.16	18.64	16.22	197.6	224	2600	216.7
	11	1.25	18.64	16.04	211.8	224	2770	230.8
18	1	.63	19.50	18.24	116.5	133	1535	127.9
	2	.68	19.50	18.14	125.4	133	1640	136.7
	3	.73	19.92	18.46	137.3	154	1805	150.4
	4	.79	19.92	18.34	148.1	154	1935	161.3
	5	.85	19.92	18 22	158.9	154	2065	172.1
	6	.92	19.92	18.08	171.3	154	2210	184.2
	7	.99	19.92	17.94	183.7	154	2360	196.7
	8	1.07	20.34	18.20	202.1	222	2650	220.8
	9	1.16	20.34	18.02	218.1	222	2840	236.7
	10	1.25	20.78	18.28	239.3	283	3155	262.9
	11	1.35	20.78	18.08	257.1	283	3370	280.8
20	1	.66	21.60	20.28	135.5	156	1785	148.8
	2	.71	21.60	20.18	145.4	156	1905	158.8
	3	.77	21.60	20.06	157.2	156	2045	170.4
	4	.83	22.06	20.40	172.7	189	2265	188.8
	5	.90	22.06	20.26	186.7	189	2430	202.5
	6	.97	22.06	20.12	200.5	189	2600	216.7
	7	1.05	22.06	19.96	216.2	189	2785	232.1
	8	1.13	22.54	20.28	237.1	260	3110	259.2
	9	1.22	22.54	20.10	255.0	260	3325	277.1
	10	1.32	22.54	19.90	274.6	260	3560	296.7
	11	1.43	23.02	20.16	302.6	326	3960	330.0
24	1	.74	25.80	24.32	181.8	199	2385	198.8
	2	.80	25.80	24.20	196.0	199	2555	212.9
	3	.86	25.80	24.08	210.2	199	2725	227.1
	4	.93	26.32	24.46	231.5	250	3030	252.5
	5	1.00	26.32	24.32	248.2	250	3230	269.2
	6	1.08	26.32	24.16	267.2	250	3460	288.3
	7	1.17	26.32	23.98	288.4	250	3715	309.6
	8	1.26	26.90	24.38	316.7	349	4155	346.2
	9	1.36	26.90	24.18	340.5	349	4440	370.0
	10	1.47	26.90	23.96	366.4	349	4750	395.8
	11	1.59	27.76	24.68	407.9	489	5385	448.8
	12	1.72	27.76	24.32	439.0	489	5760	480.0
	13	1.86	27.76	24.04	472.2	489	6160	513.3
30	1	.87	31.74	30.00	263.3	296	3460	288.3
	2	.94	32.00	30.12	286.2	298	3735	311.3
	3	1.02	32.00	29.96	309.7	298	4020	335.0
	4	1.10	32.40	30.20	337.5	351	4405	367.1
	5	1.19	32.74	30.36	368.0	416	4835	402.9
	6	1.29	32.74	30.16	397.7	416	5190	432.5
	7	1.39	32.74	29.96	427.1	416	5545	462.1

*Including Bell and Spigot Bead. Calculated weight of Pipe rounded off to nearest 5 pounds.

Table 2 (continued)

