Designation: D2925 – 14

An American National Standard

Standard Test Method for Beam Deflection of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Under Full Bore Flow[1]

This standard is issued under the fixed designation D2925; 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 measurement of the deflection as a function of time of a specimen of fiberglass pipe supported on a flat non-arced support as a simple beam under full bore flow of water at elevated temperatures. Both glass-fiber-reinforced thermosetting-resin pipe (RTRP) and glass-fiber-reinforced polymer mortar pipe (RPMP) are fiberglass pipes.

NOTE 1—For the purposes of this standard, polymer does not include natural polymers.

1.2 This test method can be used to determine deflection at varying conditions by substituting other test media.

1.3 Deflections observed using this test method are representative only of piping supported as a simple beam under full bore flow which has one diameter of pipe overhanging at each support.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

NOTE 2—There is no known ISO equivalent to this standard.

1.5 *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]

C33 Specification for Concrete Aggregates

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 *General*—Definitions are in accordance with Terminologies D883 and F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregate*—a siliceous sand conforming to the requirements of Specification C33, except that the requirements for gradation shall not apply.

3.2.2 *fiberglass pipe*—a tubular product containing glass fiber reinforcement embedded in or surrounded by cured thermosetting resin; the composite structure may contain aggregate, granular or platelet fillers, thixotropic agents, pigments, or dyes; thermoplastic or thermosetting liners may be included.

3.2.3 *reinforced thermosetting resin pipe (RTRP)*—a fiberglass pipe without aggregate.

3.2.4 *reinforced polymer mortar pipe (RPMP)*—a fiberglass pipe with aggregate.

4. Significance and Use

4.1 In the absence of deflection measurements from actual installed-above-ground piping, this test method may be used to evaluate the influence of span length on mid-span deflections at differing temperatures under full bore flow.

NOTE 3—A flat bearing area, small contact area, and narrow bearing width may induce high localized support interaction stresses, and constraints imposed by the supports may also adversely influence deflections and performance of the pipe.

5. Apparatus

5.1 *Rigid Support* with edges rounded to a 6-mm (¼-in.) radius, consisting of two uprights of a convenient height. The uprights are to be spaced at a predetermined distance over which deflection is to be determined as shown on Fig. 1. The uprights shall have lateral guides, a saddle, groove, or indentation on the top to keep the pipe specimen from rolling off when placed in position.

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.23 on Reinforced Plastic Piping Systems and Chemical Equipment.

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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.

