Designation: C 1540 – 08

Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings[1]

This standard is issued under the fixed designation C 1540; 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 evaluating 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 minimum dimensions as found in Table 1 and Fig. 1 of this standard.

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 committee with jurisdiction over this standard is aware of comparable standards published by other organizations, namely Cast Iron Soil Pipe Institute specification CISPI 310 and Factory Mutual Research standard FM 1680.

1.5 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A 240/A 240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A 493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

A 644 Terminology Relating to Iron Castings

A 888 Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

C 564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

2.2 *CISPI Standards:*

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 coupling for use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications

FM 1680 Approval Standard Couplings used in Hubless Cast Iron Systems for Drain, Waste or Vent Systems above or below ground Industrial, Commercial, and Residential

TABLE 1

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

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions of the following terms used in this specification are found in Terminology A 644.

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

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

3.2.6 *heavy duty coupling*, *n*—a shielded coupling that has dimensions not less than those detailed in Table 1 and Fig. 1.

[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.

Current edition approved Oct. 1, 2008. Published November 2008. Originally approved in 2002. Last previous edition approved in 2004 as C 1540 – 04.

[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.

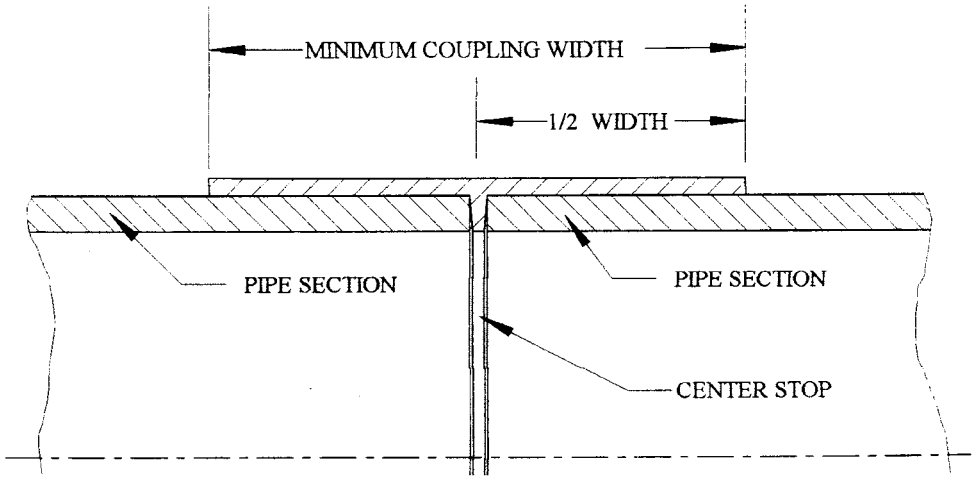

FIG. 1 Typical Center Stop Detail

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

3.2.8 *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 properties of gaskets shall comply with Specification C 564 using the applicable durometer hardness requirement of the column of Table 2 of that document as specified by the manufacturer.

4.2 Clamp assembly screws or bolts shall not have screwdriver slots.

4.3 All stainless steel shall meet the physical requirements of Specification A 240.

5. Elastomeric Gasket Requirements

5.1 The elastomeric gasket shall consist of one piece polychloroprene construction conforming to the physical requirements of Specification C 564.

5.1.1 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.

TABLE 2 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)	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 (134.63+2.29/-1.27)
6 (152)	6.30+0.09-0.05 (160.02+2.29/-1.27)
8 (203)	8.38+0.13-0.09 (212.85+3.30/-2.29)
10 (254)	10.56 ± 0.09 (268.22 ± 2.29)
12 (305)	12.50 ± 0.09 (317.5 ± 2.29)
15 (381)	15.83 ± 0.09 (402.08 ± 2.29)

5.1.2 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.

6.1.1 All metallic parts shall be of 300 series stainless steel and shall conform to the requirements of Specification A 240. All metallic parts made from round stock shall be of 300 series stainless steel and shall conform to the requirements of Specification A 493 (excluding copper bearing alloys).

6.1.2 Clamp assemblies shall be tested to withstand no less than 125 % of the manufacturers 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.

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 A 888 and conduct deflection and shear tests. In addition, unrestrained hydrostatic tests shall be performed as detailed in 7.2.

7.1.1 *Deflection Test*:

7.1.1.1 A test apparatus such as the one shown in Fig. 2 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.

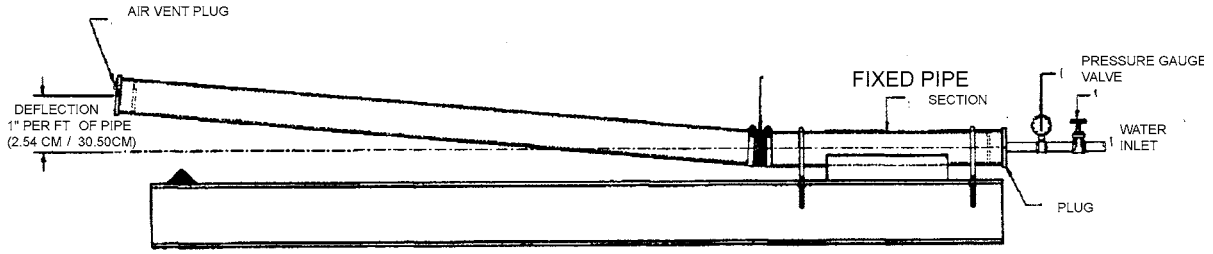

FIG. 2 Deflection Test

(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. 3. 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.

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 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 ⅜ 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 2 and lengths as shown in Fig. 4. 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 ⅛ in. (3.18 mm) intervals down the pipe section for a distance equal to that covered by the elastomeric 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. 4.

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 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 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 C 564.

8.3 The product shall also have any other markings required by law and shall have the option to include this designation (Specification C 1540).