STANDARD THICKNESSES, DIAMETERS AND WEIGHTS OF PIT CAST PIPE

Dimensions in Inches — Weights in Pounds

Nominal Diam.	Thickness Class	Thickness	Outside Diam.	Inside Diam.	Wt. of Barrel Per Ft.	Wt. of Bell	Wt. Based on 12 Ft. Length*	
							Per Length	Avg. Per Foot
1	2	3	4	5	6	7	8	9
30	8	1.50	33.10	30.10	464.6	557	6135	511.3
	9	1.62	33.46	30.22	505.6	626	6695	557.9
	10	1.75	33.46	29.96	543.0	626	7155	596.3
36	1	.97	37.96	36.02	351.7	383	4610	384 2
	2	1.05	38.30	36.20	383.4	446	5050	420 8
	3	1.13	38.30	36 04	411.7	446	5390	449.2
	4	1.22	38.70	36.26	448.2	512	5895	491.3
	5	1.32	38.70	36.06	483.6	512	6320	526.7
	6	1.43	39.16	36.30	528.9	586	6940	578.3
	7	1.54	39.16	36.08	567.9	586	7405	617.1
	8	1.66	39.60	36.28	617.3	770	8180	681.7
	9	1.79	39.60	36.02	663.4	770	8735	727.9
	10	1.93	40.04	36.18	720.9	876	9530	794.2
42	1	1.07	44.20	42.06	452.3	539	5970	497.5
	2	1.16	44.50	42.18	492.8	586	6505	542.1
	3	1.25	44.50	42.00	520.9	586	6950	579.2
	4	1.35	45.10	42.40	578.9	701	7655	637.9
	5	1.46	45.10	42.18	624.5	701	8200	683.3
	6	1.58	45.58	42.42	681.4	805	8990	749.2
	7	1.71	45.58	42.16	735.3	805	9635	802.9
48	1	1.18	50.50	48.14	570.4	660	7510	625.8
	2	1.27	50.50	47.96	612.8	660	8020	668.3
	3	1.37	50.80	48.06	663.8	745	8715	726.3
	4	1.48	51.40	48.44	724.2	900	9595	799.6
	5	1.60	51.40	48.20	781.0	900	10280	856.7
	6	1.73	51.98	48.52	852.1	1046	11280	940.0
	7	1.87	51.98	48.24	918.5	1046	12075	1006.3
	8	2.02	51.98	47.94	989.2	1046	12925	1077.1
54	1	1.30	56.66	54.06	705.4	855	9325	777.1
	2	1.40	57.10	54.30	764.3	993	10170	847.5
	3	1.51	57.10	54.08	822.8	993	10875	906.3
	4	1.63	57.80	54.54	897.4	1189	11965	997.1
	5	1.76	57.80	54.28	966.8	1189	12800	1066.7
	6	1.90	58.40	54.60	1052.2	1391	14025	1168 8
	7	2.05	58.40	54.30	1132.3	1391	14985	1248.8
	8	2.21	58.40	53.98	1217.2	1391	16005	1333.8
60	1	1.39	62.80	60.02	836.7	1021	11070	922.5
	2	1.50	63.40	60.40	910.1	1145	12075	1006.3
	3	1.62	63.40	60.16	981.0	1145	12925	1077.1
	4	1.75	63.40	59.90	1057.5	1145	13845	1153.8
	5	1.89	64.20	60.42	1154.3	1393	15250	1270.9
	6	2.04	64.20	60.12	1242.9	1393	16315	1359.6
	7	2.20	64.82	60.42	1350.3	1647	17860	1488.3
	8	2.38	64.82	60.06	1456.6	1647	19135	1594.6

NOTE: When pipe is to be cement lined, patterns and cores giving larger outside and inside diameter without change of thickness will be used if ordered.

*Including Bell and Spigot Bead. Calculated weight of Pipe rounded off to nearest 5 pounds.

Table No. 3

STANDARD THICKNESSES AND WEIGHTS OF CAST IRON PIT CAST PIPE

NOTE: These weights are for pipe laid without blocks, on flat bottom trench, with tamped backfill, under 5 feet of cover. For other conditions see Table 4 hereof and the Manual.

