Designation: F1429 − 99 (Reapproved 2014)

Standard Test Method for Assembly Force of Plastic Underground Conduit Joints That Use Flexible Elastomeric Seals Located in the Bell[1]

This standard is issued under the fixed designation F1429; 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 test method covers the determination of the relative force required to assemble plastic underground conduit joints that use flexible elastomeric seals located in the bell.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D695 Test Method for Compressive Properties of Rigid Plastics

F412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *assembly force*—the peak force or effort required to insert the spigot into the belled end for gasketed conduit joining systems.

3.1.2 *chart recorder*—a device that records on paper (or similar permanent medium) the readings obtained by a physical testing machine, such as a compression tester. The chart recorder receives input from the testing machine in the form of electrical signals that are proportional to the test readings.

3.1.3 *gasketed conduit joining system*—a push-on conduit joining system (see joint, push-on in Terminology F412) with the following three manufacturer-specified components that influence joint assembly force: (*1*) the elastomeric seal, (*2*) the chamfer on the spigot, and (*3*) the joint lubricant. This system is as supplied or recommended by the conduit manufacturer.

4. Summary of Test Method

4.1 A sample of eight gasketed conduit bells of the same nominal diameter are prepared from typical production stock of the conduit manufacturer. An aluminum spigot mandrel made to the specifications of Annex A1 for the conduit size being tested is inserted into each of the eight gasketed conduit bell specimens by means of a compression tester and the joint system assembly force is recorded for each specimen. The mean and standard deviation of the sample of eight recorded assembly forces is then calculated and recorded.

4.2 Any variation in the type of gasket, spigot chamfer, or joint lubricant specified by the manufacturer constitutes a change in the gasketed conduit joining system and requires that a new sample of eight specimens be tested.

5. Significance and Use

5.1 The assembly force of a conduit joining system is one measure of the ease of which the conduit system can be assembled and installed in the field. This test method provides a means by which to quantify the assembly force of gasketed conduit joining systems. The results of the testing can be used to compare and categorize the assembly force of different designs of gasketed conduit joining systems.

5.2 This test method is not intended for use as a quality control test.

5.3 This test method can be used for comparison of gasketed conduit joining systems on the basis of assembly force. No information about joint sealing performance can be obtained from the use of this test method.

5.4 This test method covers all plastic conduit with push-on joints that use flexible elastomeric gaskets located in the bell to provide the joint seal.

5.5 This test method is also applicable to all fittings that are fabricated from conduit covered in 5.4 and that utilize the same type of push-on joints as the conduit covered in 5.4, and that are intended for use with the conduit types described in 5.4. For

[1] This test method is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.40 on Test Methods.

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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.

purposes of this test method, assembly force data obtained from the testing of the conduit that is the parent stock of a fitting shall apply to the fitting also.

6. Apparatus

6.1 *Testing Machine*—A properly calibrated compression testing machine of the constant-rate-of-crosshead movement type meeting the requirements of Testing Method D695 shall be used to make the tests. The compression tester shall be capable of a compression rate of 20 ± 0.5 in./min (500 ± 12.7 mm/min). The compression tester shall be equipped with a chart recorder that is capable of recording compression force versus time or position.

6.2 *Spigot Mandrels*—Spigot mandrels shall be constructed to mount rigidly to the compression tester. The mandrels shall conform to the dimensions and specifications shown in Annex A1.

6.3 *Joint Lubricant*—Joint lubricant shall be used prior to the assembly of the conduit joints. It shall be as specified or supplied by the conduit manufacturer, or both.

7. Test Specimens

7.1 Specimens shall be comprised of a conduit bell with an elastomeric seal.

7.2 Specimens shall have no less than 1 in. (25 mm) and no more than 3 in. (76 mm) of nominal conduit diameter extending past the bottom of the bell shoulder (see Fig. 1).

7.3 The bottom of each specimen (spigot end) shall be cut perpendicular to the axis of the bell barrel within ±1° (see Fig. 1).

7.4 Bell dimensions and specifications shall be determined by the bell manufacturer, but the specimens shall be representative of normal and customary production by the manufacturer.

7.5 Test specimens can have any standard wall thickness. It is not necessary to test more than one wall thickness per nominal conduit size.

