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An American National Standard

Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials¹

This standard is issued under the fixed designation D 2837; 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.

This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—The terms **Hydrostatic Design Stress** and **Pressure Rating** were editorially updated in June 2002.

1. Scope

1.1 This test method describes a procedure for obtaining a long-term hydrostatic strength category, referred to herein as the hydrostatic design basis (HDB), for thermoplastic pipe materials based on the material's long-term hydrostatic strength (LTHS). The LTHS is determined by analyzing stress versus time-to-rupture (that is, stress-rupture) test data that cover a testing period of not less than 10 000 h and that are derived from sustained pressure testing of pipe made from the subject material. The data are analyzed by linear regression to yield a best-fit log-stress versus log time-to-fail straight-line equation. Using this equation, the material's mean strength at the 100 000-h intercept (LTHS) is determined by extrapolation. The resultant value of the LTHS determines the HDB strength category to which the material is assigned. An HDB is one of a series of preferred long-term strength values. This test method is applicable to all known types of thermoplastic pipe materials, and for any practical temperature and medium that yields stress-rupture data that exhibit an essentially straight-line relationship when plotted on log stress (pound-force per square inch) versus log time-to-fail (hours) coordinates, and for which this straight-line relationship is expected to continue uninterrupted through at least 100 000 h.

1.2 Unless the experimentally obtained data approximate a straight line, when calculated using log-log coordinates, it is not possible to assign an HDB to the material. Data that exhibit high scatter or a “knee” (a downward shift, resulting in a subsequently steeper stress-rupture slope than indicated by the earlier data) but which meet the requirements of this test method tend to give a lower forecast of LTHS. In the case of data which exhibit excessive scatter or a pronounced “knee,” the lower confidence limit requirements of this test method are not met and the data are classified as unsuitable for analysis.

1.3 A fundamental premise of this test method is that when the experimental data define a straight-line relationship in

accordance with this test method's requirements, this straight line may be assumed to continue beyond the experimental period, through at least 100 000 h (the time intercept at which the material's LTHS is determined). In the case of polyethylene piping materials, this test method includes a supplemental requirement for the “validating” of this assumption. No such validation requirements are included for other materials (see Note 1). Therefore, in all these other cases, it is up to the user of this test method to determine based on outside information whether this test method is satisfactory for the forecasting of a material's LTHS for each particular combination of internal/external environments and temperature.

NOTE 1—Extensive long-term data that have been obtained on commercial pressure pipe grades of polyvinyl chloride (PVC), polybutylene (PB), and cross linked polyethylene (PEX) materials have shown that this assumption is appropriate for the establishing of HDB's for these materials for water and for ambient temperatures. Refer to Note 2 and Appendix X1 for additional information.

1.4 The experimental procedure to obtain individual data points shall be as described in Test Method D 1598, which forms a part of this test method. When any part of this test method is not in agreement with Test Method D 1598, the provisions of this test method shall prevail.

1.5 General references are included at the end of this test method.

1.6 *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.*

1.7 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only and are not considered the standard.

NOTE 2—Over 3000 sets of data, obtained with thermoplastic pipe and piping assemblies tested with water, natural gas, and compressed air, have been analyzed by the Plastic Pipe Institute's² (PPI) Hydrostatic Stress Board. None of the currently commercially offered compounds included in PPI TR-4, “PPI Listing of Hydrostatic Design Bases (HDB), Pressure

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

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² Plastic Pipe Institute, 1825 Connecticut Avenue N.W., Washington, DC 20009.