Size Inches	CLASS 50 — 50 Lb. Pressure — 115 Feet Head			CLASS 100 — 100 Lb. Pressure — 231 Feet Head			CLASS 150 — 150 Lb. Pressure — 346 Feet Head			CLASS 200 — 200 Lb. Pressure — 462 Feet Head		
		Wt Based on 12 Ft. Lgh.*			Wt. Based on 12 Ft. Lgh.*			Wt. Based on 12 Ft. Lgh.*			Wt. Based on 12 Ft. Lgh.*	
	Thickness Inches	Avg. Per Foot	Per Length	Thickness Inches	Avg. Per Foot	Per Length	Thickness Inches	Avg. Per Foot	Per Length	Thickness Inches	Avg. Per Foot	Per Length
3	.37	14.2	170	.37	14.2	170	.37	14.2	170	.37	14.2	170
4	.40	19.2	230	.40	19.2	230	.40	19.2	230	.40	19.2	230
6	.43	30.0	360	.43	30.0	360	.43	30.0	360	.43	30.0	360
8	.46	42.9	515	.46	42.9	515	.46	42.9	515	.46	42.9	515
10	.50	57.1	685	.50	57.1	685	.54	60.8	730	.58	64.5	775
12	.54	73.3	880	.54	73.3	880	.58	77.9	935	.63	83.8	1005
14	.54	85.4	1025	.58	91.3	1095	.63	100.8	1210	.68	107.9	1295
16	.58	105.4	1265	.63	113.3	1360	.68	125.0	1500	.79	142.5	1710
18	.63	127.9	1535	.68	136.7	1640	.73	150.4	1805	.85	172.1	2065
20	.66	148.8	1785	.71	158.8	1905	.83	188.8	2265	.90	202.5	2430
24	.74	198.8	2385	.80	212.9	2555	.93	252.5	3030	1.00	269.2	3230
30	.87	288.3	3460	.94	311.3	3735	1.10	367.1	4405	1.19	402.9	4835
36	.97	384.2	4610	1.05	420.8	5050	1.22	491.3	5895	1.43	578.3	6940
42	1.07	497.5	5970	1.25	579.2	6950	1.35	637.9	7655	1.58	749.2	8990
48	1.18	625.8	7510	1.37	726.3	8715	1.48	799.6	9595	1.73	940.0	11280
54	1.30	777.1	9325	1.51	906.3	10875	1.63	997.1	11965	1.90	1168.8	14025
60	1.39	922.5	11070	1.62	1077.1	12925	1.89	1270.9	15250	2.20	1488.3	17860

*Including Bell and Spigot Bead. Calculated weight of Pipe rounded off to nearest 5 pounds.

Table No. 3 (Continued)

STANDARD THICKNESSES AND WEIGHTS OF CAST IRON PIT CAST PIPE

NOTE: These weights are for pipe laid without blocks, on flat bottom trench, with tamped backfill, under 5 feet of cover. For other conditions see Table 4 hereof and the Manual.

Size Inches	CLASS 250 — 250 Lb. Pressure — 577 Feet Head			CLASS 300 — 300 Lb. Pressure — 693 Feet Head			CLASS 350 — 350 Lb. Pressure — 808 Feet Head		
		Wt. Based on 12 Ft. Lgh.*			Wt. Based on 12 Ft. Lgh.*			Wt. Based on 12 Ft. Lgh.*	
	Thickness Inches	Avg. Per Foot	Per Length	Thickness Inches	Avg. Per Foot	Per Length	Thickness Inches	Avg. Per Foot	Per Length
3	.37	14.2	170	.37	14.2	170	.37	14.2	170
4	.40	19.2	230	.40	19.2	230	.40	19.2	230
6	.43	30.0	360	.46	31.7	380	.50	34.2	410
8	.50	45.8	550	.54	49.2	590	.58	53.8	645
10	.63	72.1	865	.68	77.1	925	.73	81.7	980
12	.68	92.1	1105	.73	97.9	1175	.79	105.0	1260
14	.79	123.3	1480	.85	131.7	1580	.92	148.3	1780
16	.85	152.1	1825	.92	162.9	1955	.99	181.7	2180
18	.92	184.2	2210	.99	196.7	2360	1.07	220.8	2650
20	.97	216.7	2600	1.05	232.1	2785	1.22	277.1	3325
24	1.08	288.3	3460	1.26	346.2	4155	1.36	370.0	4440
30	1.39	462.1	5545	1.50	511.3	6135	1.62	557.9	6695
36	1.54	617.1	7405	1.79	727.9	8735	1.93	794.2	9530
42	1.71	802.9	9635						
48	2.02	1077.1	12925						
54	2.21	1333.8	16005						
60	2.38	1594.6	19135						

*Including Bell and Spigot Bead. Calculated weight of Pipe rounded off to nearest 5 pounds.

