



Designation: C1540 – 20

Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings¹

This standard is issued under the fixed designation C1540; 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 reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the evaluation of the performance of heavy-duty shielded couplings to join hubless cast iron soil pipe and fittings.

1.2 Couplings covered by this standard shall have nominal dimensions as found in [Table 1](#) and [Fig. 1](#).

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The following precautionary caveat pertains only to the test method portion, Section 7, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications](#)

[A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging](#)

[A644 Terminology Relating to Iron Castings](#)

¹ This specification is under the jurisdiction of ASTM Committee A04 on Iron Castings and is the direct responsibility of Subcommittee A04.75 on Gaskets and Coupling for Plumbing and Sewer Piping.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[A888 Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications](#)

[C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings](#)

[D3677 Test Methods for Rubber—Identification by Infrared Spectrophotometry](#)

2.2 CISPI Standards:³

[CISPI 301 Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications](#)

[CISPI 310 Specification for Couplings for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications](#)

2.3 Factory Mutual Standard:⁴

[FM 1680 Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater, or Storm Drain Systems Above and Below Ground, Industrial/Commercial and Residential](#)

3. Terminology

3.1 Definitions of the following terms used in this specification are found in Terminology [A644](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *center stop, n*—an integral part of the gasket centered on the axial length of the gasket, intended to limit the insertion depth of the pipe to be coupled.

3.2.2 *clamp assembly, n*—that portion of the coupling excluding the gasket.

3.2.3 *coupling, n*—the complete assembly.

3.2.4 *coupling manufacturer, n*—the entity that assembles the gasket with the clamp and shield assembly.

3.2.5 *fitting, n*—parts of a pipeline other than straight pipes, valves, or couplings.

3.2.6 *gasket, n*—the elastomeric portion of the coupling.

³ Available from Cast Iron Soil Pipe Institute (CISPI), 2401 Fieldcrest Dr., Mundelein, IL 60060, <http://www.cispi.org>.

⁴ Available from FM Approvals, P.O. Box 9102, Norwood, MA 02062. <http://www.fmglobal.com>.

TABLE 1 Coupling Width

Nominal Pipe Size	Nominal Coupling Width
1½ to 4 in. (38 to 100 mm)	3 in. (76 mm)
5 to 10 in. (127 to 254 mm)	4 in. (100 mm)
12 to 15 in. (305 to 381 mm)	5½ in. (140 mm)

3.2.7 *gasket manufacturer, n*—the entity that molds the gaskets inserted into the couplings covered by this standard specification.

3.2.8 *heavy-duty coupling, n*—a shielded coupling that has dimensions detailed in [Table 1](#) and [Fig. 1](#).

3.2.9 *joint, n*—the point of assembly consisting of the coupling and the joined pipes or fittings, or both.

3.2.10 *shield, n*—an external metallic protective device designed to protect the sealing gasket from external elements that could cause failure of the sealing assembly.

4. Materials and Manufacture

4.1 Physical and chemical properties of gaskets shall comply with Specification [C564](#) in accordance with Column “C” of [Table 1](#) of that document. Typical dimensions shall be in accordance with [Fig. 2](#) and [Table 2](#).

TABLE 2 Dimensional Tolerances for Gasket Sleeves

Size, in.	Fixed, ±	Closure, ± ^A
1½	0.020	0.050
2	0.020	0.050
3	0.020	0.050
4	0.020	0.050
5	0.025	0.055
6	0.025	0.055
8	0.030	0.063
10	0.030	0.063
12	0.035	0.063
15	0.035	0.063

^A Gasket closure tolerances shall be applied to the average of three (3) readings per coupling.

4.2 Clamp assembly screws or bolts shall not have screw-driver slots.

4.3 All stainless steel shall meet the physical requirements of Specification [A240/A240M](#).

5. Elastomeric Gasket Requirements

5.1 The gasket shall be tested in accordance with Test Methods [D3677](#) and be manufactured from a properly vulcanized virgin compound where the primary elastomer is poly-chloroprene (neoprene).

