PLAINTIFF'S EXHIBIT

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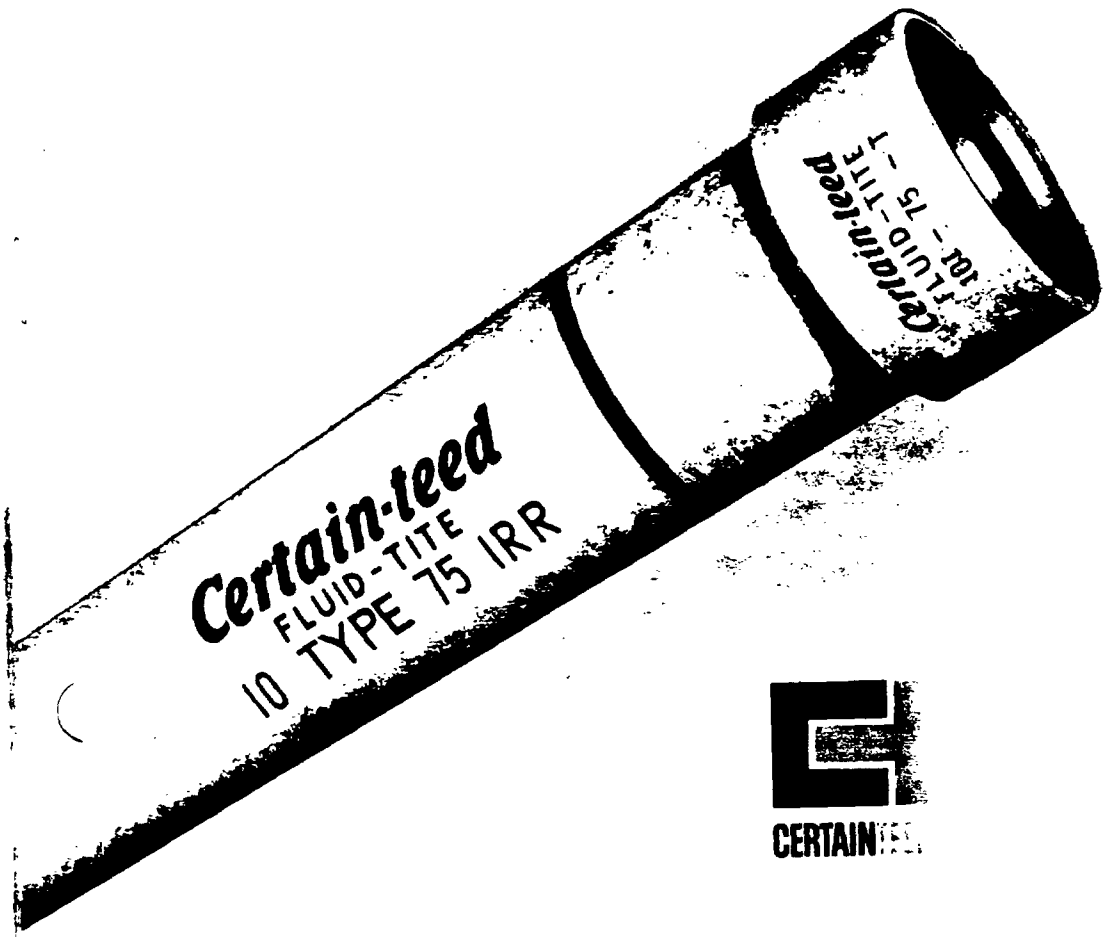

CERTAIN-TEED

FLUID-TITE.

ASBESTOS-CEMENT TYPE 25, 75 and 125 IRRIGATION PIPE SPECIFICATIONS

CTD010361

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STANDARD SPECIFICATIONS
CERTAIN-TEED ASBESTOS-CEMENT TYPE 25, 75 AND 125 IRRIGATION PIPE

SECTION 1 - GENERAL

Sec. 1.1 Scope – This specification designates the requirements for Certain-teed FLUID-TITE® Asbestos-Cement Irrigation Pipe, Types 25, 75 and 125, manufactured for use in irrigation supply lines and distribution systems which carry water under pressure.

Sec. 1.2 Conformance –

Certain-teed Irrigation Pipe, as manufactured to meet these specifications, meets the requirements of the U. S. Dept. of Agriculture, Soil Conservation Service Specification Guide 432 for Asbestos Cement Pipe.

