Designation: D 2924 – 01

An American National Standard

Standard Test Method for External Pressure Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe[1]

This standard is issued under the fixed designation D 2924; 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 determination of the resistance of fiberglass pipe to external pressure. It classifies failures as buckling, compressive, and leaking. 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 The values stated in inch-pound units are to be regarded as standard. The SI units given in parentheses are for information only.

NOTE 2—There is no similar or equivalent ISO 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:*

C 33 Specification for Concrete Aggregates[2]

D 618 Practice for Conditioning Plastics for Testing[3]

D 883 Terminology Relating to Plastics[3]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

F 412 Terminology Relating to Plastic Piping Systems[4]

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions are in accordance with Terminology D 883 or F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregate*, *n*—a siliceous sand conforming to the requirements of Specification C 33, except that the requirements for gradation shall not apply.

3.2.2 *buckling failure pressure*— the external gage pressure at which buckling occurs. Buckling is characterized by a sharp discontinuity in the pressure-volume change graph and subsequent fracture in the test specimen appearing as an axially oriented crack. Buckling is an elastic instability type of failure and is normally associated with thin-wall pipe.

3.2.3 *compressive failure pressure*—the maximum external gage pressure that the specimen will resist without transmission of the testing fluid through the wall. Compressive failure pressure will not be associated with a sharp discontinuity in the pressure-volume change graph nor lead to a fracture appearing as a sharp axially oriented crack. It will appear as a fracture which is the result of reaching the compressive strength limits of the material and is normally associated with thick-wall pipe. Failure is usually identified by a sudden drop in pressure.

3.2.4 *fiberglass pipe*, *n*—a tubular product containing glass fiber reinforcements 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 or coatings may be included.

3.2.5 *leaking pressure*—the external gage pressure at which the test fluid is transmitted through the pipe wall. It is characterized in this test by continuous volume change indications with no pressure increase.

3.2.6 *reinforced polymer mortar pipe (RPMP)*, *n*—a fiberglass pipe with aggregate.

3.2.7 *reinforced thermosetting resin pipe (RTRP)*, *n*—a fiberglass pipe without aggregate.

4. Summary of Test Method

4.1 This test method consists of loading a specimen to failure in a short time interval by means of continuously increasing external fluid pressure at a controlled constant temperature. Fluid is also maintained inside the pipe, and changes in the inside volume are monitored with a bleed hole and fluid level tube. On Cartesian coordinates, pressure versus

[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] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 08.04.

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

change in volume is plotted and the failure pressure selected as indicated by the graph. Scaling constants are presented for extending the results to other diameters.

5. Significance and Use

5.1 The values obtained by this test method are applicable only to conditions that specifically duplicate the procedures used.

5.2 After a scaling constant is determined for one diameter, this may be used for calculating the external failure pressures of other diameters as long as the resin and reinforcement (if used), the wall thickness-to-diameter ratio, and the reinforcement pattern (if reinforcement is used) are the same.

NOTE 3—Based upon tests conducted on one size of pipe, a scaling constant is calculated according to 11.1 or 11.2. The appropriate constant is used to calculate failure pressure for other pipe diameters, but it can only be applied if the same resin and reinforcement are used, the wall thickness to diameter ratios are similar, and the reinforcement pattern is constant.

5.3 In the application of the following test requirements and recommendations, care must be exercised to ensure that the specimens tested are truly representative of the group being studied.

6. Apparatus (see Figs. 1 and 2)

6.1 *Test Chamber*—An external chamber capable of withstanding pressures to be encountered. It may be either the type that applies both hoop and axial loads as shown in Fig. 1 or the type that applies hoop load only as shown in Fig. 2. In either event, the report shall state which type loading was used for test.

