



Standard Guide for Selection and Use of Full-Encirclement-Type Band Clamps for Reinforcement or Repair of Punctures or Holes in Polyethylene Gas Pressure Pipe¹

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1. Scope

1.1 This guide specifically addresses the design and installation of full-encirclement-type band clamps for repair of gouges, punctures, or holes, and for reinforcement of polyethylene plastic pipe. Guidelines are provided for selecting and using clamps in pipe sizes 2 in. nominal (60 mm) and larger.

1.1.1 A test method is also provided for the user to assess the applicability of the repair clamp. Under appropriate circumstances, this type of clamp offers a convenient, effective, and safe means of restoring the integrity of an in-service pipeline, without cutting out a section of pipe (see [Note 1](#)). The pipe to be repaired cannot be backed by a stiffener for internal support and cross-sectional dimensional control. Satisfactory use of this type of clamp must rely on the crush resistance of the pipe itself and a fitting design concept, which retains the cross-sectional pipe configuration while minimizing compressive forces required to obtain an effective leakage seal.

NOTE 1—The appropriateness for use of this type of clamp should be determined by using the information contained in this guide and from consultation with, and recommendations of, both the pipe and clamp manufacturers. The basic premise for use of this type of clamp is that it is recommended by the manufacturer for this specific application and that step-by-step installation instructions are available for that application. It is important in the development of this type of clamp that prototype testing be conducted to evaluate performance expectations because of the physical limitations encountered when designing it for use with plastic pipe.

1.2 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.

1.3 *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.*

¹ This guide is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.60 on Gas.

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2. Referenced Documents

2.1 *ASTM Standards*:²

F1041 Guide for Squeeze-Off of Polyolefin Gas Pressure Pipe and Tubing

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *creep*—the time-dependent part of strain resulting from stress, that is, dimensional change caused by the application of load over and above the elastic deformation and with respect to time.

4. Significance and Use

4.1 Full-encirclement-type band clamps are recommended for repairs only where the pipe is able to maintain its structural integrity. These clamps are not recommended for permanent repair of pipe where the damage could propagate outside the clamp under anticipated field conditions (see [5.1.1](#) for repair limitations). In such situations, cut out and replace the damaged pipe with a new piece.

4.2 These clamps may be used to cover holes left in the pipe from abandoned service line connections, purge points, and accidental punctures.

4.3 These clamps may be used to reinforce the pipe where the wall thickness has been reduced because of gouges or other irregularities.

4.4 Some users reinforce polyethylene pipe after it has been squeezed-off as a precaution against pipe damage that may have occurred during the squeeze-off process and as a means of ensuring that the pipe will not be squeezed-off again at the same location. Consult with the polyethylene pipe manufacturer as to the appropriateness of squeeze-off for their product, and for circumstances when reinforcement is recommended. See Guide [F1041](#).

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.

5. General Considerations

5.1 The following general considerations apply to determine the appropriateness of using full-encirclement-type band clamps:

5.1.1 *Type or Extent of Failure*—Consider repairs only to a clean-cut round hole or deep scratches or gouges of maximum dimension, less than the nominal diameter of the pipe divided by three. Do not repair pipe with cracks, jagged punctures, long tears, or deep scratches or gouges which could propagate outside the clamp under anticipated field loads. Cut out and replace the damaged pipe with a new piece.

5.1.2 *Pipe/Clamp Profile*—This type of clamp is usually made from flexible materials which have minimal ring stiffness. The clamp, by design, must rely on the pipe itself for an assembled profile and resistance to deformation from secondary loading.

5.1.3 *Creep Properties of Pipe Material*—Creep properties affect both the pipe strength and its dimensional change. As resistance to creep increases, stiffness increases and dimensional change decreases.

5.1.4 *Minimum Pipe Size*—Normally full-encirclement-type band clamps have a minimum pipe size limitation due to the basic design characteristics and the need to develop minimum sealing pressures against the pipe. The pipe must also be strong enough to resist anticipated secondary loading.

5.1.5 *Pipe Dimension Ratio (DR)*—The DR is determined by dividing the specified average outside diameter of the pipe by the minimum specified wall thickness. A lower DR provides greater resistance to pipe deformation and creep.

5.1.6 *In-service Internal Pressure*—Higher pressures tend to internally support the existing pipe dimensions and round profile.

5.1.7 *In-service Operating Temperature*—Increased temperatures lower pipe stiffness and creep resistance.