SECTION 2 - GENERAL REQUIREMENTS

Sec. 2.1 Sizes – Pipe shall be manufactured with nominal inside diameters of 3", 4", 6", 8", 10", 12", 14", 15", 16", 18", 20", 21", and 24" in Types 25, 75 and 125; 5" in Types 25 and 75.

Sec. 2.2 Types – Certain-teed Irrigation Pipe, to meet these specifications, shall be manufactured in three types, for working pressures of 25, 75 and 125 psi. The types shall be designated as Type 25, Type 75 and Type 125.

Sec. 2.3 Lengths –

2.3.1 The standard length of Irrigation Pipe shall be 13 feet in all classes and sizes. At least 90% of the total footage of any class and size, excluding short lengths, shall be of this length with a tolerance of plus zero or minus 1 inch. The remaining 10% or less may be in random lengths of not less than 7 feet, with a tolerance of plus or minus 1 inch.

2.3.2 **Short Lengths** – Short lengths for use in making connections to valves, fittings, and structures, and for making closures shall not exceed 6 feet 6 inches. Standard lengths are ½ lengths (6' 6" ± 1") machined ends only (M.E.O.) and ¼ lengths (3' 3" ± 1") fully machined (FM). Short lengths (includes), when not specified on the order, may be furnished as a maximum at factory option as follows:

In sizes 3" through 12", 1% of total footage in ¼ F.M. with one coupling for every two pieces and 1% in ½ M.E.O. with one coupling for each piece.

In sizes 14" through 24", ½% of total footage in ¼ F.M. with one coupling for every two pieces and ½% in ½ M.E.O. with one coupling for each piece except that includes will be supplied in sizes 18" through 24" only on customer request at time of order.

½ F.M. with one coupling per piece may be substituted for ¼ F.M. in sizes 8" through 16" on an equal percentage basis upon request.

Sec. 2.4 Couplings –

Couplings shall be of the FLUID-TITE design, unless otherwise specified. They shall provide tight joints when subjected to the same hydrostatic test as designated for the pipe. One coupling of the same manufacture as the pipe shall be furnished with each standard and random length of pipe. It shall consist of an asbestos-cement sleeve and two rubber gaskets suitable for use with the particular size and class of pipe with which it is supplied.

2.4.1 **CERTA-SPACER Band** – Each end of a standard, random and M.E.O. pipe shall include a factory installed CERTA-SPACER to provide positive end separation without employing the sealing gasket for this function.

Sec. 2.5 Materials –

2.5.1 **Pipe and Couplings** – Asbestos-Cement Irrigation Pipe and Couplings shall be composed of an intimate mixture of Portland cement, asbestos fiber and silica, and shall be free from organic additives. The material shall be formed under pressure and cured by autoclave process to meet the physical and chemical requirements of the specification.

2.5.2 **Rubber Gaskets** – Rubber Sealing Gaskets shall conform to the requirements of ASTM-D-1869 latest issue and consist of a vulcanized rubber compound as specified by the manufacturer.

2.5.3 **CERTA-SPACER BAND** – CERTA-SPACER Band shall consist of a special yielding synthetic compound as specified by the manufacturer.

SECTION 3 – DETAIL REQUIREMENTS

Sec. 3.1 Pipe –

3.3.1 **Description** – Asbestos-Cement Irrigation Pipe shall be made to the manufacturer's standard dimensions and tolerances. The pipe shall be machined on each end to properly receive the coupling and gasket.

3.1.2 **Hydrostatic Test** – Each standard, random or short length of pipe and each coupling for the corresponding pipe shall have sufficient strength to hold an internal hydrostatic test for each type of pipe equal to three times the working pressure of the pipe as shown in the following table, when tested as described in Section 4.2.

TYPE OF PIPE	TEST PRESSURE
Type 25	75 psi
Type 75	225 psi
Type 125	375 psi

3.1.3 **Flexural Strength** – Each standard length of pipe in sizes 3", 4", 5", 6" and 8" shall have sufficient beam strength to withstand without failure the total applied load specified below when tested as described in Section 4.2.2. The following values are based on tests across a 12 foot span.

TOTAL APPLIED LOADS – LBS.