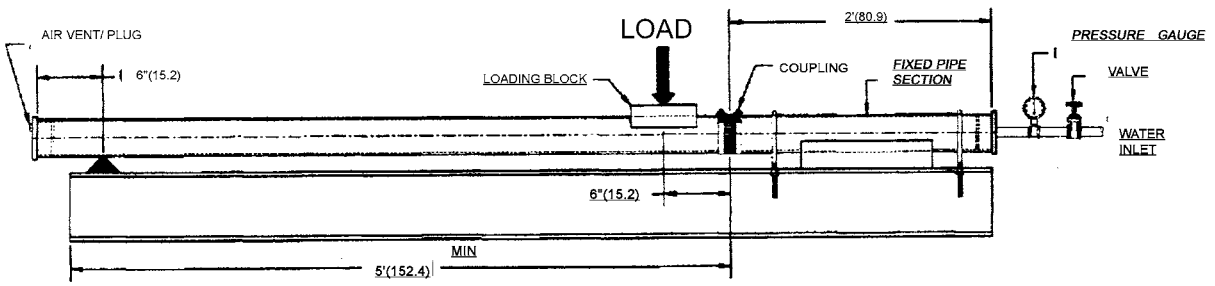

FIG. 3 Shear Test

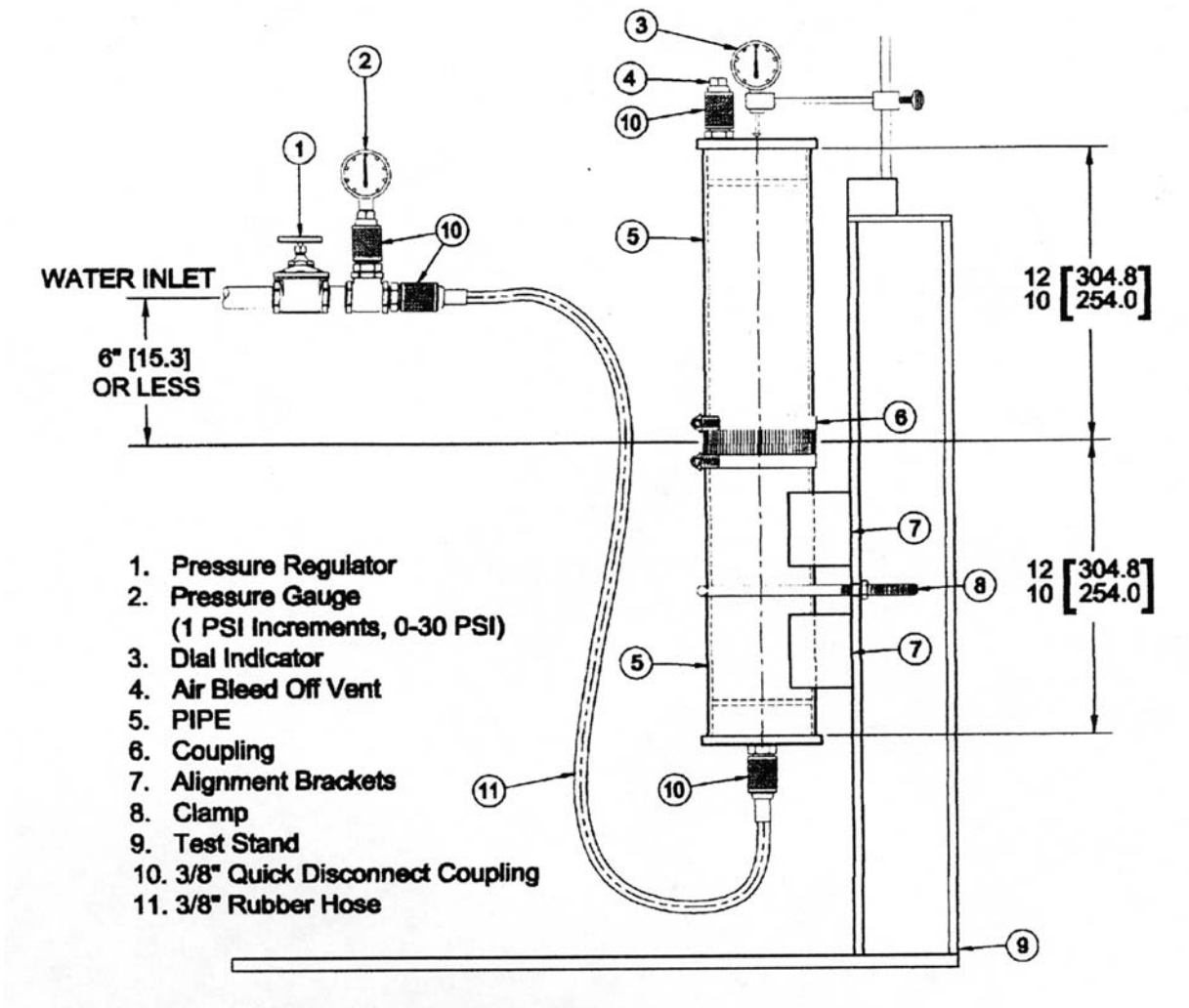

FIG. 4 Unrestrained Hydrostatic Joint Testing Apparatus

APPENDIX

(Nonmandatory Information)

X1. INSTALLATION PROCEDURES FOR HUBLESS CAST IRON SOIL PIPE AND FITTINGS FOR SANITARY AND STORM DRAIN, WASTE AND VENT PIPING APPLICATIONS

X1.1 Introduction

X1.1.1 Several different types of hubless couplings are available for use in hubless cast iron sanitary and storm drain, waste, and vent piping applications to connect hubless cast iron soil pipe and fittings by using a sleeve-type, or some other type coupling device. It is the purpose of this portion of C 1540 to furnish procedures as to the installation of couplings, which are manufactured in accordance with C 1540 when applied to cast iron soil pipe and fittings manufactured in accordance with CISPI Standard 301 and Specification A 888, latest revisions. It must be noted that these installation procedures are not intended to be applicable for couplings not made in accordance with C 1540.