Table No. 4

STANDARD THICKNESSES OF CAST IRON PIT CAST PIPE

Thickness in Inches. Working Pressure in Pounds per Square Inch.
Thicknesses Include Allowances for Water Hammer,
Foundry Practice and Corrosion

Laying Condition A—Flat Bottom Trench, Without Blocks, Untamped Backfill
Laying Condition B—Flat Bottom Trench, Without Blocks, Tamped Backfill
Laying Condition C—Pipe Laid on Blocks, Untamped Backfill
Laying Condition D—Pipe Laid on Blocks, Tamped Backfill

Size Inches	Working Pressure	3½ FEET OF COVER				5 FEET OF COVER				8 FEET OF COVER			
		Laying Condition				Laying Condition				Laying Condition			
		A	B	C	D	A	B	C	D	A	B	C	D
3	50	.37	.37	.37	.37	.37	.37	.37	.37	.37	.37	.43	.37
	100	.37	.37	.37	.37	.37	.37	.37	.37	.37	.37	.43	.37
	150	.37	.37	.37	.37	.37	.37	.40	.37	.37	.37	.43	.37
	200	.37	.37	.37	.37	.37	.37	.40	.37	.37	.37	.43	.37
	250	.37	.37	.37	.37	.37	.37	.40	.37	.37	.37	.46	.37
	300	.37	.37	.37	.37	.37	.37	.40	.37	.37	.37	.46	.37
	350	.37	.37	.40	.37	.37	.37	.40	.37	.37	.37	.46	.37
4	50	.40	.40	.40	.40	.40	.40	.43	.40	.40	.40	.50	.40
	100	.40	.40	.40	.40	.40	.40	.43	.40	.40	.40	.50	.40
	150	.40	.40	.40	.40	.40	.40	.43	.40	.40	.40	.50	.40
	200	.40	.40	.43	.40	.40	.40	.43	.40	.40	.40	.50	.40
	250	.40	.40	.43	.40	.40	.40	.46	.40	.40	.40	.50	.40
	300	.40	.40	.43	.40	.40	.40	.46	.40	.40	.40	.54	.40
	350	.40	.40	.46	.40	.40	.40	.46	.40	.40	.40	.54	.40
6	50	.43	.43	.46	.43	.43	.43	.50	.43	.43	.43	.58	.43
	100	.43	.43	.46	.43	.43	.43	.50	.43	.43	.43	.58	.43
	150	.43	.43	.50	.43	.43	.43	.50	.43	.43	.43	.58	.43
	200	.43	.43	.50	.43	.43	.43	.54	.43	.43	.43	.58	.43
	250	.43	.43	.58	.43	.43	.43	.54	.43	.46	.46	.63	.46
	300	.46	.43	.54	.43	.46	.46	.54	.46	.50	.46	.63	.46
	350	.50	.50	.54	.46	.50	.50	.58	.50	.50	.50	.63	.50
8	50	.46	.46	.54	.46	.46	.46	.54	.46	.46	.46	.63	.46
	100	.46	.46	.54	.46	.46	.46	.54	.46	.46	.46	.63	.50
	150	.46	.46	.58	.46	.46	.46	.58	.46	.50	.50	.68	.50
	200	.46	.46	.58	.50	.50	.46	.58	.50	.54	.50	.68	.54
	250	.50	.50	.63	.50	.54	.50	.63	.54	.54	.54	.68	.58
	300	.54	.54	.63	.54	.58	.54	.63	.58	.58	.58	.73	.58
	350	.58	.58	.63	.58	.58	.58	.68	.58	.63	.63	.73	.63
10	50	.50	.50	.58	.50	.50	.50	.58	.50	.54	.50	.68	.54
	100	.50	.50	.58	.50	.50	.50	.63	.50	.58	.54	.73	.58
	150	.50	.50	.58	.50	.54	.54	.63	.54	.58	.58	.73	.58
	200	.54	.54	.63	.54	.58	.58	.68	.58	.63	.50	.79	.63
	250	.58	.58	.63	.58	.63	.63	.68	.63	.68	.63	.79	.68
	300	.63	.63	.68	.63	.68	.68	.73	.68	.68	.68	.79	.73
	350	.68	.68	.73	.68	.73	.73	.79	.73	.73	.73	.85	.73
12	50	.54	.54	.58	.54	.54	.54	.63	.54	.58	.58	.73	.63
	100	.54	.54	.63	.54	.54	.54	.68	.58	.63	.58	.79	.63
	150	.58	.54	.63	.58	.58	.58	.68	.63	.68	.63	.79	.68
	200	.63	.58	.68	.63	.63	.63	.73	.68	.68	.68	.85	.73
	250	.68	.68	.73	.68	.68	.68	.79	.73	.73	.73	.85	.73
	300	.73	.73	.79	.73	.73	.73	.79	.79	.79	.79	.92	.79
	350	.79	.79	.85	.79	.79	.79	.85	.85	.85	.85	.92	.85
14	50	.54	.54	.63	.58	.58	.54	.68	.68	.68	.63	.79	.68
	100	.58	.54	.68	.58	.63	.58	.73	.63	.68	.68	.85	.73
	150	.63	.63	.68	.63	.68	.63	.73	.68	.73	.73	.85	.79
	200	.68	.68	.73	.68	.73	.68	.79	.73	.79	.79	.92	.79
	250	.79	.73	.79	.79	.79	.79	.85	.79	.85	.79	.92	.85
	300	.85	.85	.85	.85	.85	.85	.92	.85	.92	.85	.99	.92
	350	.92	.92	.92	.92	.92	.92	.99	.92	.99	.92	1.07	.99

