



Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation¹

This standard is issued under the fixed designation C335/C335M; 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 U.S. Department of Defense.

^{ε1} NOTE—The designation was editorially corrected from C335/C335M to C335/C335M in January 2011.

1. Scope

1.1 This test method covers the measurement of the steady-state heat transfer properties of pipe insulations. Specimen types include rigid, flexible, and loose fill; homogeneous and nonhomogeneous; isotropic and nonisotropic; circular or non-circular cross section. Measurement of metallic reflective insulation and mass insulations with metal jackets or other elements of high axial conductance is included; however, additional precautions must be taken and specified special procedures must be followed.

1.2 The test apparatus for this purpose is a guarded-end or calibrated-end pipe apparatus. The guarded-end apparatus is a primary (or absolute) method. The guarded-end method is comparable, but not identical to ISO 8497.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 When appropriate, or as required by specifications or other test methods, the following thermal transfer properties for the specimen can be calculated from the measured data (see 3.2):

1.4.1 The pipe insulation lineal thermal resistance and conductance,

1.4.2 The pipe insulation lineal thermal transference,

1.4.3 The surface areal resistance and heat transfer coefficient,

1.4.4 The thermal resistivity and conductivity,

1.4.5 The areal thermal resistance and conductance, and

1.4.6 The areal thermal transference.

NOTE 1—In this test method the preferred resistance, conductance, and

transference are the lineal values computed for a unit length of pipe. These must not be confused with the corresponding areal properties computed on a unit area basis which are more applicable to flat slab geometry. If these areal properties are computed, the area used in their computation must be reported.

NOTE 2—Discussions of the appropriateness of these properties to particular specimens or materials may be found in Test Method C177, Test Method C518, and in the literature (1).²

1.5 This test method allows for operation over a wide range of temperatures. The upper and lower limit of the pipe surface temperature is determined by the maximum and minimum service temperature of the specimen or of the materials used in constructing the apparatus. In any case, the apparatus must be operated such that the temperature difference between the exposed surface and the ambient is sufficiently large enough to provide the precision of measurement desired. Normally the apparatus is operated in closely controlled still air ambient from 15 to 30°C, but other temperatures, other gases, and other velocities are acceptable. It is also acceptable to control the outer specimen surface temperature by the use of a heated or cooled outer sheath or blanket or by the use of an additional uniform layer of insulation.

1.6 The use any size or shape of test pipe is allowable provided that it matches the specimens to be tested. Normally the test method is used with circular pipes; however, its use is permitted with pipes or ducts of noncircular cross section (square, rectangular, hexagonal, etc.). One common size used for interlaboratory comparison is a pipe with a circular cross section of 88.9-mm diameter (standard nominal 80-mm [3-in.] pipe size), although several other sizes are reported in the literature (2-4).

1.7 The test method applies only to test pipes with a horizontal or vertical axis. For the horizontal axis, the literature includes using the guarded-end, the calibrated, and the calibrated-end cap methods. For the vertical axis, no experience has been found to support the use of the calibrated or calibrated-end methods. Therefore the method is restricted to using the guarded-end pipe apparatus for vertical axis measurements.

¹ This test method is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.30 on Thermal Measurement.

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² The boldface numbers in parentheses refer to the references at the end of this test method.