X1.1.2 The installation procedures stated below are illustrative only and are not a mandatory portion of C 1540.

X1.2 Purposes

X1.2.1 These installation procedures provide guidelines for installation, use and inspection of hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications when the coupling device described in C 1540 is used.

X1.2.2 All construction projects involve many variables, hence it is not possible to state in advance every installation consideration which may apply in the field. In the end the final and controlling judgment decisions concerning installation

questions that arise must be made in the design and "on the job" taking into account prevailing circumstances or conditions. These procedures are not a substitute for such informed judgements and for manufacturer-provided installation instructions.

X1.2.3 Complete stability of all components of hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications should be given prime consideration.

X1.3 Methods of Cutting Cast Iron Soil Pipe

X1.3.1 There are several methods of successfully cutting cast iron soil pipe. These methods may be placed into two basic categories; those that require external power for their operation and those methods that require only hand operation. Methods that require external power are usually used for prefabrication work or high volume cutting operations. Examples of this type of equipment would be: *(1)* the abrasive saw (chop SAW), *(2)* power hack saw, and *(3)* an electrically actuated hydraulic snap cutter. Before using electrical equipment of this nature, the manufacturer's operating instructions should be carefully reviewed for safe use of the equipment.

X1.3.2 There are two hand operated cutting tools that are used in the industry today: *(1)* the standard steel pipe cutter using cutting wheels specifically designed to cut cast iron soil pipe, and *(2)* the snap cutter. The snap cutter accounts for the majority of all cuts made on cast iron soil pipe in the field. There are several types of snap cutter available, the following procedure has been found to produce consistently good cuts:

X1.3.2.1 After marking the pipe length to be cut, position the chain cutter squarely around the pipe to ensure a straight cut. The maximum number of wheels possible should be in contact with the pipe.

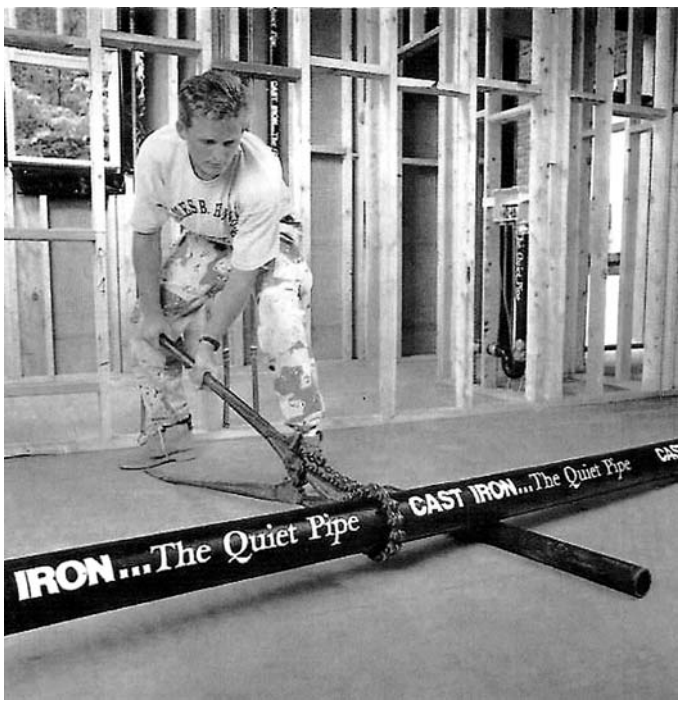

FIG. X1.1 Snap Cutter

X1.3.2.2 Score the pipe by applying pressure on the handles to make the cutter wheels indent the pipe.

X1.3.2.3 Rotate the pipe a few degrees and then apply quick final pressure to complete the cut. If a piece of pipe is unusually tough, score the pipe several times before making your final cut. Scoring the pipe before the actual cut is the key to a clean straight cut.

X1.3.3 Cast iron soil pipe may also be cut with a hammer and a cold chisel. This method of cutting is very time consuming and should only be used if snap cutters are not available. Again, protective equipment, such as safety goggles, should be used. The procedure for cutting soil pipe with a hammer and chisel are as follows:

X1.3.3.1 Measure the length to be cut and mark the cut line completely around the circumference of the pipe.

X1.3.3.2 Place the mark to be cut on a 2 by 4 so the edge of the 2 by 4 is directly under the mark.

X1.3.3.3 By striking the chisel with the hammer, cut a groove following your mark all the way around the circumference of the pipe.

X1.3.3.4 Continue cutting as outlined in X1.3.3.3 until the pipe is cut. This procedure may take several revolutions of the pipe before it is cut.

NOTE X1.1—Installers should be aware of safety considerations, including the need to use protective equipment, such as safety goggles, when cutting cast iron soil pipe.

X1.4 Definitions

X1.4.1 *alternately*—a change from one to another repeatedly.

X1.4.2 *coupling*—a mechanical device by which the ends of pipe or fittings are connected.

X1.4.3 *hanger*—a device by which or to which something is hung or hangs.

X1.4.4 *joint*—a place where two ends of pipe or fittings are connected.

X1.4.5 *restrain*—to limit, restrict or keep under control.

X1.4.6 *restraint*—a device that restricts movement.

X1.4.7 *seismic*—shock, earthquake, to shake.

X1.4.8 *support*—to hold up or to serve as a foundation or prop.

X1.4.9 *torque*—a force that produces or tends to produce rotation or torsion: A turning or twisting force.

X1.5 Clamp and Gasket Installation

X1.5.1 Hubless cast iron soil pipe is joined by using the hubless coupling. Several different types of hubless couplings are available. The following will outline the installation procedures of hubless couplings that meet the requirements of C 1540. It must be noted that these installation procedures are not intended to be applicable for couplings other than those manufactured in accordance with C 1540. Installation procedures from the manufacturer shall be followed for best performance. These couplings are manufactured using a stainless steel shield and clamp assembly and an elastomeric sealing sleeve conforming to the requirements of Specification C 564. The following steps should be taken to ensure a proper joint.

