Designation: F2261 – 06 (Reapproved 2023)

Standard Test Method for Pressure Rating Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 and 80 Socket-Type[1]

This standard is issued under the fixed designation F2261; 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 a procedure for establishing Pressure Rating for PVC schedule 40 and 80 socket-type fittings by evaluating fitting failure test data derived by testing water-filled assemblies of pipe and fittings.

1.2 Unless the data approximates a straight line, when calculated using log-log coordinates, it is not possible to assign a pressure rating to that product or sample of product. Data that exhibit high scatter, or a downward curve, due to low long term data, will give low extrapolated values that are more conservative when calculated using log-log co-ordinates. In addition, this downward curve will show as higher scatter, and where the lower confidence level limits are not met the data shall be classified as unsuitable. (See Note 1)

NOTE 1—This test method is similar to that used in Test Method D2837, which has been used for about 30 years to establish the HDS of plastic pipe materials and is the basis for all pressure ratings assigned to plastic pipes.

1.3 The products covered by this test method are schedule 40 or 80 molded PVC fittings that conform to Specifications D2466 or D2467.

1.4 The pressure ratings developed using this test method applies only to fittings identical to the ones that were tested. Some variables that will affect the pressure rating are – pipe size, pattern, mold design, material, and molding conditions.

1.5 The values in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 The testing procedure used to obtain the fitting failure data shall be as described in those sections of Test Method D1598, that are referenced in Section 6 of this test method.

1.7 The products covered by this test method are intended for use in the distribution of pressurized liquids at 73 °F. When appropriate, the design engineer must consider the effects of elevated temperature and chemical compatibility of the liquid with the fitting material and apply necessary design factors.

1.8 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 2—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety hazards should a system fail for any reason.

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D2466 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D2467 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

2.2 *Other Standards:*

PPI Report– TR-4 – HDB/SDB/PDB/MRS Listed Materials[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *failure*—the act, state, or fact of failing, specifically a lost of strength or breakdown of function

[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.

[3] Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, http://www.plasticpipe.org.

3.1.1.1 *Discussion*—for testing purposes, failure is the bursting, cracking or weeping of the fitting

3.1.2 *$LTHS_p$*—the estimated internal pressure that when applied continuously will cause failure of the fitting at 100 000 h. This is the intercept of the pressure regression line with the 100 000-h intercept.

3.1.3 *pressure design basis (PDB)*—one of a series of established pressure values for plastic piping components (multilayer pipe, fitting, valve, etc.) obtaining by categorizing the $LTHS_p$ in accordance with Table 2 of Specification D2837.

3.1.4 *pressure rating (PR)*—the estimated maximum continuous water pressure that the fitting is able of withstanding continuously with a high degree of certainty that failure of the fitting will not occur.

3.1.4.1 *Discussion*—The PR and PDB are related by the following equation:

$$PR = (PDB)\,(DF) \quad (1)$$

3.1.5 *service (design) factor (DF)*—a number less than 1.00 (which takes into consideration all the variables and degree of safety involved in a thermoplastic pipe installation and is multiplied by the HDB to give the HDS, or multiplied by the PDB to give the pressure rating.

4. Significance and Use

4.1 The procedure for establishing the long-term pressure rating of fittings starts with an extrapolation of a regression line that is based on fitting failure data with respect to time, when assemblies are tested in accordance with Test Method D1598. The pressure-versus time to failure data are obtained using water at 73 °F in assemblies that are immersed in a water or air environment. The extrapolation is made in such a manner that the long-term hydrostatic pressure rating is determined for these conditions.

4.2 The pressure design basis is determined by considering the following items and evaluating them in accordance with 6.3.

4.2.1 Long-term hydrostatic pressure-strength at 100 000 h,

4.2.2 Long-term hydrostatic pressure-strength at 50 years

4.3 The fitting pressure rating may be calculated by multiplying the pressure design basis (PDB) by the appropriate design factor (DF).

5. Test Specimen

5.1 *General*—Each test specimen shall consist of a socket-end fitting. Fittings shall be representative of commercial parts and shall meet the requirements of D2466 or D2467. Pipe stubs shall be solvent cemented into each socket and the ends of the stubs shall be closed with mechanical end-closures (or solvent cement caps). At least one stub shall be fitted with a pressure connection.

5.2 *Qualified Data*—In order to be considered as a qualified data point, the failure must occur in the body of the fitting. However, as the testing proceeds data points resulting from the failure of a solvent-cement joint qualify for use if those data points improve the scatter or the $LTHS_p$ intercept.

NOTE 3—If solvent-cement joint failures occur before the fittings fail, modify the curing procedure or cure time in order to eliminate or minimize the joint failures.

6. Procedure

6.1 *General*—Generate data in accordance with Test Method D1598 Sections 6 *Apparatus*, 8. *Conditioning* and 9. *Procedure*. When any part of this test method is not in agreement with those sections of Test Method D1598, the provisions of this test method shall control.

6.2 *Pressure-versus Time Data*—Obtain a minimum of 18 fitting-failure data points distributed as follows. Use water as the test medium with an air or water environment.

Hours	Data points
< 10	At least 6
10 – 1000	At least 3
1000 - 6000	At least 3
After 10 000	At least 1

6.3 *Stress Rated PVC (Pressure-versus Time Data)*—If the fittings being evaluated with this test method are all made from PVC materials that have a long term strength listing in PPI TR 4, the testing data requirements are as follows

Hours	Data points
< 10	At least 3
10 – 1000	At least 3
1000 – 4000	At least 3
6000 +	At least 1

6.4 *Pressure Design Basis*—the procedure for determining the PDB shall be as follows:

6.4.1 Calculate the hydrostatic pressure-strength at 100 000 h (LTHSp) in accordance with section 5.2 of Specification D2837.

6.4.2 Calculate the hydrostatic pressure-strength at 50 years in accordance with 5.2.3.1 of Specification D2837.

6.4.3 Determine the pressure design basis (PDB) by categorizing, in accordance with Table 2 of Specification D2837, the applicable hydrostatic pressure-strength value as specified below:

6.4.4 Use the $LTHS_p$ value (6.4.1) if it is less than 125 % of the 50-year value (6.4.2).

6.4.5 Use the 50-year value if is less than 80 % of the $LTHS_p$ value.

6.5 *LCL Limit*—Calculate the 100 000 h lower-confidence value in accordance with D2837 Appendix X3. The lower-confidence value shall be at least 85 % of the $LTHS_p$ value.

7. Report

7.1 *The report shall include the following:*

7.1.1 Complete identification of the sample, including fitting material type and grade, fitting manufacturer's name, pipe and solvent cement used and joint cure time and temperature.

7.1.2 Fitting size, pattern, schedule and ASTM Standard markings.

7.1.3 Test temperature.

7.1.4 Test environment inside and outside of the fitting.

7.1.5 A table of the pressures in pounds-force per square inch gage, the time-to-failure in hours for all the specimens tested (specimens that are designated as failures after they have been under pressure for more than 10 000 hours shall be indicated) and the nature and location of the failure.