***A Summary of Changes section appears at the end of this standard**

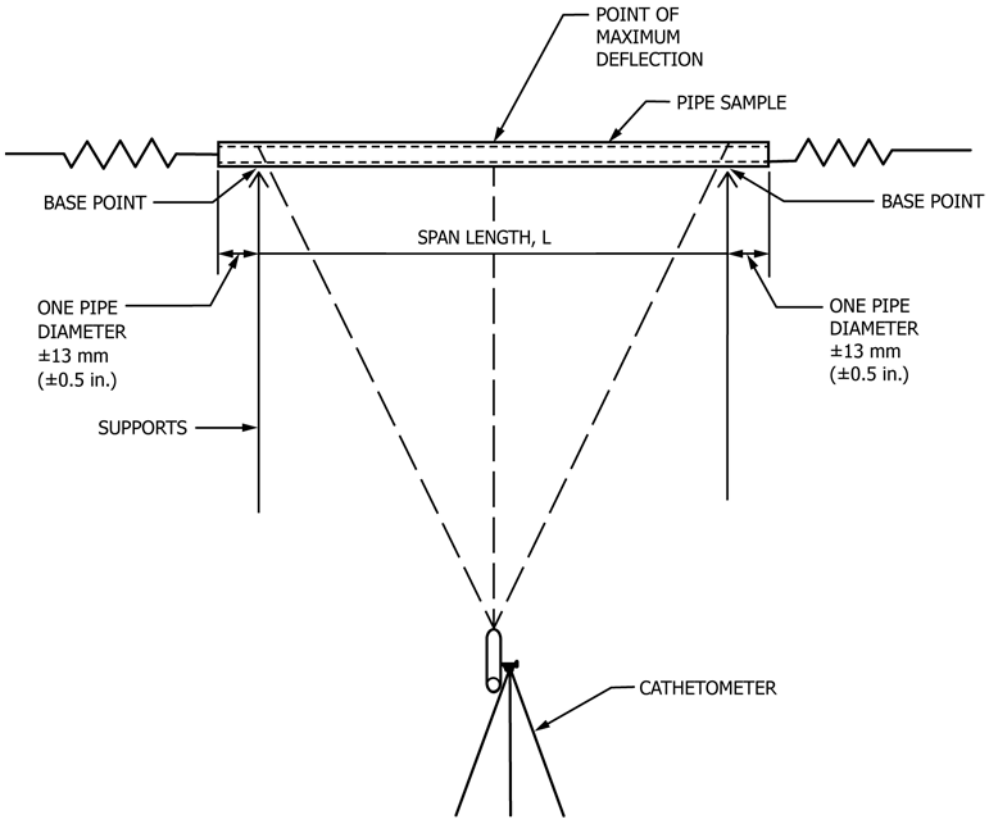

FIG. 1 Schematic of Test Specimen Support

5.1.1 The support space distance shall be estimated for a maximum allowable sag of 12.7 mm (½ in.) at test conditions. This estimate may be made by solving Eq 1 for *L*, using *y* = 12.7 mm (½ in.) and assuming an elastic modulus, *E* = 1 000 000 psi, unless a more accurate value is available.

5.2 *Source of Hot Water and a Feed System* maintained at conditions such that when this source is coupled to the pipe specimen and the water is fed into the specimen, the water emerging from the specimen shall be maintained continuously at the controlled temperature within ±2°C (3.6°F). The water shall be fed into the specimen at a head not exceeding 1.5 m (5 ft) and allowed to flow through it under such conditions that the pipe specimen is filled with the controlled temperature water at all times. Any recirculation shall be vented to atmosphere. A schematic drawing of the test setup is shown on Fig. 2.

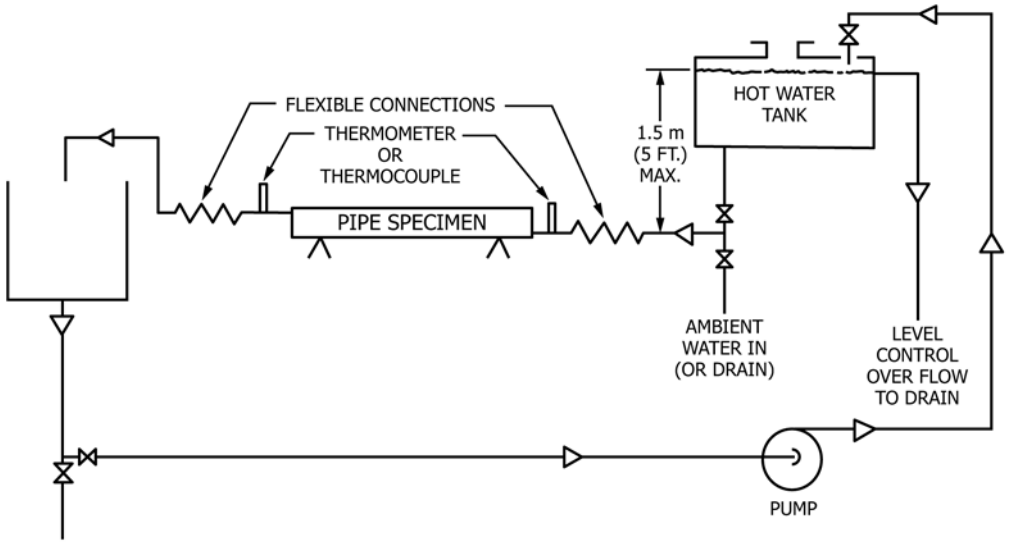

FIG. 2 Schematic of Test Set-up for Beam Deflection Test on Pipe

5.3 *Flexible Connections* for the ends of the pipe test specimens, installed so as to produce negligible moment on the ends of the pipe.

5.4 *A Device for Measuring the Deflection* of the pipe specimen to the nearest 0.025 mm (0.001 in.) with negligible constraint on the specimen. A recommended device is a cathetometer as shown on Fig. 1.