X1.5.1.1 Place the gasket on the end of one pipe or fitting and the stainless steel clamp and shield assembly on the end of the other pipe or fitting.

X1.5.1.2 Firmly seat the pipe or fitting ends against the integrally molded center stop inside the elastomeric sealing sleeve.

X1.5.1.3 Slide the stainless steel shield and clamp assembly into position centered over the gasket and tighten the bands. The bands should always be tightened using a properly calibrated torque wrench set at 80 lbf-in. or the specific torque required by the manufacturer of couplings, which require a higher torque.

X1.5.1.4 For couplings that have four bands, the following sequence should be tightened to 80 lbf-in.

(1) First tighten the inner bands alternately to 80 lbf-in.

(2) Next, tighten the outer bands alternately to 80 lbf-in.

X1.5.1.5 For couplings that have six bands, the following sequence should be tightened to 80 lbf-in.

(1) First tighten the innermost bands alternately to 80 lbf-in.

(2) Next, move outward to the next set of bands and tighten alternately to 80 lbf-in.

X1.5.1.6 Once the coupling is installed and torqued in this pattern, it is not necessary to go back and re-torque the coupling.

SUGGESTED INSTALLATION INSTRUCTIONS

X1.6 Underground Installation Procedures

X1.6.1 The physical properties of cast iron soil pipe make it a good choice for DWV (Drain, Waste and Vent) material for underground installation. The two keys for proper underground installation are trench preparation and backfilling.

X1.6.2 The trench should be wide enough to assemble the joints. Total load on the pipe includes both earth load and the truck load. For additional information refer to CISPI's "Trenching Recommendations for Cast Iron Soil Pipe" brochure or the CISPI handbook.[3]

NOTE X1.2—Safety procedures in trenching should be observed, including provisions to avoid collapse of the trench wall.

X1.6.3 The trench bottom should be stable enough to support the complete barrel of the pipe. If possible the barrel should rest on even and undisturbed soil. In certain conditions, that is, rocky, it becomes necessary to excavate deeper than needed, place and tamp back fill material to provide an appropriate bed. Holes should be provided at each joint for the hub or couplings to allow for continuous support of the barrel along the trench bottom. If the ditch must be excavated deeper than the depth of the drainage pipe, place and tamp backfill material to provide uniform support for the pipe barrel.

X1.6.4 Many times in the installation of underground soil pipe it is necessary to change the direction of the line. Cast iron soil pipe will allow this through deflection in the joints. Installation should initially be completed in a straight line and then deflected to the appropriate amount. Maximum deflections should not exceed 1 in. per foot of pipe. This would allow 10 in. of deflection for a 10-ft piece of soil pipe and 5 in. for 5-ft pipe. For changes in direction greater than these deflections an appropriate fitting should be used.

X1.6.5 Once installation (for joining methods refer to X1.5) is completed, the underground section is ready for test. Because this portion of the system is usually the largest diameter pipe it may be necessary to restrain the system or joints from movement prior to testing. This may be done by partially backfilling and leaving the joints exposed for inspection, or rodding or bracing, or both.

X1.6.6 After testing is completed, the trench can be properly backfilled. When backfilling, care should be taken to protect the pipe from large rocks, stones, or frozen fill material etc., that could damage the pipe. Cast iron soil pipe laid on a solid trench bottom requires no tedious placement of selected backfill materials.

X1.6.7 Installers should always consider local conditions, codes, manufacturer instructions, and architect/engineer instructions in any installation.

X1.7 Aboveground Installation Procedures

X1.7.1 With attention to a few basic rules the installation of cast iron soil pipe and fittings is easily accomplished.

X1.7.1.1 Cast iron soil pipe installed in the horizontal position shall be supported at every coupling. The hanger shall be placed within 18 in. of the coupling. Joints used for connecting cast iron soil pipe possess sufficient shear strength to require one hanger per joint. For 12 in. and 15 in. hubless pipe, hangers shall be placed on both sides of the coupling when installing full 10-ft lengths.

X1.7.1.2 Installations requiring multiple joints within a 4-ft developed length shall be supported at every other or alternating couplings. Vertical components shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the pipe and its contents. Riser clamps, sometimes called floor or friction clamps are required for vertical piping in multi-story structures in order for each floor not to exceed 15 ft.

X1.7.2 *Large Diameter Fittings*:

X1.7.2.1 Horizontal pipe and fittings five (5) in. and larger shall be suitably braced to prevent horizontal movement. This shall be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement. Closet bends, traps, trap-arms and similar branches must be secured against movement in any direction.

X1.7.2.2 Closet bends installed above ground shall be stabilized by firmly strapping and blocking. Where vertical

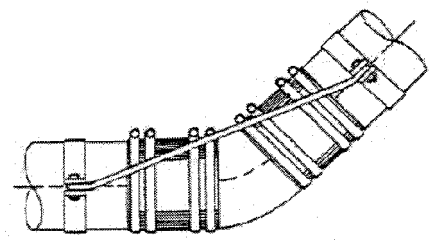

FIG. X1.2 Thrust Restraint

[3] 2002, Available from Cast Iron Soil Pipe Institute (CISPI), 5959 Shallowford Rd., Suite 419, Chattanooga, TN 37421, http://www.cispi.org.

closet stubs are used they must be stabilized against horizontal or vertical movements.

X1.8 General Installation Instructions

X1.8.1 *Vertical Piping*:

X1.8.1.1 Secure vertical piping at sufficiently close intervals to keep the pipe in alignment and to support the weight of the pipe and its contents. Support stacks at their bases and at sufficient floor intervals to meet the requirements of local codes. Approved metal clamps or hangers should be used for this purpose.

X1.8.1.2 If vertical piping is to stand free of any support or if no structural element is available for support and stability during construction, secure the piping in its proper position by means of adequate stakes or braces fastened to the pipe.