5.2 The elastomeric gasket shall consist of a one-piece construction conforming to the physical requirements of Specification [C564](#). The gaskets shall be tested by the gasket manufacturer for compliance to Specification [C564](#) a minimum of 24 h after production, but not longer than 72 h after time of production. These tests shall include hardness, elongation and tensile strength, tear strength, and compression set. Heat, aging, water absorption, ozone resistance, and oil immersion tests shall be conducted annually or when a formulation changes, or a supplier changes, whichever occurs first.

5.2.1 The elastomeric gasket shall have an inside center stop that does not create an enlargement chamber or recess with a ledge, shoulder, or reduction of pipe area or offer an obstruction to flow.

5.2.2 The elastomeric gasket shall be free of defects that affect the use and serviceability.

6. Clamp Assembly Requirements

6.1 The clamp assembly shall be made of material conforming to the requirements as outlined in Sections [4](#) and [6](#), [Table 3](#), and [Fig. 3](#).

6.1.1 All metallic parts shall be of 300 series stainless steel and shall conform to the requirements of Specification [A240/A240M](#). All metallic parts made from round stock shall be of 300 series stainless steel and shall conform to the requirements of Specification [A493](#) (excluding copper-bearing alloys).

6.1.2 Clamp assemblies shall be tested to withstand no less than 125 % of the manufacturer’s stated installation torque without visible signs of failure. The clamp assembly shall be tested over a steel mandrel of the appropriate diameter and torqued as required. These tests shall be performed on randomly selected samples during the course of production as needed, but not less than one clamp per shift per size during clamp assembly production.

7. Couplings Requirements and Test Methods

7.1 Assemble each coupling to be tested according to the manufacturer’s instructions between two sections of randomly selected hubless cast iron soil pipe meeting the requirements of CISPI 301 or Specification [A888](#) and conduct deflection and shear tests. In addition, unrestrained hydrostatic tests shall be performed as detailed in [7.2](#). The deflection and shear tests shall be performed on each size and type coupling utilizing first article approval as required, not to exceed 120 days. The unrestrained hydrostatic test shall be performed on randomly selected couplings of each size during the course of production using first article selection, not to exceed 30 days.

7.1.1 Deflection Test:

7.1.1.1 A test apparatus such as the one shown in [Fig. 4](#) is suggested. Other testing apparatus that provide restraint to the assembly shall also be permitted. Close the outboard ends of the pipe with test plugs.

7.1.1.2 Fill the assembly with water, expel all air, and hydrostatically pressurize to 8.6 psi (59.3 kPa) for the duration of the test. One pipe shall be rigidly supported and, while the assembly is under pressure, raise the opposite end of the other pipe 1 in. (25 mm) per lineal foot of pipe. Maintain the pressure for 15 min. Any leakage shall mean failure.

7.1.2 Shear Test:

7.1.2.1 Support two joined lengths of randomly selected hubless cast iron soil pipe on blocks, a minimum of 1½ in. (38.1 mm) high, at three locations. One length shall be a minimum of 24 in. (609.6 mm) in length, supported on blocks, one near the uncoupled end, and the other immediately adjacent to the couplings. Firmly restrain this length in position as shown in [Fig. 5](#). The other coupled length shall be a minimum of 5 ft (1.52 m) in length and supported by a single block 6 in. (152.4 mm) from the end of the pipe.