Nominal Diameter Inches	Type 25	Type 75	Type 125
3"	225	375	565
4"	450	750	975
5"	675	1125	
6"	975	1500	2475
8"	1875	2775	4500

3.1.4 **Crushing Strength** – Each pipe when tested shall have sufficient strength, when submitted to the ASTM three-edge bearing test as specified in Section 4.2.3, to support not less than the loads indicated in the following tabulation:

MINIMUM CRUSHING STRENGTH

Nominal Diameter Inches	Type 25	Type 75	Type 125
3"	1500	2300	4400
4"	1100	1900	4200
5"	1000	1650	
6"	1000	1400	3700
8"	1300	1650	4000
10"	1500	1900	4300
12"	1500	2200	4600
14"	1500	2600	5000
15"	1500	2600	5100
16"	1500	2750	5400
18"	1800	2900	5800
20"	2000	3100	6400
21"	2400	3300	6800
24"	2400	3500	7500

3.1.5 **Workmanship** –

3.1.5.1 **Inside Surface** – Each pipe shall be free from bulges, dents, and tears on the inside surface which result in a variation in diameter greater than 3/16 from that obtained on adjacent unaffected portions of the surface.

3.1.5.2 **Ends** – Machined ends of the pipe that receive the coupling shall be free from dents and gouges that will affect the tightness of the joint.

3.1.5.3 **Straightness** – Each pipe shall not vary from straightness more than 5/8 inch measured as an outside mid-ordinate, in lengths of 13 feet.

Sec. 3.2 **Couplings** – Asbestos-Cement Couplings shall be machined on the inside surface so that the gaskets are retained in the proper position to make a tight seal.

Sec. 3.3 **Rubber Gaskets** – The rubber gaskets shall conform to the manufacturer's standards.

Sec. 3.4 **Chemical Requirements** – The Uncombined Calcium Hydroxide in Certain-teed Asbestos-Cement Irrigation Pipe and Couplings shall not be greater than 1 per cent when tested by the methods described in Section 4.2.4.

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SECTION 4 – INSPECTION TESTS AND REJECTIONS

Sec. 4.1 General – All material furnished under this specification shall be inspected and tested in accordance with this specification. All material shall be in a normal processed condition prior to test for conformance to the requirements stated in previous sections. When requested on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this witnessing, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification. To insure the purchaser that all pipe purchased under this specification conforms to the standards herein required and for the convenience of the purchaser or his representative, all tests must be conducted in the Continental U. S.

Sec. 4.2 Tests –

4.2.1 Hydrostatic Test – Each standard, random, or short length of pipe, and each coupling shall be tested under the hydrostatic pressures outlined in Section 3.1.2. All air shall be expelled and the water pressure shall be increased to the test pressure at a uniform rate of not less than 100 p.s.i. per second. The specified test pressure shall be maintained for at least 5 seconds. Any pipe length or sleeve showing leakage, sweating or other defect shall be rejected.

4.2.2 Flexural Strength – Each standard length of pipe having a nominal diameter of 3", 4", 5", 6", or 8" shall be tested in flexure. The load is applied at a uniform rate of at least 250 lbs. per second until it equals the proof load specified. The load is distributed equally at the third points of the clear span and it is maintained for at least 5 seconds.

4.2.3 Crushing – From each 300 lengths of pipe, or fraction thereof, of each size and class when specifically requested by the purchaser on his order, one length shall be selected by the inspector for a three-edge bearing test before shipment. From each selected length, there shall be cut one unmachined section of pipe one foot long. This section shall be tested by the ASTM three-edge bearing method and shall not fail until the total applied load exceeds the applicable value shown in Section 3.1.4. The rate of loading shall be 2,000 pounds per minute per lineal foot, with a tolerance of plus or minus 500 pounds per minute per lineal foot.

For this test, the two lower bearings shall consist of two straight wooden strips with vertical sides, each strip having its interior top edge rounded to a radius of approximately 1/2 inch. The strips shall be securely fastened to a rigid block, with the interior vertical faces parallel and clear space distance of 1/2 inch for pipe 12 inches and under and 1 inch for pipe 14 and 16 inches. The upper bearing shall be a rigid wooden block, at least 6 inches in cross section straight and true from end to end. The upper and lower bearings shall extend the full length of the test section.

4.2.4 Uncombined Calcium Hydroxide Test – The manufacturer shall conduct periodic controlled Uncombined Calcium Hydroxide tests. Upon request, certifications shall be issued to the customer that the pipe and couplings will conform to the requirements of maximum Uncombined Calcium Hydroxide permitted under 3.4.

Reagents

(a) Phenolphthalein Indicator – Dissolve 1.0 g of phenolphthalein in 100:0 ml. of absolute ethanol.*

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(b) **Glycerol** – Ethanol Solvent – Prepare a solution consisting of glycerol and anhydrous or absolute ethanol, *1:2 by volume. To each liter of this solution 2.0 ml. of the indicator is added. Adjust the solvent to slightly basic with either dilute NaOH in absolute ethanol* or standard ammonium acetate depending on the original pH.