X1.8.2 *Horizontal Piping, Suspended*:

X1.8.2.1 Support horizontal piping and fittings at sufficiently close intervals to maintain alignment and prevent sagging or grade reversal. Support each length of pipe by an approved hanger located not more than 18 in. from the joint. For 12 in. and 15 in. hubless pipe, hangers shall be placed on both sides of the coupling when installing full 10-ft lengths.

X1.8.2.2 Support terminal ends of all horizontal runs or branches and each change of direction or alignment with an approved hanger.

X1.8.2.3 Closet bends installed above ground should be firmly secured.

X1.8.3 *Horizontal Piping, Underground*:

X1.8.3.1 To maintain proper alignment during backfilling, stabilize the pipe in proper position by partial backfilling and cradling.

X1.8.3.2 Piping laid on grade should be adequately secured to prevent misalignment when the slab is poured.

X1.8.3.3 Closet bends installed under slabs should be adequately secured.

X1.8.4 *Installation Inside the Building*:

X1.8.4.1 *Installation Suggestions*—According to most authorities and plumbing codes, it is sufficient to support horizontal pipe at each joint, that is, 5-ft pipe should be supported at 5-ft intervals, 10-ft in length may be supported at 10-ft intervals. Supports should be adequate to maintain alignment and prevent sagging and should be placed within eighteen inches of the joint.

NOTE X1.3—For 12 in. and 15 in. hubless pipe, hangers shall be placed on both sides of the coupling when installing full 10-ft lengths.

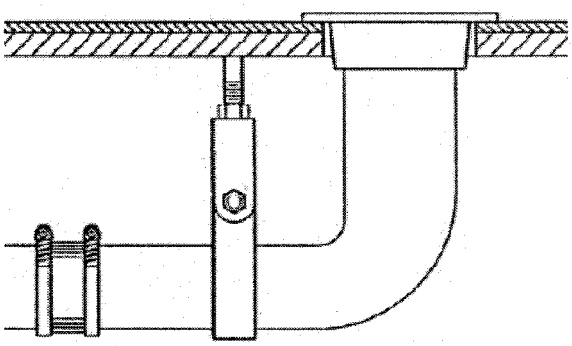

FIG. X1.3 Support of Closet Bend

X1.8.4.2 When the system is filled with water, sufficient beam strength is provided by cast iron soil pipe to carry the load with hangers every ten feet. Any of the horizontal supports or clamps illustrated in Figs. X1.5 and X1.6 may be used, depending on conditions or what is regarded as essential by the contractor, architect or engineer. Whatever method of support or clamp is used for the horizontal line, care should be exercised to make certain that the line has a proper grade (¼ in. or more per foot).

X1.8.4.3 Hangers may be fastened to wood members or beams with wood screws, lag screws or large nails. For fastening to "I" beams, bar joists, junior beams or other structural members, beam clamps or "C" clamps may be used. Fasteners for masonry walls may be expansion bolts or screws, or where a void is present, the toggle bolt may be used. Studs shot into the masonry by the explosion method may also be used. Along a wall, a bracket made of structural members or a cast bracket may be used.

X1.8.4.4 Adequate provision should be made to prevent "shear." Where components are suspended in excess of eighteen (18) in. by means of non-rigid hangers they should be suitably braced against movement horizontally, often called sway bracing. Examples of sway bracing are illustrated in Figs. X1.7 and X1.8.

X1.8.5 *Horizontal Installation of Large Diameter Pipe*:

X1.8.5.1 Horizontal pipe and fittings five (5) in. and larger must be suitably braced to prevent horizontal movement. This must be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement or joint separation. Fig. X1.9 illustrates several methods of bracing.

X1.8.6 *Suggested Installation of Horizontal Fittings*:

X1.8.6.1 Hangers should be provided as necessary to provide alignment and grade. Hangers should be provided at each horizontal branch connection. Hangers should be adequate to maintain alignment and prevent sagging and should be placed adjacent to the coupling. By placing the hangers properly, the proper grade will be maintained. Adequate provision should be made to prevent shear. Where pipe and fittings are suspended in excess of 18 in.by means of non-rigid hangers they should be suitably braced against movement horizontally, often called sway bracing. Refer to Figs. X1.7 and X1.8 for illustrations.

X1.8.6.2 Closet bends, traps, trap-arms and similar branches must be firmly secured against movement in any direction. Closet bends installed above ground should be stabilized. Where vertical closet studs are used they must be stabilized against horizontal or vertical movement. In Figs. X1.10 and X1.11, see illustration for strapping a closet bend under a sub-floor and how a clevis type hanger has been used to an advantage.

X1.8.6.3 When a hubless blind plug is used for a required cleanout, the complete coupling and plug must be accessible for removal and replacement.

X1.8.6.4 The connection of closet rings, floor and shower drains and similar "slip-over" fittings and the connection of hubless pipe and fittings to soil pipe hubs may be accomplished by the use of caulked lead and oakum or compression joints.

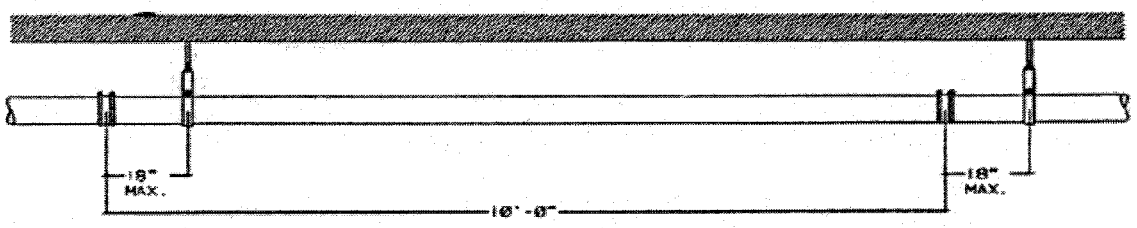

FIG. X1.4 Horizontal Support of Pipe with Placement of Hangers Relative to Couplings