5.5 *Time-Interval Measuring Device* graduated in minutes or seconds.

5.6 *Temperature and Pressure Gages* and suitable control devices to maintain standard test conditions.

6. Test Specimens

6.1 The test specimens shall be sections of fiberglass pipe cut to a precalculated span length plus two pipe diameters ± 13 mm (±0.5 in.), essentially straight and of a diameter and wall thickness to be specified.

6.2 At least three specimens shall be tested for any given pipe size.

7. Test Temperature

7.1 The test temperature selected should be the maximum recommended service temperature for the piping unless it is desired to test the effects of temperature variation.

8. Procedure

8.1 Measure the total wall thickness, liner thickness, and diameter of the pipe specimen in accordance with Practice D3567.

8.2 Place the test specimen on the upright supports so that there is an overhang of one pipe diameter ±13 mm (±0.5 in.) on each end.

8.3 Connect the test specimen to the water supply and outlet system by means of supported flexible connectors.

8.4 Fill the pipe test specimen with water at ambient temperature and determine initial deflection.

8.5 Circulate the test media (water) through the test specimen until a steady-state temperature (see 5.2) is attained at the designated test temperature. Then take the initial elevated temperature deflection reading.

8.6 Measure the position of the base point and the point of maximum deflection at 15-min intervals for 1 h and then at 1-h intervals for 4 h.

8.7 Continue to measure the position of the base point and the point of maximum deflection at suitable time intervals until 1000 h have elapsed or until the total maximum deflection exceeds the allowable design limit of 12.7 mm (½ in.). If a change of deflection less than 0.025 mm (0.001 in.) occurs in two consecutive 24-h periods after 1000 h elapsed time, the test may be terminated. If the change in deflection is greater than 0.025 mm (0.001 in.) in two consecutive 24-h periods after 1000 hour elapsed time, the test should be continued until the design limit of 12.7 mm (½ in.) is reached or until a change of deflection less than 0.025 mm (0.001 in.) occurs in two consecutive 24-h periods. Record this equilibrium time and maximum deflection.

9. Calculation

9.1 Calculate *EI* values from the data obtained, as follows:[3]

$$EI = 22.5wL^4/y \quad (1)$$

where:

- w = combined weight of pipe and fluid at test temperature, lb/ft,
- L = span length, ft,
- y = maximum measured deflection, in.,
- E = apparent elastic modulus of pipe, psi,
- I = 0.0491 (D^4 – d^4), cross-section moment of inertia of pipe, in.^{4},
- D = average outer diameter of pipe, in., and
- d = average inner diameter of pipe, in.

10. Report

10.1 The report shall include the following:

10.1.1 Test laboratory and supervisor of tests,

10.1.2 Dates of test,

10.1.3 Complete identification of the sample, including material, manufacturer, type, source, and previous history,

10.1.4 Pipe dimensions, including nominal pipe size, minimum and average wall thickness, liner thickness, and the minimum and average outside diameter of each specimen,

10.1.5 Number of specimens tested,

10.1.6 Calculated weight of pipe filled with water at test temperature, pounds per foot,

10.1.7 Type of support used and dimensions of support (width and saddle radius),

10.1.8 Span length between supports used in test,

10.1.9 Temperature of inlet and outlet water at equilibrium,

10.1.10 Table of deflection in inches versus time in hours, and

10.1.11 Calculated *EI* values.

10.1.12 Temperature of environment outside the pipe.

11. Precision and Bias

11.1 Attempts to develop a precision and bias statement for this method have not been successful. For this reason, data on precision and bias cannot be given.[4]

12. Keywords

12.1 beam deflection; fiberglass pipe; fullbore flow; elastic modulus

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[3] Crocker, Sabin, *Piping Handbook,* McGraw-Hill Book Co., NY, Fourth Edition, 1945, p. 745.

[4] Anyone wishing to participate in the development of precision and bias data should contact the Chairman, Subcommittee D 20.23, ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 .

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue, D2925 – 01 (2007)$^{\varepsilon 1}$, that may impact the use of this standard.

(1) Replaced the term "load" with "moment" in section 5.3.
(2) Added requirement (10.1.12) to report temperature conditions of test laboratory.