(c) **Standard Ammonium Acetate Solution** – (1 ml. - 0.005 g CaO). Dissolve 16.0 g. dry crystalline ammonium acetate in one liter of absolute or anhydrous ethanol.* The solution is standardized by following the analytical Procedure except that 0.05 - 0.06 g. of pure ground CaO is substituted for the 1 g. sample.

***Note:** Specially denatured alcohol No. 30, 3a or 2b or alcohol consisting of 95% specially denatured alcohol No. 3a plus 5% isopropanol may be substituted.

Procedure

Representative samples of pipe or sleeves shall be prepared and immediately screened through a 20 mesh screen. Place the material passing through the screen immediately into a weighing bottle and cover with its ground-glass top. Place the bottle with top removed, in a drying oven at 105°C. for two hr., and then cool in a desiccator to room temperature. Weigh out 1 g. ±0.010 g. of the dried sample from a pipe or sleeve to the nearest 0.001 g. and place it into a dry 250 ml. Erlenmeyer flask, to which a teflon encapsulated stirring bar, 60 ml. of the glycerol-ethanol solvent and 2.0 g. Sr. $(NO_3)2$ are added. Attach the flask to a water-cooled condenser (with a standard 24/40 glass joint), and place on a hot plate-magnetic stirrer. Boil the solution gently for 30 minutes with mild stirring. Then remove the flask and filter the mixture on a Buchner funnel under vacuum. Bring the filtrate to a boil and titrate with the standardized ammonium acetate reagent to a colorless endpoint. The endpoint is observed by comparison with a similar mixture containing no phenolphthalein indicator. No excess ammonium acetate should be added at any time because an excess may react with calcium silicates and aluminates.

Calculations

(a) Standardization of Ammonium Acetate Solution

$$E = \frac{W(CaO) \times 1.32}{Va.}$$

Where E = weight of $Ca(OH)_2$ in g/ml. of ammonium acetate solution.

W(CaO) = weight of CaO in grams.
Va = volume of ammonium acetate in ml.

(b) Percentage of Uncombined $Ca(OH)_2$

$$\%Ca(OH)_2 = \frac{EV}{W} \times 100$$

Where V = volume of ammonium acetate solution required by sample in ml.

W = weight of sample in grams.

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Sec. 4.3 Rejection –

4.3.1 Crushing – Failure of the specimen tested for crushing strength to attain 75 per cent of the crushing load required in Section 3.1.4 shall be cause for rejection of the entire lot the test pipe prepresents. If any specimen tested for crushing strength supports more than 75 per cent but less than 100 per cent of the crushing load required in Section 3.1.4, one specimen shall be cut from each of two additional pipes of the same size and class manufactured during the same shift and shall be subjected to the crushing test. Failure of one of these additional specimens to meet the crushing strength requirements shall be cause for rejection of the entire lot of that size and class manufactured during the same shift as the test specimen.

SECTION 5 – MARKING

Section 5.1 Pipe – Each standard, random and short length of pipe shall be clearly marked on the outside surface with the trade name, pipe size, type designation, date of manufacture and test pressure or maximum working pressure.

Sec. 5.2 Coupling – Each coupling shall be clearly marked with the trade name, type and size of pipe for which it is intended to be used, and the letter "T" to indicate that it has been tested.

Sec. 5.3 Gaskets – Each rubber gasket shall be marked with the manufacturers identification, the size and year of manufacture.

Sec. 5.4 Additional Marking – When factory inspection is made by the purchaser, each pipe and each coupling may receive an additional special marking of no more than three letters, as required by the purchaser.

SECTION 6 – PREPARATION FOR SHIPMENT

Sec. 6.1 General – All pipe, couplings and gaskets shall, unless otherwise specified, be prepared for standard commercial shipment, so as to insure acceptance by common or other carriers.

SECTION 7 – SUPPLEMENTARY DETAILS TO BE PROVIDED BY PURCHASER

Sec. 7.1 General – When purchasing Irrigation Pipe under these specifications, it will be necessary for the purchaser to make specific statements for each lot of pipe.

Sec. 7.2 Size – The purchaser shall state the pipe size or sizes required.

Sec. 7.3 Types – The purchaser shall state the type or types of pipe required.

Sec. 7.4 Standard Lengths – The purchaser shall state the total footage of 13 ft. lengths required.