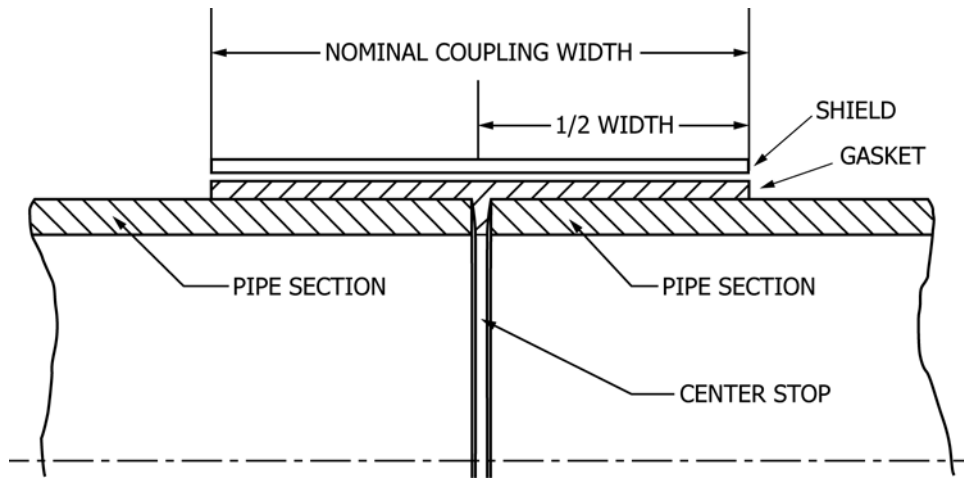
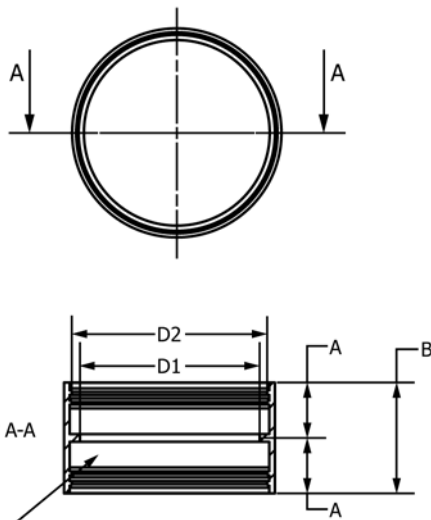


FIG. 1 Typical Center Stop Detail



MARKINGS SHALL BE BETWEEN SEALING BEADS AND CENTER STOP.
MARKINGS MAY BE ON BOTH SIDES OF CENTER STOP

	Dimensions										
	1 1/2 in.	2 in.	3 in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.	15 in.	
A	1.500	1.500	1.500	1.500	2.000	2.000	2.000	2.000	2.750	2.750	
B	3.000	3.000	3.000	3.000	4.000	4.000	4.000	4.000	5.500	5.500	
D1	1.531	1.968	2.968	3.968	4.968	5.968	7.968	9.975	12.000	15.200	
D2	1.937	2.343	3.343	4.343	5.343	6.343	8.343	10.350	12.430	15.650	

NOTE 1—The dimensions A and B found in the table are mandatory. Dimensions D1 and D2 found in the table are referenced only for mold design. Sealing ring shape and dimensions are to manufacturer’s design.

NOTE 2—Dimensional tolerances to be RMA Class 3 (see Table 2).

FIG. 2 Rubber Gasket

7.1.2.2 Fill the assembly with water and expel all air. Apply a load of 50 lb per in. (22.7 kg) of nominal diameter at a point 6 in. (152.4 mm) from the edge of the coupling upon a 12-in. (304.8-mm) length of 3 by 3-in. (76.2 by 76.2-mm) angle iron or load distribution pad located on the top of the pipe

TABLE 3 Material Specifications

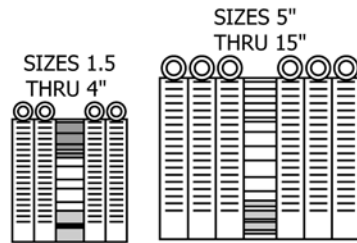
Band	Type 301 AISI stainless steel—minimum tensile 140 000 psi for 1½ to 15 in.; Type 304 AISI stainless steel is permitted.
	Type 304 AISI stainless steel—minimum tensile 140 000 psi
Eyelets/Rivets	Type 300 grade AISI stainless steel
Screw Housing	Type 301 AISI stainless steel for 1½ to 15 in.; Type 304 AISI stainless steel is permitted.
Screw	Type 305 AISI or Type 304L, or both, annealed stainless steel—manufacturers shall identify recommended installation torques for their couplings either on the couplings or within installation instructions.
Shield	Type 301 AISI or Type 304, or both, AISI stainless steel (annealed and pickled not acceptable)
	Hardness—Rockwell B-100 (Vickers 240) in accordance with A240/A240M max (max burr height not to exceed 25 % of thickness)
	Thickness—0.0065 in. min

immediately adjacent to the coupling of the pipe having one support only. Under this loading there shall be no visible leakage or displacement of more than 3/8 in. (9.53 mm) from true alignment adjacent to the coupling, when an internal pressure equivalent to a 20-ft (6.10-m) head of water 8.6 psi (59.3 kPa) is applied. Maintain the load and internal pressure for 15 min.