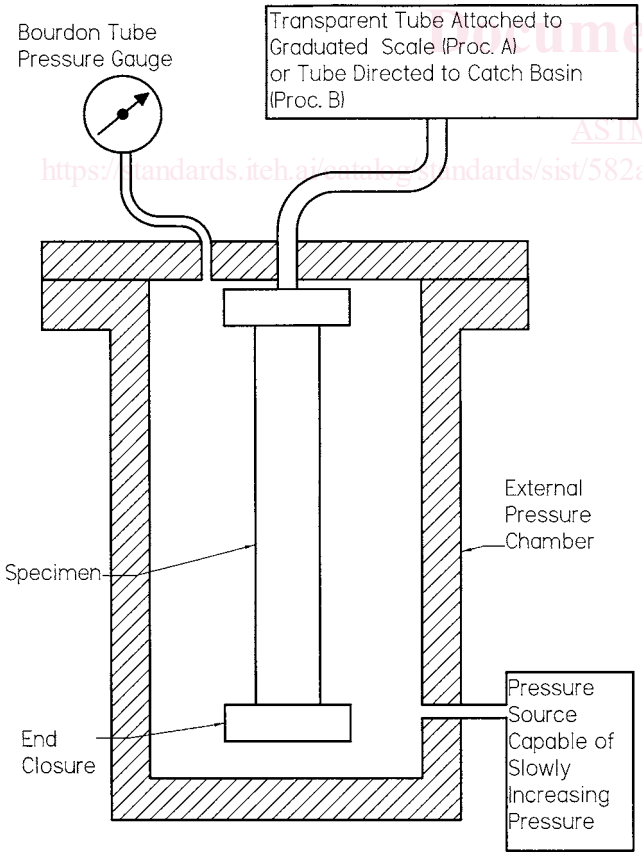

FIG. 1 Apparatus Showing Specimen Loading with Both Hoop and Axial Loads

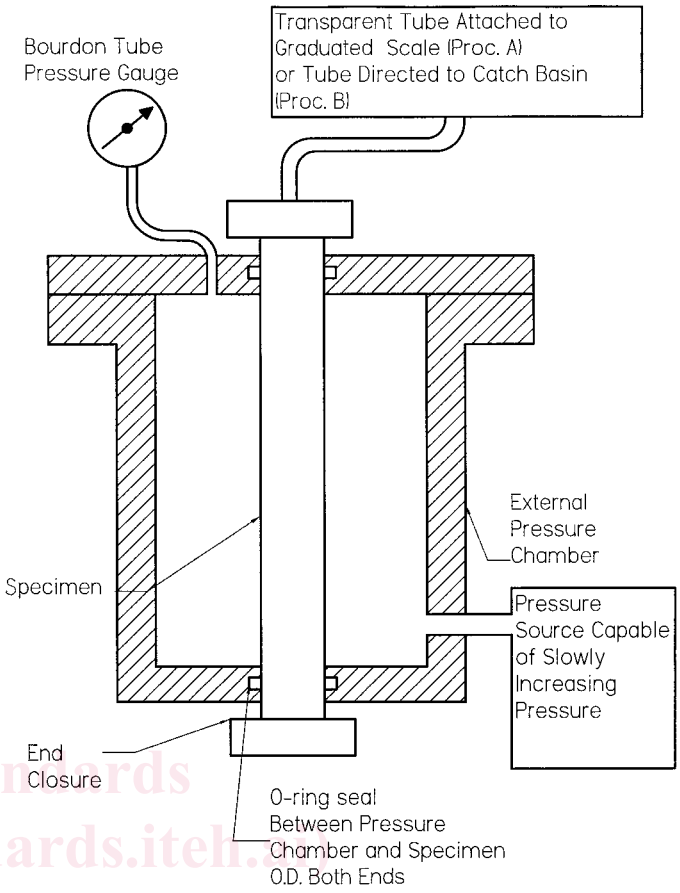

FIG. 2 Apparatus Showing Specimen Loading with Hoop Load Only

6.2 *Volume or Weight Change Indicator*—The specimen shall be instrumented to measure changes in volume or weight. One of the following two devices shall be used.

6.2.1 *Transparent Tube*—connected to the test specimen so that the volume changes of the specimen result in changes in the level of fluid in the tube. A scale shall be affixed to the tube so variations in fluid level can be recorded. Absolute measurement of volume change is not required.

6.2.2 *Scale*—A balance accurate to within ±0.1 g.

6.3 *Pressurizing System*—A device capable of exerting external fluid pressure to the specimen at a specified constant rate. A Bourdon-tube pressure gage or recording gage with an accuracy of± 1 % of full scale should be used, and the anticipated failure pressure should be in the middle two thirds of the gage range. Care should be exercised so the gage is placed where it will give a true reading of the external pressure on the test specimen.

6.4 *Test Fluid*—Water or hydraulic oil.

6.5 *Timer*—Any time-measuring device that can measure the duration of test with accuracy of 1 s.

6.6 *Temperature Regulator*—When temperatures other than ambient are being studied, a temperature-regulating system