Sec. 7.5 Short Lengths – The purchaser shall state the total footage of 6 ft. 6 inch and 3 ft. 3 inch lengths required.

Sec. 7.6 Inspection & Tests –

7.6.1 Crushing Tests – The purchaser shall state on his order when crushing tests are required.

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7.6.2 **Uncombined Calcium Hydroxide Tests** – The purchaser shall state on his order when the Uncombined Calcium Hydroxide Test is required.

7.6.3 **Certificate of Tests** – The purchaser shall state on his order when a certificate of tests in lieu of inspection is required.

Sec. 7.7 **Definitions** – Under these specifications the following definitions will apply:

7.7.1 **Purchaser** – The person, firm, corporation or governmental sub-division entering into a contract or agreement to purchase pipe according to these specifications.

7.7.2 **Manufacturer** – The person, firm or corporation who manufactures the pipe.

7.7.3 **Inspector** – The representative of the purchaser, properly authorized and limited by the duties entrusted to him.

7.7.4 **Working Pressure** – The maximum hydrostatic pressure to which the pipe will be subjected after installation, exclusive of allowance for water hammer.

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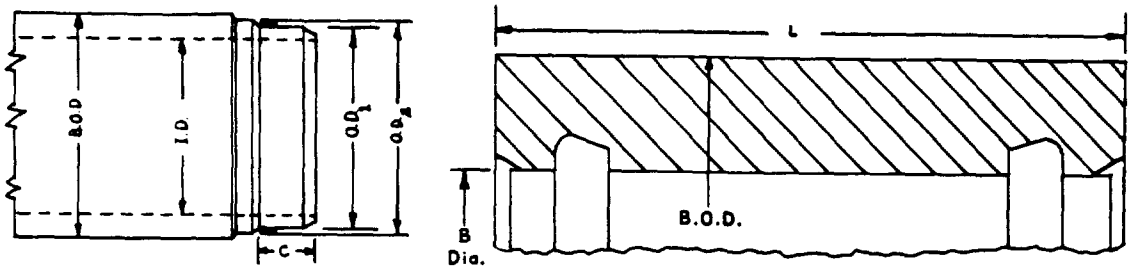
DIMENSIONS & TOLERANCES
ASBESTOS-CEMENT FLUID-TITE®
TYPE 25, 75, 125 IRRIGATION PIPE & COUPLINGS



TOLERANCES

PIPE OD1 & OD2	COUPLING ID (B)
3" – 16" ± 0.020"	3" – 16" ± .025"
18" – 24" ± 0.030"	18" – 24" ± .040"

	PIPE					COUPLINGS		
PIPE SIZE	B.O.D. INCHES	I.D. INCHES	O.D.1 INCHES	O.D.2 INCHES	C ±1/16 INCHES	B(I.D.) INCHES	L +.25 −.00	B-O.D.
TYPE 25								
3	3.99	3.00	3.74	3.90	2.60	3.850	6.25	5.35
4	5.05	4.00	4.70	4.86	2.55	4.790	6.00	6.19
5	5.91	5.00	5.68	5.84	2.58	5.750	5.75	7.12
6	6.91	6.00	6.66	6.82	2.58	6.750	5.75	8.18
8	9.05	8.00	8.80	8.96	2.97	8.890	6.50	10.50
10	11.14	10.00	10.89	11.05	3.07	11.000	6.75	12.75
12	13.24	12.00	12.99	13.15	3.07	13.100	7.00	15.00
14	15.32	14.00	15.07	15.23	3.63	15.190	7.50	17.15
15	16.45	15.00	16.11	16.38	4.31	16.225	8.50	18.26
16	17.48	16.00	17.15	17.31	3.63	17.270	7.50	19.31
18	19.60	18.00	19.23	19.39	4.38	19.410	10.00	21.52
20	21.66	20.00	21.29	21.45	4.38	21.470	10.00	23.76
21	22.74	21.00	22.37	22.64	5.27	22.500	10.50	24.96
24	26.00	24.00	25.51	25.67	4.38	25.690	10.00	28.22
TYPE 75								
3	3.99	3.00	3.74	3.90	2.60	3.850	6.25	5.35
4	5.05	4.00	4.70	4.86	2.55	4.790	6.00	6.19
5	5.91	5.00	5.68	5.84	2.58	5.750	5.75	7.12
6	6.91	6.00	6.66	6.82	2.58	6.750	5.75	8.18
8	9.05	8.00	8.80	8.96	2.97	8.890	6.50	10.50
10	11.14	10.00	10.89	11.05	3.07	11.000	6.75	12.75
12	13.24	12.00	12.99	13.15	3.07	13.100	7.00	15.00
14	15.32	14.00	15.07	15.23	3.63	15.190	7.50	17.15
15	16.45	15.00	16.11	16.38	4.31	16.225	8.50	18.26
16	17.48	16.00	17.15	17.31	3.63	17.270	7.50	19.31
18	19.60	18.00	19.23	19.39	4.38	19.410	10.00	21.52
20	21.66	20.00	21.29	21.45	4.38	21.470	10.00	23.76
21	22.74	21.00	22.37	22.64	5.27	22.500	10.50	24.96
24	26.00	24.00	25.51	25.67	4.38	25.690	10.00	28.22