7.2 Unrestrained Hydrostatic Joint Test:

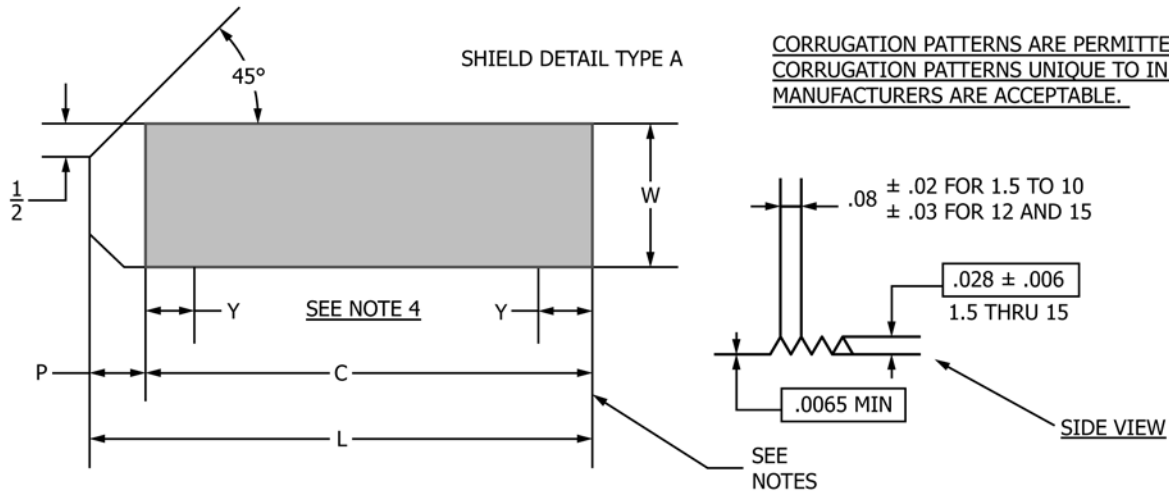
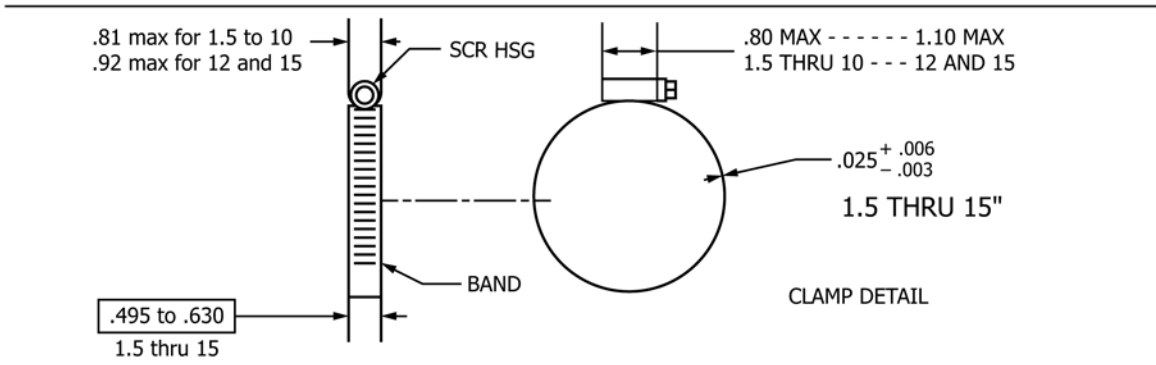
7.2.1 Assemble each coupling to be tested according to the manufacturer’s instruction between two sections of machined steel pipe and conduct the unrestrained hydrostatic joint test.

7.2.2 The assembly shall consist of a maximum outside diameter pipe connected to a minimum outside diameter pipe with diameters as referenced in Table 4 and lengths as shown



SHIELD AND CLAMP ASSEMBLY

MANUFACTURERS MAY HAVE DIFFERENT NUMBER OF CLAMPS BASED ON THEIR COUPLING DESIGNS



1. SINGLE CORRUGATIONS ARE SHOWN IN DRAWING SIDE VIEW. THE "P" DIMENSION MIGHT NOT APPLY TO ALL COUPLING DESIGNS.
2. THE "P" DIMENSION (IF APPLICABLE), IS PERMITTED ON EITHER END OF THE CORRUGATED SHIELD.
3. MEASURE CORRUGATION MATERIAL THICKNESS AND FORMED THICKNESS WITH CALIPERS OR DISC MICROMETER
4. ON CORRUGATED SHIELDS, TAPERING OF CORRUGATIONS IS ALLOWED AT EITHER END TO IMPROVE FUNCTIONALITY.