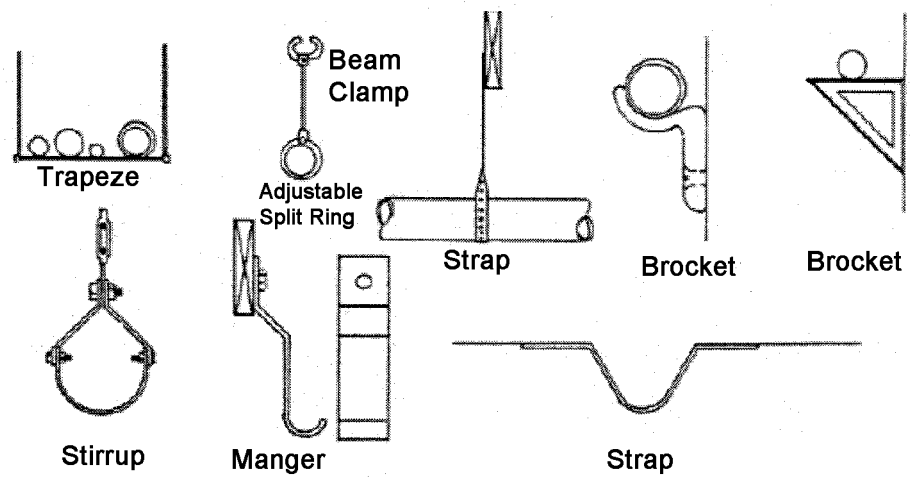

FIG. X1.5 Horizontal Pipe Supports

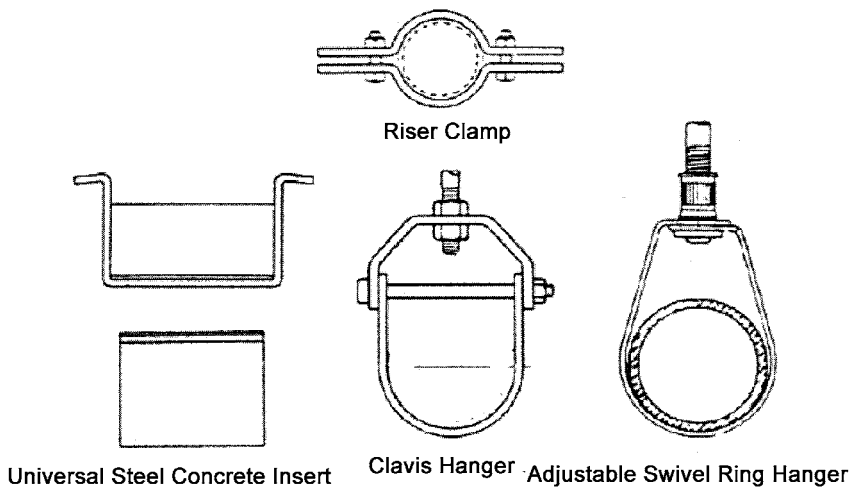

FIG. X1.6 Horizontal Pipe Supports (cont'd)

X1.8.7 *Seismic Restraints*:

X1.8.7.1 The following recommendations are some of the factors to consider when installing cast iron pipe in seismically active areas. All installations must comply with local codes and instructions of architects or engineers who are responsible for the piping design.

(1) Brace all pipe 2 in. and larger.

(a) Exceptions: Seismic braces may be omitted when the top of the pipe is suspended 12 in. or less from the supporting structure member and the pipe is suspended by an individual hanger.

(2) Vertical Piping Attachment—Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Stacks

