



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

This standard is issued under the fixed designation C 335; 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 the measurement of the steady-state heat transfer properties of pipe insulations installed on a horizontal test pipe operating at temperatures above ambient. Specimens may be rigid, flexible, or loose fill, may be homogeneous or nonhomogeneous, isotropic or nonisotropic, and of 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 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):

1.2.1 The pipe insulation lineal thermal resistance and conductance,

1.2.2 The pipe insulation lineal thermal transference,

1.2.3 The surface areal resistance and heat transfer coefficient,

1.2.4 The thermal resistivity and conductivity,

1.2.5 The areal thermal resistance and conductance, and

1.2.6 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 C 177, Test Method C 518, and in the literature (1).²

1.3 This test method allows for operation over a wide range of temperatures. The upper limit of the pipe surface tempera-

ture is determined by the maximum service temperature of the specimen or of the materials used in constructing the apparatus. The lower limit is determined by the restriction that it be sufficiently greater than the temperature of the specimen outer surface to provide the precision of measurement desired. Normally the apparatus is operated in closely controlled still air ambient from 15 to 30°C, but this may be extended to other temperatures, other gases, and other velocities. The outer specimen surface temperature may also be fixed by the use of a heated or cooled outer sheath or blanket or by the use of an additional uniform layer of insulation.

1.4 The test pipe may be of any size or shape 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).

1.5 The test method applies only to test pipes with a horizontal axis. Other orientations, such as vertical, require special precautions, which are being considered for a separate method.

1.6 This test method covers two distinctly different types of pipe apparatus, the guarded-end and the calibrated or calculated-end types, which differ in the treatment of axial heat transfer at the end of the test section.

1.6.1 The guarded-end apparatus utilizes separately heated guard sections at each end, which are controlled at the same temperature as the test section to limit axial heat transfer. This type of apparatus may be used for all types of specimens within the scope of this test method and must be used for specimens incorporating elements of high axial conductance, such as reflective insulations or metallic jackets.

1.6.2 The calibrated or calculated-end apparatus utilizes insulated end caps at each end of the test section to minimize axial heat transfer. Corrections, based either on calibration of the end caps under the conditions of test or on calculations using known material properties, are applied to the measured test section heat transfer. These apparatuses are not applicable for tests on specimens with elements of high axial conductance

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.