FIG. 3 Shield and Clamp Assembly

Pipe Size, In.	Dimensions, in.				
	P	C	L	W	Y
1½	0.813 ± 0.25	6.688 Ref.	7.37 min	3.000 ± 0.015	2.00 ref.
2	0.813 ± 0.25	8.188 Ref.	8.87 min	3.000 ± 0.015	2.50 ref.
3	0.813 ± 0.25	11.438 Ref.	12.12 min	3.000 ± 0.015	3.50 ref.
4	0.813 ± 0.25	14.813 Ref.	15.49 min	3.000 ± 0.015	4.50 ref.
5	2.375 ± 0.50	17.563 Ref.	19.69 min	4.000 ± 0.015	5.75 ref.
6	2.375 ± 0.50	20.250 Ref.	22.38 min	4.000 ± 0.015	6.75 ref.
8	3.000 ± 0.50	26.000 Ref.	28.75 min	4.000 ± 0.015	8.75 ref.
10	3.000 ± 0.50	33.250 Ref.	36.00 min	4.000 ± 0.015	10.9 ref.
12	3.500 ± 0.50	39.100 Ref.	42.30 min	5.500 ± 0.015	12.9 ref.
15	3.500 ± 0.50	49.200 Ref.	52.40 min	5.500 ± 0.015	16.12 ref.

NOTE 1—The “P” dimension is allowed on either end of the part. A “P” dimension is required on shield designs that have a single corrugated pattern. Shield material thickness and the corrugated or pattern height are to be measured with a caliper or a disc micrometer. The material thickness is 0.0065 min. Three random measurements of shield corrugated height should be taken and the median used as the value.

FIG. 3 Shield and Clamp Assembly (continued)