6. Design Recommendations

6.1 Properly designed full-encirclement-type band clamps should meet the following recommendations:

6.1.1 Maximum allowable operating pressure (MAOP) of 100 psig (689 kPa).

6.1.2 Maximum and minimum allowable operating temperature limits are provided by the manufacturer.

6.1.3 All components of the clamp are made from corrosion-resistant material, such as stainless steel, fiber-reinforced composite, or other plastic approved for use on buried polyethylene gas piping.

6.1.4 The clamp is designed and made of material which does not cause the pipe profile (ring) to assume a different shape after being installed.

6.1.5 The clamp materials have sufficient long-term strength to last as long as the expected life of the pipe being clamped.

6.1.6 The clamp, including the gasket, encircles the pipe and provides 360° reinforcement of the pipe.

6.1.7 The gasket material is suitable for the intended service and of such hardness that significant compression of the pipe is not required to maintain a seal.

6.1.8 The interface between the clamp and gasket material maintains the position of the gasket within the band configuration.

6.1.9 The dimensions of the clamp compensate for expected circumferential compression of the pipe, thereby ensuring a pressure seal when the pipe is in the contracted position.

7. Installation Recommendations

7.1 Refer to the general considerations stated in Section 5 of this guide to determine the appropriateness of using full-encirclement-type band clamps to repair plastic pipe.

7.2 Select a clamp with a length at least 1½ times the nominal diameter of the pipe, but not less than 9 in. (229 mm) long.

7.3 Use on pipe which is clean and free of any irregularities that affect its profile.

7.4 Center the clamp over the area to be repaired.

7.5 Install the clamp in accordance with the clamp manufacturer's recommended procedures.

7.6 Leak test the repaired area using an appropriate leak detector to validate the repair.

8. Test Method

8.1 This test is recommended as a means for the user to assess the applicability of a candidate repair clamp for use with polyethylene gas pipe. The user may also wish to perform additional tests (that is, pipe deflection), relevant to the specific intended use.

NOTE 2—The manufacturer is responsible for selecting a test appropriate to the intended applications for its product. Repair limitations, installation requirements, and performance expectations should be made available to users by the manufacturer.

NOTE 3—It is not intended that this or any other user test be the only test method used for product qualification.

8.2 Select a pipe specimen with a hole size slightly less than the nominal diameter of the pipe divided by 3 (that is, 3 in. nominal (89 mm) SDR 11.0 pipe with 1.125-in. (26.6-mm) hole); and of sufficient length to extend at least 12 in. (305 mm) beyond both ends of the clamp being tested.

8.3 Select a clamp as specified in 7.2, and center it over the area to be tested.

8.4 Install the clamp following the pipe and clamp manufacturer's recommended installation procedures.

8.5 Provide suitable end closures for pressure testing.

8.6 Once installed, do not adjust the clamp or retorque bolts.

8.7 At 73°F (23°C), pressurize the specimen to 100 psig (689 kPa) with suitable test fluid and check for leakage. Reduce the pressure to 5 psig (34 kPa).

8.7.1 Condition the specimen for 24 h at the lowest operating temperature anticipated by the user. Check again for leakage. Allow the specimen to stabilize at room temperature for another 24 h and recheck for leakage.

8.7.2 Condition the specimen for 24 h at the highest operating temperature anticipated by the user. Check again for

leakage. Allow the specimen to stabilize at room temperature for another 24 h and recheck for leakage.

NOTE 4—Most of the significant creep occurs within the first 1000 h. Since the application of a mechanical clamp on polyethylene pipe results in a rapidly decreasing load because of the initial gasket and pipe deformation, laboratory installations, corroborated by field experience, indicate that visible deformation occurs within 24 to 48 h after the clamp is installed. Further deformation with time is not of the magnitude necessary to affect the original pressure seal provided by a suitable clamp.

8.8 Remove the clamp and end closures of the specimen and visually inspect the inside and outside of the pipe that was beneath the clamp for cracks or other damage caused by the clamp.

9. Rejection

9.1 Any leakage detected during the test constitutes failure of the specimen.

9.2 Any signs of splitting or cracking in the pipe constitutes rejection of the specific pipe and clamp assembly being tested.

10. Keywords

10.1 damage; full-encirclement-type band clamp; hole; leak repair; pipe reinforcement; plastic pipe; puncture

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