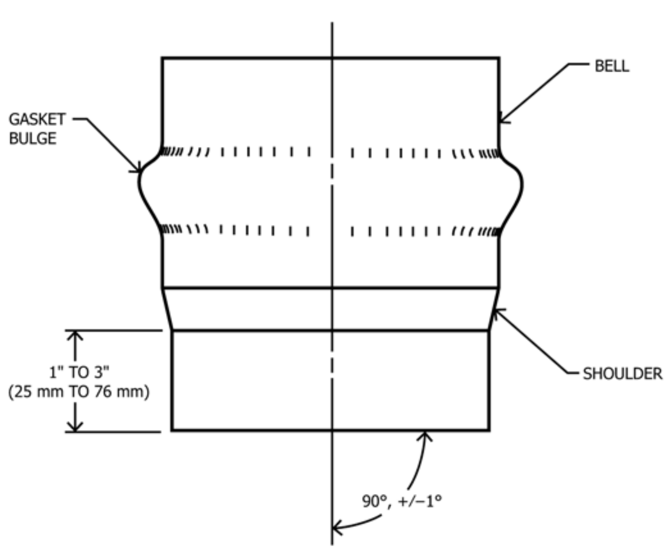

FIG. 1 Bell Specimen Preparation

7.6 *Number of Test Specimens*—There shall be eight specimens to be tested for each design of gasketed conduit joining system and nominal conduit size.

8. Conditioning

8.1 Condition specimens, spigot mandrels, and joint lubricant for at least 8 h in air at a temperature of 73 ± 7°F (23 ± 4°C) prior to testing. Begin testing immediately after conditioning period.

8.2 Conduct the testing in a room maintained at the conditioning temperature.

9. Procedure

9.1 Select eight bell specimens of the same nominal size which have been prepared and conditioned according to Sections 7 and 8 of this test method.

9.2 Mark the specimens with consecutive numbers, starting with "1" and ending with "8."

9.3 Rigidly mount the proper spigot mandrel for the nominal size of conduit being tested to the compression tester.

9.4 Mark specimen number and type on chart recorder paper to identify the force tracing that will be recorded.

9.5 Position compression arms of the compression tester to provide a gap between the spigot mandrel and the bell specimen such that access to the spigot mandrel and bell specimen is easily achieved.

9.6 Stir the joint lubricant to remix any separation that may have occurred.

9.7 Using a paint brush or sponge, apply the joint lubricant to the gasket and spigot mandrel. Make sure to cover the entire contact surface of the gasket and halfway to the depth-of-insertion line on the spigot mandrel, leaving no dry spots. Also be sure that the entire surface of the chamfer on the spigot mandrel is covered.

NOTE 1—As a guide, the approximate thickness of the lubricant film should be between 1⁄32 in. (0.8 mm) and 1⁄16 in. (1.6 mm).

9.8 Position the bell specimen on the compression tester with the bell entrance pointing towards the spigot mandrel.

9.9 Using the compression tester controls, slowly close the distance between the spigot mandrel and bell specimen until the spigot mandrel is approximately 1⁄4 in. (6.4 mm) from the entrance of the bell specimen.

9.10 Manipulate the position of the bell specimen while slowly bringing the spigot mandrel and the bell specimen together such that the spigot mandrel enters the lip of the bell. Stop when about 1⁄4 in. (6.4 mm) of the spigot mandrel is inside the bell.

9.11 Set the rate of compression on the compression tester to 20 in./min (500 mm/min).

9.12 Arrange the controls of compression tester such that the compression travel stops before the spigot mandrel bottoms out in the bell specimen.

9.13 Activate the compression and chart recorder simultaneously.

9.14 When compression stops (see 9.12), deactivate the chart recorder and return the compression tester to a position at which the bell specimen can be withdrawn from the spigot mandrel.

NOTE 2—If the bell specimen is difficult to remove from the spigot mandrel, it may be necessary to mechanically restrain the bell specimen and allow the compression tester to withdraw the spigot mandrel from the bell specimen when the compression tester is retracted.

9.15 Remove the bell specimen.

9.16 Clean the lubricant from the spigot mandrel in preparation for the next test specimen.

9.17 Repeat 9.4 through 9.16 until all eight specimens have been tested.

9.18 From the chart recorder tracings, find and record the maximum force encountered during joint assembly for each of the eight specimens tested. See X1for an example of a chart recorder tracing.

9.19 If other sizes of conduit are to be tested, repeat 9.1 through 9.18.

10. Calculation

10.1 Express the results of the tests of the eight specimens in terms of a sample mean and sample standard deviation in accordance with the following:

10.1.1 Calculate the sample mean of the sample peak assembly force results as follows:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \quad (1)$$

where:

$\bar{x}$ = mean of sample of eight peak assembly force readings,

x_i = individual value of peak assembly force from specimen "i" in sample, and

n = number of specimens in sample (eight in this case).

10.1.2 Calculate the standard deviation of the sample peak assembly force results as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1}} \quad (2)$$

where:

s = standard deviation of sample of eight peak assembly force readings,

x_i = individual value of peak assembly force from specimen "c" in sample,

$\bar{x}$ = mean of sample of assembly force readings (calculated in 10.1.1), and

n = number of specimens in sample (eight in this case).