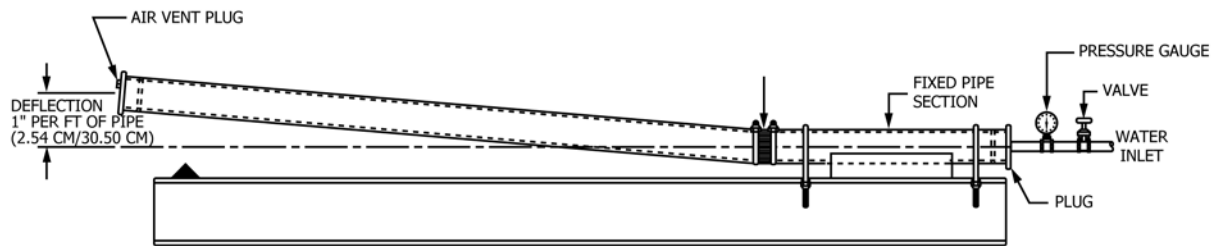


FIG. 4 Deflection Test

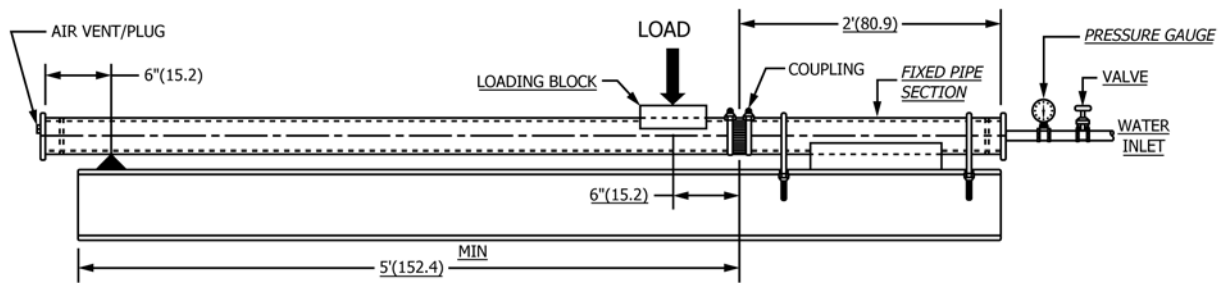


FIG. 5 Shear Test

TABLE 4 Dimensions and Tolerances for Hubless Pipe and Fittings

Size, in. (mm)	Outside Diameter, in. (mm)
1½ (38)	1.90 ± 0.06 (48.26 ± 1.52)
2 (51)	2.35 ± 0.09 (59.69 ± 2.29)
3 (76.2)	3.35 ± 0.09 (85.09 ± 2.29)
4 (102)	4.38+0.09/-0.05 (111.25+2.29/-1.27)
5 (127)	5.30+0.09/-0.05 (134.62+2.29/-1.27)
6 (152)	6.30+0.09/-0.05 (160.02+2.29/-1.27)
8 (203)	8.38 ± 0.09 (212.85 ± 2.29)
10 (254)	10.56 ± 0.09 (268.22 ± 2.29)
12 (305)	12.50 ± 0.13 (317.5 ± 3.30)
15 (380)	15.83 ± 0.13 (402.8 ± 3.30)

sleeve of the coupling being tested. The tool used to machine the grooves shall have a 60° included angle and cut into the pipe from a perpendicular position. The surface between the grooves shall be a lathe-turned surface of 125 RMS.

7.2.3 The plain ends of the pipe for the thrust test shall be uncoated and cleaned with acetone and thoroughly dried before each assembly.

7.2.4 Test Method:

7.2.4.1 Support the pipe assemblies in a manner that does not restrain joint movement as shown in Fig. 6.

7.2.4.2 Fill the pipe assembly (as required in 7.2) with water, expelling all air. Increase the hydrostatic pressure at a rate of 1 psi (6.9 kPa) every 30 s until the specified test pressure is reached. The specified test pressure shall be 30 psi (206.8 kPa) for 1½ in. (38.1 mm) through 5 in. (127 mm), 27 psi (186 kPa) for 6 in. (152.4 mm), 15 psi (103.4 kPa) for 8 in. (203.2 mm), 9 psi (62 kPa) for 10 in. (254 mm), and 6 psi (31.3 kPa) for 12 and 15 in. pipe. When the specified test

in Fig. 6. Machine the plain ends of the pipe to be used for the thrust test to the correct diameters. Plain ends shall have 0.015-in. (0.38-mm) deep grooves machined circumferentially around them at ¼-in. (3.18-mm) intervals down the pipe section for a distance equal to that covered by the elastomeric