Table No. 4—Continued

Size Inches	Working Pressure	3½ FEET OF COVER				5 FEET OF COVER				8 FEET OF COVER			
		Laying Condition				Laying Condition				Laying Condition			
		A	B	C	D	A	B	C	D	A	B	C	D
16	50	.58	.58	.68	.63	.63	.58	.73	.63	.73	.68	.85	.73
	100	.63	.58	.73	.63	.68	.63	.73	.68	.73	.73	.85	.79
	150	.68	.68	.73	.68	.73	.68	.79	.73	.79	.79	.92	.85
	200	.73	.73	.79	.73	.79	.79	.85	.79	.85	.79	.92	.85
	250	.79	.79	.85	.85	.85	.85	.92	.85	.92	.85	.99	.92
	300	.92	.92	.92	.92	.92	.92	.99	.92	.99	.92	1.07	.99
	350	.99	.99	.99	.99	.99	.99	1.07	.99	1.07	.99	1.16	1.07
18	50	.63	.63	.73	.68	.68	.63	.79	.68	.79	.73	.85	.79
	100	.68	.63	.73	.68	.73	.68	.79	.73	.85	.79	.92	.85
	150	.73	.73	.79	.73	.79	.73	.85	.79	.85	.85	.99	.92
	200	.79	.79	.85	.85	.85	.85	.92	.85	.92	.85	.99	.99
	250	.92	.92	.92	.92	.92	.92	.99	.92	.99	.99	1.07	.99
	300	.99	.99	.99	.99	.99	.99	1.07	1.07	1.07	1.07	1.16	1.07
	350	1.07	1.07	1.07	1.07	1.07	1.07	1.16	1.07	1.16	1.16	1.25	1.16
20	50	.66	.66	.77	.71	.71	.66	.83	.77	.83	.77	.90	.83
	100	.71	.66	.83	.77	.77	.71	.83	.83	.83	.83	.97	.90
	150	.77	.77	.83	.77	.83	.83	.90	.83	.90	.90	1.05	.97
	200	.83	.83	.90	.90	.90	.90	.97	.90	.97	.97	1.05	1.05
	250	.97	.97	.97	.97	.97	.97	1.05	1.05	1.05	1.05	1.13	1.13
	300	1.05	1.05	1.05	1.05	1.13	1.05	1.13	1.13	1.13	1.13	1.22	1.13
	350	1.22	1.13	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.32	1.32
24	50	.74	.74	.86	.80	.80	.74	.86	.86	.93	.86	1.00	.93
	100	.80	.74	.86	.86	.86	.80	.93	.93	1.00	.93	1.08	1.00
	150	.86	.86	.93	.86	.93	.93	1.00	1.00	1.08	1.00	1.08	1.08
	200	1.00	1.00	1.00	1.00	1.08	1.00	1.08	1.08	1.17	1.08	1.17	1.17
	250	1.08	1.08	1.17	1.08	1.17	1.08	1.17	1.17	1.26	1.17	1.26	1.26
	300	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.36	1.26	1.36	1.36
	350	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.47	1.36	1.47	1.47
30	50	.94	.87	1.02	.94	.94	.87	1.02	.94	1.10	1.02	1.19	1.10
	100	.94	.87	1.02	.94	1.02	.94	1.10	1.02	1.19	1.10	1.29	1.19
	150	1.10	1.02	1.10	1.10	1.19	1.10	1.19	1.19	1.29	1.19	1.39	1.29
	200	1.19	1.19	1.19	1.19	1.29	1.19	1.29	1.29	1.39	1.28	1.39	1.39