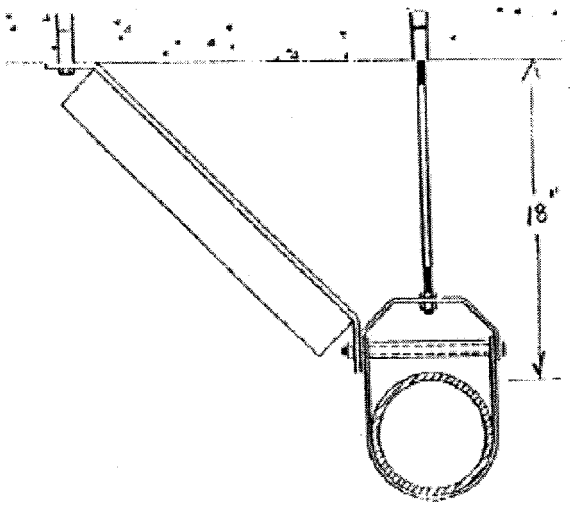

FIG. X1.7 Horizontal Pipe with Sway Brace

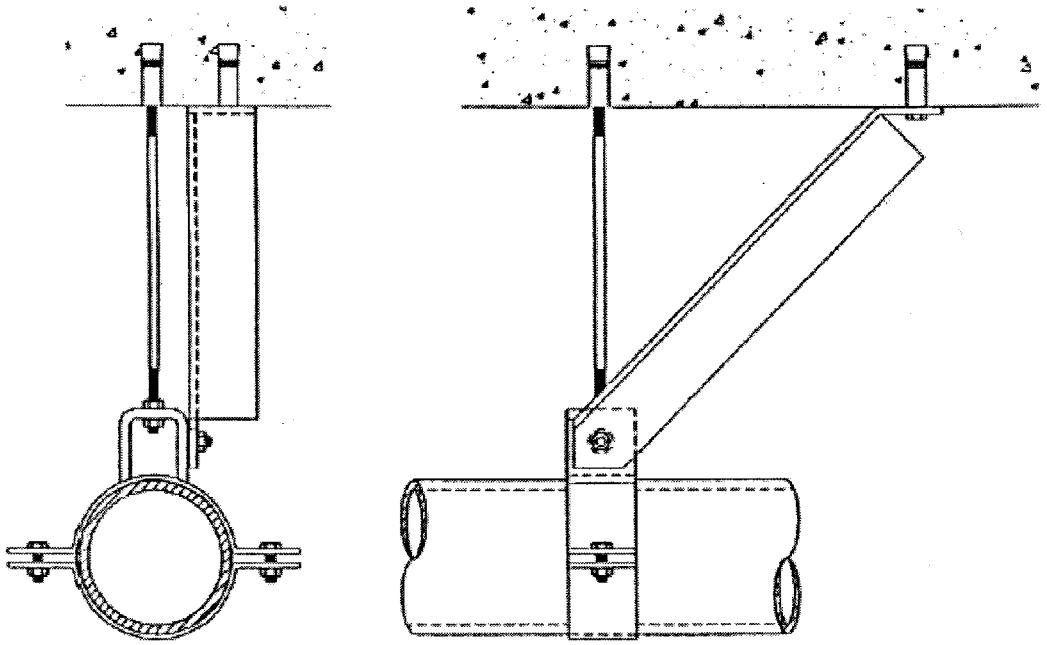

FIG. X1.8 Sway Brace

shall be supported at their bases and if over two stories in height at each floor by approved floor clamps. At vertical pipe risers, whenever possible, support the weight of the riser at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 30 ft-0 in. on center.

(3) Horizontal Piping Supports—Horizontal piping shall be supported at sufficiently close intervals to prevent sagging. Trapeze hangers may be used. Pipe, where top of the pipe is 12 in. or more from supporting structure, shall be braced on each side of a change of direction of 90° or more.

(4) Traverse Bracing—40 ft-0 in. o.c. maximum spacing unless otherwise noted. One pipe section may act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed with 24 in. of the elbow or tee of similar size.

(5) Longitudinal Bracing—80 ft-0 in. o.c. maximum spacing unless otherwise noted.

(6) Miscellaneous—Provide large enough pipe sleeves through walls or floors to allow for anticipated differential movements.

X1.8.7.2 Where multiple shield and clamp joints occur in a closely spaced assembly (that is, fitting fitting-fitting, etc.) a 16 gauge half sleeve may be installed under the assembly with a pipe hanger at each end of the sleeve.

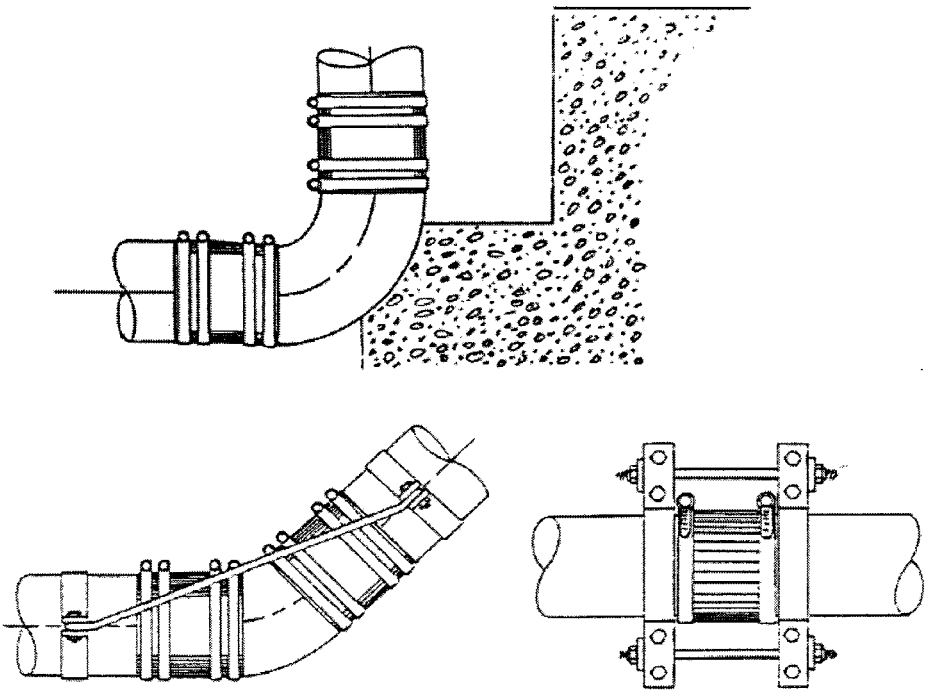

FIG. X1.9 Large Diameter Pipe

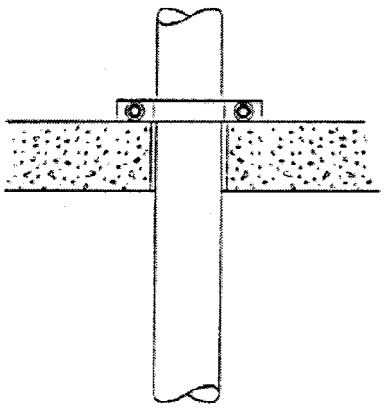

FIG. X1.10 Vertical Support using as Riser Clamp

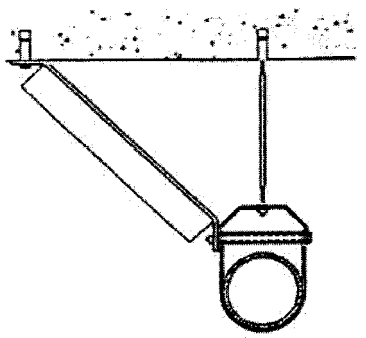

FIG. X1.11 Sway Bracing

NOTE X1.4—Seismic braces may be installed at either hanger; braces at both hangers are not required.

X1.8.8 *Vertical Piping*:

X1.8.8.1 Vertical components should be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents. Floor clamps, sometimes called friction clamps, are required for vertical piping in multi-story structures in order for each floor to carry its share of the load. Fig. X1.10 shows a method of clamping the pipe at each floor, using a friction or floor clamp.

X1.8.8.2 If vertical piping is to stand free of any support or if no structural element is available for support and stability during construction, secure the piping in its proper position by means of adequate metal stakes or braces fastened to the pipe.