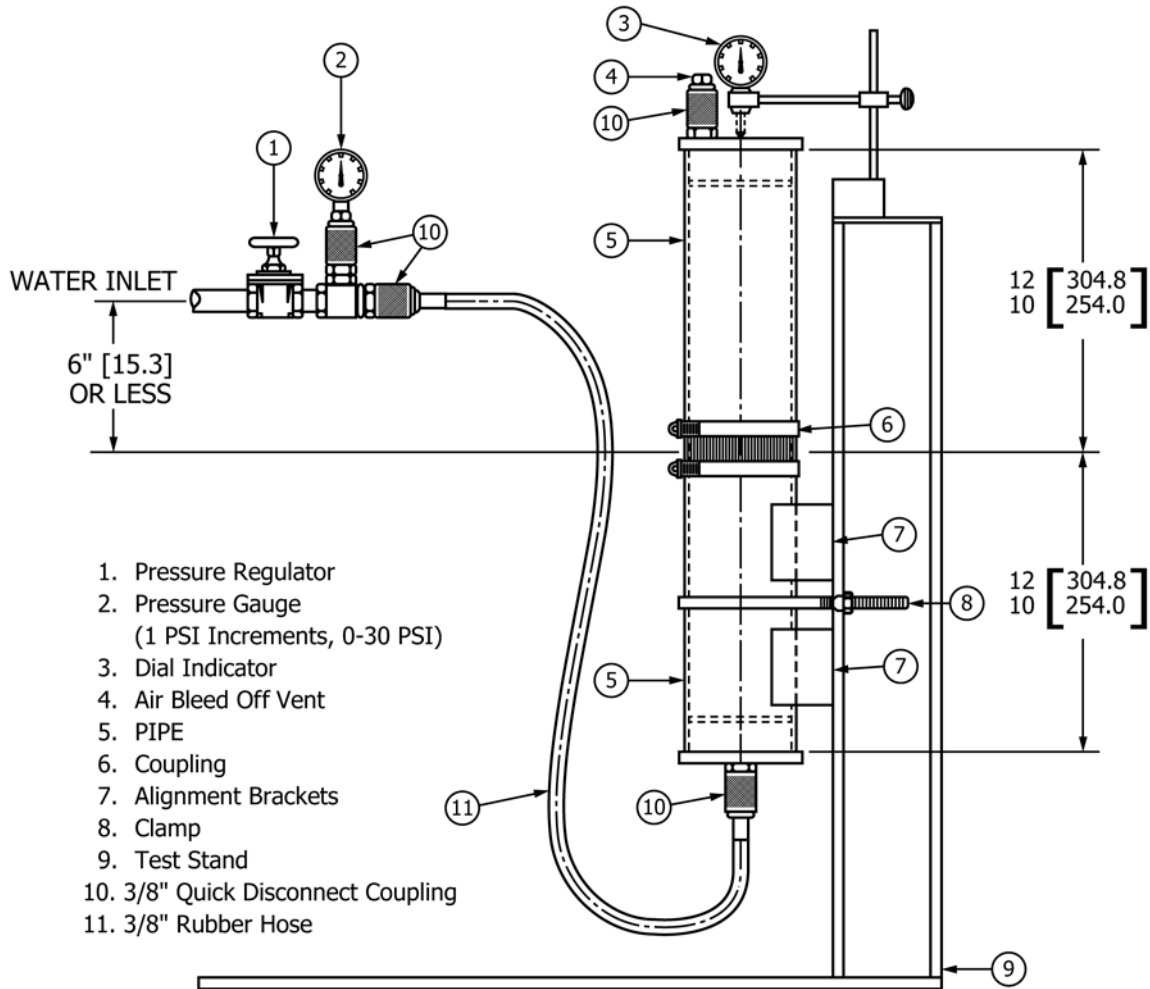


FIG. 6 Unrestrained Hydrostatic Joint Testing Apparatus

pressure is reached, hold it for 15 min. Any leakage or axial joint movement of more than 0.150 in. (3.81 mm) shall mean failure.

8. Markings and Identification

8.1 Permanently mark each clamp assembly or shield with the manufacturer’s name or U.S. registered trademark, country of origin, all stainless, and the pipe size for which it is designed. Marking shall be visible after installation.

8.2 Gasket markings shall conform to Specification C564.

8.3 The product shall also have any other markings required by law and shall have the option to include this designation (Specification C1540).

9. Certification

9.1 Upon request, the purchaser, design professional, or the administrative authority having jurisdiction where the products

are being installed shall be furnished certification by the manufacturer, stating samples representing each lot have been tested and inspected as indicated in this specification and the requirements have been met. If requested by the purchaser, design professional, or the administrative authority having jurisdiction where the products are being installed, certification shall be accompanied by test reports as prepared in accordance with Sections 4 – 7. Certification shall include the legal name and address of each manufacturer.

9.2 Third-party certifiers or inspectors shall utilize the procedures detailed in Annex A1 when conducting inspections at the manufacturing locations.

(Mandatory Information)

The following supplementary requirements shall be applied when the manufacturer or seller of the products covered by this specification utilizes third-party certification agencies as part of their certifications as detailed in Section 9.

A1. THIRD-PARTY CERTIFICATION OR INSPECTION

A1.1 Third-party certifiers or inspectors conducting regular inspections at the manufacturer's production facility shall include but not be limited to the following during each inspection.

A1.1.1 A review of the manufacturer's records to verify compliance with Sections 4 – 8. Copies of the manufacturer's test reports shall be added to the third-party certifier's inspection report.

A1.1.2 Random inspections of the manufacturer's finished goods inventory shall be conducted during each inspection. These inspections shall include a dimensional and marking inspection of not less than three of these pieces of different size couplings in inventory during each inspection. Each gasket used as part of a coupling shall be subject to the requirements of the applicable coupling standard.

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