Designation: F2331 – 11 (Reapproved 2016)

Standard Test Method for Determining Chemical Compatibility of Substances in Contact with Thermoplastic Pipe and Fittings Materials[1]

This standard is issued under the fixed designation F2331; 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 is used for determining chemical compatibility of substances in contact with thermoplastic pipe and fittings materials.

1.2 This test method is not intended to evaluate the suitability of solvent cements or adhesives used to join plastic piping.

1.3 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.

1.4 *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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D638 Test Method for Tensile Properties of Plastics

3. Summary of Test Method

3.1 The procedure uses tensile specimen test bars in a longitudinal tensile test geometry in a constant load (creep) method. All procedures are run at an ambient temperature of 73°F (23°C).

4. Significance and Use

4.1 These procedures can be used to evaluate chemicals or materials expected to come in contact with plastic piping relative to causing environmental stress-cracking in thermoplastic materials. This testing results in determining time-to-failure versus engineering stress. This procedure can also be used in stress-rupture regression analysis, where a variety of stress levels are needed. The methodology can be readily adapted to conducting immersion tests in liquids or testing temperatures other than 73°F (23°C).

5. Interferences

5.1 In these procedures, there may be interference effects due to differences in resin or the additives in the thermoplastic materials. Until such time as data is available to address this, the user should take this into consideration when applying this test method.

6. Apparatus

6.1 Apparatus for constant tensile method.

6.1.1 Constant-tensile-load test apparatus which maintains the load to within ±1 % throughout the test duration.

6.1.2 Immersion vessels which can be mounted to the tensile-load apparatus (if applicable).

7. Test Specimen

7.1 Test bars may be either fabricated from compression molded plaques, injection molded, or cut from finished product. Test times and/or stress levels may be reduced by incorporating a knit-line into an injection-molded test bar. If a knit-line is present, the mold should be designed such that the knit-line occurs in the center of the bar, perpendicular to the longitudinal axis.

7.2 A Type IV specimen as shown in Test Method D638 shall be used for referee testing. Other specimen geometries are acceptable if shown to provide equivalent results.

8. Calibration and Standardization

8.1 All test instrumentation shall be calibrated to standards traceable to a national standards agency such as the National Institute of Standards and Technology in the United States.

9. Conditioning

9.1 Condition the specimens and the test chemical or material for 40 h at 73 ± 4°F (23 ± 2°C) and 50 % ± 10 % RH prior to applying the test chemical or material to the specimen.

[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.

Current edition approved Feb. 1, 2016. Published February 2016. Originally approved in 2004. Last previous edition approved in 2011 as F2331–11. DOI: 10.1520/F2331-11R16.

[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**

10. Procedure

10.1 *Constant Tensile Method:*

10.1.1 Attach the grips to the test specimen. The ends of the grips shall be at least 0.75 in. (15 mm) from the area where the test material is being applied. If testing in an immersion apparatus, this requirement does not apply, failures within 0.25 in. (6.4 mm) of the grip shall not be considered a valid test.

10.1.2 If using a semi-solid paste material, wrap the specimens with plastic wrap or aluminum foil to prevent evaporation of liquid components of the paste.

10.1.3 If using a liquid, the test specimen must be immersed in the liquid or otherwise exposed in direct contact with the liquid until failure. This exposure should only be used if the chemical agent remains as a liquid for the expected duration of exposure when installed (for example, antifreeze solutions).

10.1.4 For liquid spray-applied products, the product shall be sprayed or brushed onto the test specimen at a coating thickness representative of field installation.

10.1.5 *Test Stress:*

10.1.5.1 For single-stress testing, the stress level shall be the 1000-h stress from the material stress-rupture curve.

10.1.5.2 For multiple-stress testing, at least four stress levels shall be used with at least one stress at or beyond the 2500-h point on the material stress-rupture curve.

10.1.6 Apply the load to the specimen gradually within a period of 5 to 10 s without any abrupt or impact-type loading of the specimen.

10.1.7 Record the time-to-failure of each specimen.

10.1.8 If the failure occurs at an area away from where the test material was applied (that is, clean tensile bar region), at a time less than the negative control, it shall not be considered a valid test for that specimen. If only one of four specimens fails in this manner, it may be discarded and the remaining three reported. If more than one fails in this manner, new specimens shall be tested.

11. Calculation or Interpretation of Results

11.1 When using this method with a single stress level, the applied stress or strain should be sufficient to cause failures with known stress-cracking agents within 100 h. As such, it is generally considered acceptable if the chemical or material under test does not cause a failure within 1000 h at that same stress level.

11.2 When using this method with multiple stress levels, the test specimen fail times must be compared with control specimens at each stress level, or a previously established regression curve for the thermoplastic material.

12. Report

12.1 Complete identification of the sealant tested, plastic material used for the test bars, positive control substance and negative control substance (if any). This information shall include manufacturer, trade designations, principle dimensions and material identification code or designation.

12.2 Method of preparing test specimens.

12.3 Environment during conditioning and testing.

12.4 Conditioning procedure (time/temp/RH).

12.5 Number of specimens tested.

12.6 Cross-sectional dimensions of test specimens.

12.7 Stress levels used in testing.

12.8 Date of test.

12.9 Reference to this Test Method F2331 and the procedure used for interpretation of results.

13. Precision and Bias

13.1 This test method specifies a result that is a nonnumerical report of success or failure categorized based on criteria specified in the procedure (positive and negative controls). As such, no information is presented about either the precision or bias of Test Method F2331 for measuring chemical compatibility of substances in contact with thermoplastic pipe and fitting materials.

14. Keywords

14.1 ABS; chemical compatibility; CPVC; fittings; PVC; thread sealant

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F2331–04$^{\varepsilon 1}$) that may impact the use of this standard.

(1) Revised Title and Scope to include testing any chemical substances rather than just thread sealants.
(2) Included reference in Significance and Use to testing with other chemicals and at other temperatures.
(3) Deleted the use of positive and negative controls in the calibration section and allowed the original material to be the baseline/control.
(4) Expanded the testing procedures to include liquids and spray-applied products.
(5) Revised testing to include either single-point (1000-h stress level) or multiple points (4 stress levels).
(6) Added interpretation of results for multiple stress level tests.