X1.9 Testing and Inspection

X1.9.1 Once the roughing in is completed on a cast iron piping project, it is important to test and inspect all piping for leaks. The installer usually is required to notify the plumbing inspector of the administrative authority having jurisdiction over plumbing work before the tests are made. Concealed work should remain uncovered until the required tests are made and approved. When testing, the system should be properly restrained at all bends, changes of direction, and ends of runs.

X1.9.2 There are various types of tests used for the installed cast iron soil pipe and fittings. These are water or hydrostatic, air, smoke and peppermint. Proper safety procedures and protective equipment should be employed during all testing procedures. Installers should always consider local conditions, codes, manufacturer installation instructions, and architect/engineer instructions in any installation. A water test, also called a hydrostatic test, is made of all parts of the drainage

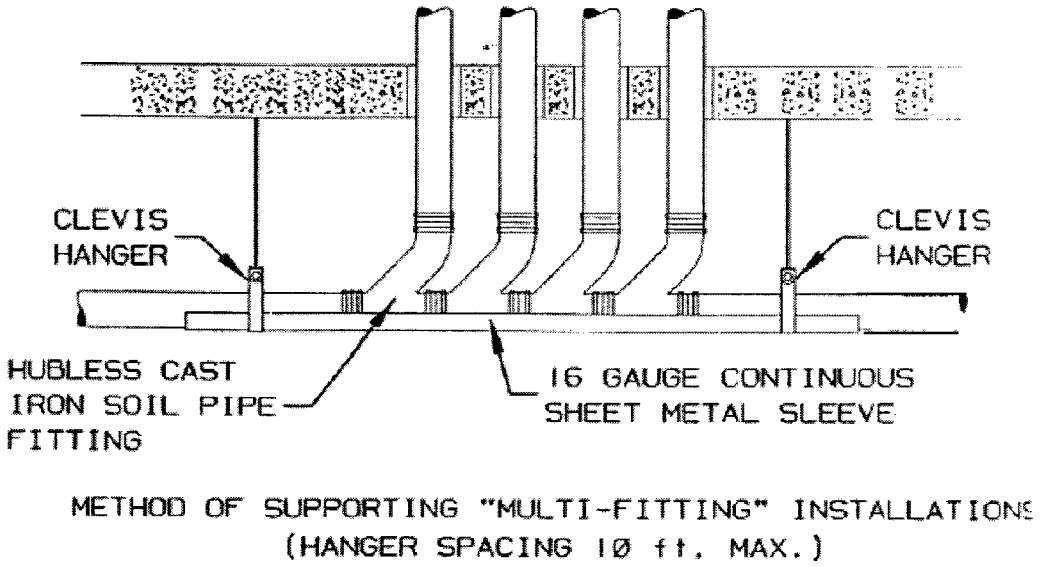

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FIG. X1.12 For Seismic Bracing Only—Method of Supporting "Multi-fitting" Installations (Hanger Spacing 10 ft, max)

system before the pipe is concealed or fixtures are in place. This test is the most representative of operating conditions of the system. Tests of this type may be made in sections on large projects. After all air is expelled, all parts of the system are subjected to 10 ft of hydrostatic pressure (4.3 psi) and checked for leaks.

X1.9.3 *Test Procedures—Water Test*:

X1.9.3.1 A water or hydrostatic test is the most common of all tests used to inspect a completed cast iron soil pipe installation. The purpose of the test is to locate any leaks at the joints and correct these prior to putting the system in service. Since it is important to be able to visually inspect the joints, water tests should be conducted prior to the "closing in" of the piping or back fill of the underground piping.

X1.9.3.2 As water fills a vertical cylinder or vertical pipe it creates hydrostatic pressure. The pressure increases as the height of water in the vertical pipe increases. The Cast Iron Soil Pipe Institute recommends 10 ft of hydrostatic pressure (4.3 psi). Table X1.1provides thrust and hydrostatic pressures for various sizes of pipe.

X1.9.3.3 Prior to the beginning of the test, all bends, changes of direction and ends of runs should be properly restrained. During the test, thrust forces are exerted at these locations. Thrust is equal to the hydrostatic pressure multiplied by area. Thrust pressures, if not restrained, will result in joint movement or separation causing failure of the test. All air entrapped in the system should be expelled prior to beginning the tests.

X1.9.3.4 Once the stack is filled to ten feet, an inspector makes a visual inspection of the section being tested to check for joint leaks. In most cases, where these leaks are found, hubless couplings have not been torqued to the recommended 80 lbf-in. or for couplings requiring higher torque improper torquing occurred. Proper torquing will correct the problem.

TABLE X1.1 Thrust or Displacement Forces Encountered in Hydrostatic Testing of Hubless Cast Iron Soil Pipe[A]

Pipe Size, in.		1½	2	3	4	5	6	8	10	12	15
HEAD, feet of water	Pressure, psi	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb	Thrust, lb
10	4.3	12	19	38	65	95	134	237	377	538	847
20	8.7	25	38	77	131	192	271	480	762	1088	1714
30	13.0	37	56	115	196	287	405	717	1139	1626	2562
40	17.3	49	75	152	261	382	539	954	1515	2164	3409
50	21.7	62	94	191	327	479	676	1197	1900	2714	4276
60	26.0	74	113	229	392	574	810	1434	2277	3252	5124
70	30.3	86	132	267	457	668	944	1671	2654	3790	5971
80	34.7	99	151	306	523	765	1082	1914	3039	4340	6838
90	39.0	111	169	344	588	860	1216	2151	3416	4878	7685
100	43.4	123	188	382	654	957	1353	2394	3801	5429	8552
110	47.7	135	208	420	719	1052	1487	2631	4178	5967	9400
120	52.0	147	226	458	784	1147	1621	2868	4554	6505	10247
Area, OD in.^{2}		2.84	4.34	8.81	15.07	22.06	31.17	55.15	87.58	125.09	197.06

[A]Thrust = Pressure × Area.

X1.9.3.5 Fifteen minutes is a suitable time for the water test. Once the system has been successfully tested it should be drained and the next section should be prepared for test.