11. Report

11.1 A test report will be generated for each group of eight specimens tested.

11.2 Report the following information:

11.2.1 The chart recorder assembly force tracings,

11.2.2 The peak assembly force sample mean and standard deviation calculated in Section 10,

11.2.3 Identification of the bell specimens tested, including nominal size, type of conduit, material of manufacture, type and source of gasket, and name of bell specimen manufacturer,

11.2.4 Identification of the joint lubricant used, including name of the lubricant manufacturer and the model number, if appropriate,

11.2.5 Manufacturing drawings of the spigot mandrel used in the test, including the spigot chamfer specifications,

11.2.6 Date(s) of testing,

11.2.7 Location of testing,

11.2.8 Name(s) of personnel conducting the test, and

11.2.9 Comments, if appropriate.

12. Precision and Bias

12.1 *Precision*—Work is in progress to develop precision data. This work is in the form of interlaboratory testing.

12.2 *Bias*—Bias is a systematic error which contributes to the difference between a test result and a true (or reference) value. There are no recognized standards on which to base an estimate of bias for this test method.

13. Keywords

13.1 assembly force; compression tester; elastomeric seal; gasketed conduit; spigot mandrel

ANNEX

(Mandatory Information)

A1. SPIGOT MANDREL SPECIFICATIONS

A1.1 Fig. A1.1 shows spigot mandrel specifications.

APPENDIX

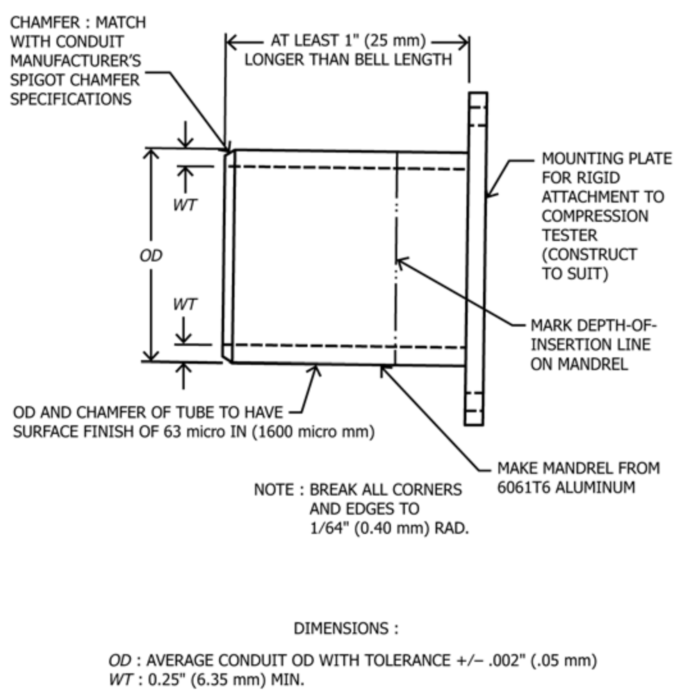

FIG. A1.1 Spigot Mandrel Specifications

(Nonmandatory Information)

X1. EXAMPLE OF TYPICAL JOINT ASSEMBLY FORCE TEST RESULT

X1.1 The graph in Fig. X1.1 is an example of a force versus time plot during an assembly of a gasketed pipe or conduit joint. In this example, force is expressed in terms of percent of full scale and time is read from right to left.

X1.2 The significant“ events” on the force versus time plot have been labeled with the letters“ A” through “E.” The following explains what is happening at these points:

X1.2.1 A—This shows the spigot mandrel beginning its travel and before it has reached the gasket.

X1.2.2 B—This shows the peak force generated as the mandrel compresses the gasket primary seal.

X1.2.3 C—This shows another force generated as the mandrel compresses a gasket protrusion located behind the primary seal.

X1.2.4 D—This shows a force drop-off when the mandrel travel is halted at the preset stop position.

X1.2.5 E—This shows the pen returning to the zero force position to be ready for the next test.

X1.3 This graph is only an example. There is a wide variety of shapes that assembly force tracings can assume, depending on the type of gasket tested. Regardless of the shape of the tracing, the peak force (event “B” in this case) is what should be recorded for purposes of this test method.

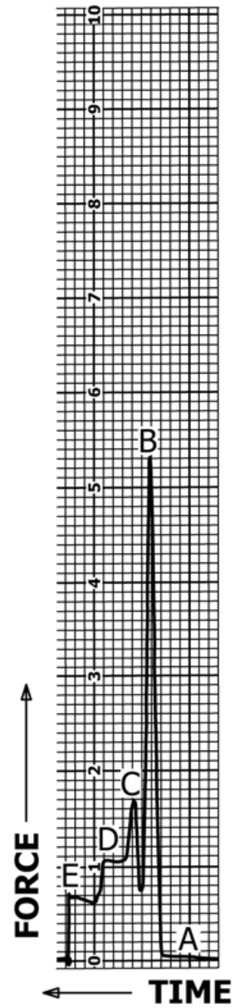

FIG. X1.1 Example of a Force Versus Time Plot During an Assembly of a Gasketed Pipe or Conduit Joint