	250	1.29	1.29	1.39	1.39	1.39	1.39	1.50	1.39	1.50	1.39	1.50	1.50
	300	1.50	1.50	1.50	1.50	1.50	1.50	1.62	1.50	1.62	1.50	1.62	1.62
	350	1.62	1.62	1.62	1.62	1.62	1.62	1.75	1.62	1.75	1.75	1.75	1.75
36	50	1.05	.97	1.13	1.05	1.05	.97	1.22	1.05	1.22	1.13	1.32	1.22
	100	1.13	.97	1.22	1.13	1.22	1.05	1.22	1.13	1.32	1.22	1.43	1.32
	150	1.22	1.13	1.22	1.22	1.32	1.22	1.32	1.32	1.43	1.32	1.54	1.43
	200	1.32	1.32	1.43	1.32	1.43	1.43	1.43	1.43	1.54	1.43	1.66	1.54
	250	1.54	1.54	1.54	1.54	1.66	1.54	1.66	1.66	1.66	1.66	1.79	1.66
	300	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.93	1.79
	350	1.93	1.93	1.93	1.93	1.93	1.93	2.08	1.93	2.08	1.93	2.08	2.08
42	50	1.16	1.07	1.25	1.16	1.25	1.07	1.35	1.25	1.35	1.25	1.46	1.35
	100	1.25	1.07	1.35	1.25	1.35	1.25	1.35	1.35	1.46	1.35	1.58	1.46
	150	1.35	1.25	1.46	1.35	1.46	1.35	1.46	1.46	1.58	1.46	1.71	1.58
	200	1.58	1.46	1.58	1.58	1.58	1.58	1.71	1.58	1.71	1.58	1.85	1.71
	250	1.71	1.71	1.85	1.71	1.85	1.71	1.85	1.85	1.85	1.85	2.00	1.85
48	50	1.27	1.18	1.37	1.27	1.37	1.18	1.48	1.37	1.60	1.37	1.60	1.48
	100	1.37	1.27	1.48	1.37	1.48	1.37	1.60	1.48	1.73	1.48	1.73	1.60
	150	1.48	1.48	1.60	1.48	1.60	1.48	1.73	1.60	1.87	1.60	1.87	1.73
	200	1.73	1.73	1.73	1.73	1.87	1.73	1.87	1.87	2.02	1.87	2.02	1.87
	250	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.18	2.02	2.18	2.18
54	50	1.40	1.30	1.51	1.40	1.51	1.30	1.63	1.40	1.63	1.51	1.76	1.63
	100	1.51	1.40	1.63	1.51	1.63	1.51	1.76	1.63	1.90	1.63	1.90	1.76
	150	1.63	1.63	1.76	1.63	1.76	1.63	1.90	1.76	2.05	1.76	2.05	1.90
	200	1.90	1.90	2.05	1.90	2.05	1.90	2.05	2.05	2.21	2.05	2.21	2.21
	250	2.21	2.21	2.21	2.21	2.21	2.21	2.39	2.21	2.39	2.21	2.39	2.39
60	50	1.50	1.39	1.62	1.50	1.62	1.39	1.75	1.50	1.89	1.62	1.89	1.75
	100	1.62	1.50	1.75	1.62	1.75	1.62	1.89	1.75	2.04	1.75	2.04	1.89
	150	1.89	1.75	1.89	1.75	2.04	1.89	2.04	1.89	2.20	2.04	2.20	2.04
	200	2.04	2.04	2.20	2.04	2.20	2.20	2.20	2.20	2.38	2.20	2.38	2.38
	250	2.38	2.38	2.38	2.38	2.57	2.38	2.57	2.57	2.57	2.57	2.78	2.57

COPY FORM	INITIALS	DATE
	CSP	10-19-99

BOX NUMBER	SEGMENT NO.	REQUESTING PARTY
04-1913		B+B

NOTES