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TOLERANCES	PIPE OD1 & OD2	COUPLING ID (B)
	3" – 16" ± 0.020"	3" – 16" ± .025"
	18" – 24" ± 0.030"	18" – 24" ± .040"

	PIPE					COUPLINGS		
PIPE SIZE	B.O.D. INCHES	I.D. INCHES	O.D.1 INCHES	O.D.2 INCHES	C ±1/16 INCHES	B(I.D.) INCHES	L +.25 −.00	B.O.D.
TYPE 125								
3	4.06	3.00	3.74	3.90	2.60	3.850	6.25	5.35
4	5.08	4.00	4.64	4.80	2.90	4.755	6.50	6.47
6	7.16	6.00	6.91	7.07	2.90	7.025	6.50	8.76
8	9.36	8.00	9.11	9.27	3.40	9.230	7.50	11.22
10	11.39	10.00	11.14	11.30	3.40	11.260	7.50	13.27
12	13.57	12.00	13.32	13.48	3.50	13.440	7.75	15.64
14	15.36	13.60	15.07	15.23	4.00	15.205	9.00	17.70
15	17.02	15.00	16.68	16.95	4.31	16.795	9.00	19.33
16	17.48	15.50	17.15	17.31	4.00	17.285	9.00	19.96
18	20.28	18.00	19.90	20.06	4.88	20.080	11.10	23.24
20	22.50	20.00	22.12	22.28	4.88	22.300	11.10	25.66
21	23.70	21.00	23.28	23.55	5.27	23.410	11.10	26.45
24	26.86	24.00	26.48	26.64	4.88	26.660	11.10	30.40

NOTE: All above dimensions are subject to manufacturing tolerances. The 15" and 21" coupling is of different design than shown.

DISTRICT OFFICES

ATLANTA PIPE DISTRICT
Suite 1132, Lenox Towers
3272 Peachtree Road, N. E.
Atlanta, Georgia 30326
Area Code 404 Telephone: 237-6331, 6332

CLEVELAND PIPE DISTRICT
Suite 110, One Commerce Park Square
23200 Chagrin Boulevard
(Beachwood)
Cleveland, Ohio 44122
Area Code 216 Telephone: 464-8060

DENVER PIPE DISTRICT
Suite 4G, Bankers Union Life Building
2401 E. Second Avenue
P. O. Box 6285
Denver, Colorado 80206
Area Code 303 Telephone: 388-5751

HOUSTON PIPE DISTRICT
Texas Gas Building Suite 275
2472 Bolsover Road
P. O. Box 25185
Houston, Texas 77005
Area Code 713 Telephone: JAckson 6-1037, 3717

LOS ANGELES PIPE DISTRICT
California Federal Savings Bldg., Suite 242
1695 Crescent Avenue
Anaheim, California 92801
Area Code 714 Telephone: 774-3900
From Los Angeles: 213-625-1915

Phoenix Branch Office
Suite 206
3625 No. 16th Street
Phoenix, Arizona 85016
Area Code 602 Telephone: 274-3642

PHILADELPHIA PIPE DISTRICT
Maple & Wissahickon Avenues
Ambler, Pennsylvania 19002
Area Code 215 Telephone: 646-9350

ST. LOUIS PIPE DISTRICT
Suite 110
12015 Manchester Road
(Des Peres)
St. Louis, Missouri 63131
Area Code 314 Telephone: YOrktown 6-3010

SAN FRANCISCO PIPE DISTRICT
Second Floor Marina Building
77 Jack London Square
Oakland, California 94607
Area Code 415 Telephone: 444-4022

PIPE DIVISION

CERTAINTEED

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CERTAIN-TEED PRODUCTS CORPORATION, Ambler, Pennsylvania 19002

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