



Designation: **E861 – 94 (Reapproved 2007) E861 – 13**

Standard Practice for Evaluating Thermal Insulation Materials for Use in Solar Collectors¹

This standard is issued under the fixed designation E861; 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 practice sets forth a testing methodology for evaluating the properties of thermal insulation materials to be used in solar collectors with concentration ratios of less than 10. Tests are given herein to evaluate the pH, surface burning characteristics, moisture adsorption, water absorption, thermal resistance, linear shrinkage (or expansion), hot surface performance, and accelerated aging. This practice provides a test for surface burning characteristics but does not provide a methodology for determining combustibility performance of thermal insulation materials.

1.2 The tests shall apply to blanket, rigid board, loose-fill, and foam thermal insulation materials used in solar collectors. Other thermal insulation materials shall be tested in accordance with the provisions set forth herein and should not be excluded from consideration.

1.3 The assumption is made that elevated temperature, moisture, and applied stresses are the primary factors contributing to the degradation of thermal insulation materials used in solar collectors.

1.4 Solar radiation is not considered a contributing factor since insulating materials are not normally exposed to it.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus](#)

[C209 Test Methods for Cellulosic Fiber Insulating Board](#)

[C356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat](#)

[C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation](#)

[C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus](#)

[C553 Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications](#)

[C687 Practice for Determination of Thermal Resistance of Loose-Fill Building Insulation](#)

[D2842 Test Method for Water Absorption of Rigid Cellular Plastics](#)

[E84 Test Method for Surface Burning Characteristics of Building Materials](#)

[E772 Terminology of Solar Energy Conversion](#)

3. Terminology

3.1 The definitions and description of terms found in this standard may be included in Terminology [E772](#).

4. Summary of Practice

4.1 The following factors, in most cases, should be considered when evaluating insulation materials for use in solar collectors. Design considerations should dictate priorities in material test evaluations:

¹ These test methods are under the jurisdiction of ASTM Committee [E44](#) on Solar, Geothermal and Other Alternative Energy Sources and is the direct responsibility of Subcommittee [E44.05](#) on Solar Heating and Cooling Systems and Materials.

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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.

<u>Factor</u>	<u>Reference Section</u>
pH	7.2
Surface Burning Characteristics	7.3
Moisture Adsorption	7.4
Water Absorption	7.5
Thermal Resistance	7.6
Linear Shrinkage (or Expansion)	7.7
Hot Surface Performance	7.8
Chemical Compatibility	7.9
Outgassing	7.10
Durability	7.11

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5. Significance and Use

5.1 The exposure conditions in solar collectors, especially under stagnation conditions, may degrade the performance of thermal insulation materials. This practice sets forth a methodology for evaluating the degree of degradation, if any, of the thermal insulation materials after exposure to simulated in-service conditions.

5.2 This practice is also intended to aid in the assessment of long-term performance by comparative testing of insulation materials. However, correlations between performance under laboratory and actual in-service conditions have not been established.

5.3 This practice also sets forth criteria that shall be considered in the selection and specification of thermal insulation materials. One such criterion is surface burning characteristics (Test Method [E84](#)), which is used by many code officials as a reference. This practice does not represent that the numerical values obtained in any way reflect the anticipated performance of the thermal insulation under actual fire conditions.

6. Sampling and Test Specimens

6.1 Representative specimens shall be selected at random from the original sample lot for each test condition.

6.2 At least three representative specimens shall be measured for each property tested unless otherwise stipulated in a particular test.

6.3 The size and shape of the representative specimens shall be as specified in the property measurement test.

6.4 A separate set of test specimens shall be prepared for each test.

7. Conditioning

7.1 Unless otherwise specified, maintain the test specimens in a conditioned space at 24°C (75 ± 5°F) and 50 ± 5 % relative humidity for at least 48 h before testing.

7.2 Maintain test samples in the conditioned space until removed to perform a particular test sequence.

8. Procedure

8.1 Conduct all the tests described in [7.2-7.11](#) and [8.2-8.11](#). The sequence of testing is optional.

8.2 *pH*:

8.2.1 Measure the pH of a mixture consisting of the insulation material and water with a pH meter using the following procedure:

8.2.1.1 Pulverize a sample of approximately 5 g of the insulation to pass through a 4760-µm sieve.

8.2.1.2 Mix the pulverized sample with 100 mL of distilled water at 24°C (75 ± 5°F) in a 500-mL glass beaker.

8.2.1.3 Stir the mixture, using a glass rod, and allow to stand for 1 h at 24°C (75 ± 5°F).

8.2.1.4 Measure the pH to the nearest 0.1 unit.

8.2.2 Calibrate the pH meter and electrodes before each testing sequence using standard buffer solutions. Buffer solution pH shall be within ± 2 pH units of the expected measured pH.

8.3 *Surface Burning Characteristics*—Determine flame spread and smoke-developed classifications of the insulation material in accordance with Test Method [E84](#).