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400 Commonwealth Drive, Warrendale, PA 15096-0001

# AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3679A

Issued 15 JUN 1975
Revised 1 OCT 1992

Submitted for recognition as an American National Standard

Superseding AMS 3679

## INSULATION, THERMAL
## Ceramic Fiber

1. SCOPE:

1.1 Form:

This specification covers alumina-silica, glass, and other ceramic fiber thermal insulation in the form of felt and fabric flat sheets, rolls, or molded non-pliable blocks. Nominal thickness is 0.1 to 2.0 inches (3 to 51 mm) and nominal density is 2 to 24 pounds mass per cubic foot (32 to 384 kg/m$^3$).

1.2 Application:

This insulation has been used typically to provide thermal insulation at continuous hot-face temperatures from 500 to 2300 °F (260 to 1260 °C), but usage is not limited to such applications.

1.3 Classification:

Insulation shall be classified with a suffix system according to type, density, and thermal conductivity as shown in Table 2.

1.3.1 The type supplied shall be as specified.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 ASTM Publications:

(R)

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM C 201 Thermal Conductivity of Refractories
ASTM C 892 High-Temperature Fiber Blanket Thermal Insulation
ASTM D 1682 Breaking Load and Elongation of Textile Fabrics

2.2 U.S. Government Publications:

(R)

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-B-5924 Batting, Insulation, Glass Fiber
MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication:

(R)

Product specified by AMS 3679/1 and AMS 3679/2 shall be composed of alumina-silica fibers felted into a flexible, easily-handled blanket of substantially uniform thickness and density. The composition of the fibers shall conform to the percentages by weight shown in Table 1, determined by colorimetric methods or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

| Component | min | max |
|---|---|---|
| Aluminum Oxide ($Al_2O_3$) | 45.0 | 55.0 |
| Silicon Dioxide ($SiO_2$) | 45.0 | 55.0 |
| Other Inorganics | -- | 5.0 |

3.1.1 (R) The composition of AMS 3679/3 through AMS 3679/8 shall be as agreed upon by purchaser and vendor.

3.1.2 (R) The blanket may contain up to 5.5% by weight of an appropriate organic binder for providing improved handling and fabrication characteristics. The binder content shall be determined in accordance with MIL-B-5924. Suitable facing may be employed. Quilting, if performed, shall be in accordance with standard practice.

3.2 (R) Properties:

The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods:

| | | | |
|---|---|---|---|
| 3.2.1 (R) | Thermal Conductivity: | As shown in Table 2. | ASTM C 201 as modified by ASTM C 892 Annex A1 |
| 3.2.2 | Linear Shrinkage After Heating, maximum | 2% | 4.5.1 |

3.2.3 Embrittlement: Specimens taken from felt, flat sheet, and rolls shall show no separation when tested in accordance with 4.5.2.

3.2.4 Corrosiveness: The product shall not have a corrosive or other deleterious effect on other materials when exposed to conditions normally encountered in service. Standards for acceptance and methods of test shall be as agreed upon by purchaser and vendor. Discoloration of metals shall not be considered objectionable.

3.2.5 Breaking Strength: When specified, the breaking strength, as received and/or after thermal exposure, shall be determined. Standards for acceptance and methods of test shall be as agreed upon by purchaser and vendor. ASTM D 1682, Method 1C, or the method described in 4.5.3 are recommended methods of test.

3.2.6 (R) Vibration Resistance: When specified, the vibration resistance shall be determined. Standards for acceptance and methods of test shall be as agreed upon by purchaser and vendor. Thermal conductivity shall meet the requirements of 3.2.1.

TABLE 2 - Thermal Conductivity

| Material Designation | Insulation (Note 1) | Reference Core Density lb/cu ft (kg/m³) | Thermal Conductivity at 1000 °F (538 °C) Mean Temperature BTU-in/hr/ft²/°F (max) Composite Thickness in. (mm) 3/16 (4.8) | Thermal Conductivity at 1000 °F (538 °C) Mean Temperature BTU-in/hr/ft²/°F (max) Composite Thickness in. (mm) 1/4 (6.4) | Continuous Use Temperature °F (°C) Maximum (Note 2) |
|---|---|---|---|---|---|
| AMS 3679-1 | Low-conductivity fiber felt insulation, pliable | 3-6 (48-96) | 1.60 (Note 4) | -- | 2000 (1093) |
| AMS 3679-2 | Low-conductivity fiber felt insulation, pliable | 6-12 (96-192) | 1.06 (Note 4) | -- | 2000 (1093) |
| AMS 3679-3 | Molded low-conductivity insulation, non-pliable | 18-22 (288-352) | 0.34 (Note 4) | -- | 1800 (982) |
| AMS 3679-4 (R) | Low-conductivity insulation with glass fabric facing and square stitching, pliable | 7-18 (112-288) | -- | 0.60 | 500 (260) |
| AMS 3679-5 (R) | Low-conductivity insulation with ceramic fabric facing and square stitching, pliable | 7-18 112-288) | -- | 0.60 | 2200 (1204) (Note 5) |
| AMS 3679-6 (R) | Low-conductivity insulation with glass fabric facing and square stitching,pliable | 7-18 (112-288) | -- | 0.60 | 1200 (649) |
| AMS 3679-7 | Lightweight low-conductivity insulation with glass fabric facing and square stitching, pliable | 8-12 (128-192) | -- | 0.27 (Note 3) | 500 (260) |
| AMS 3679-8 | Lightweight low-conductivity insulation with glass fabric facing and square stitching, pliable | 6-10 (96-160) | -- | 0.30 (Note 3 ) | 500 (260) |

NOTE 1: When no suffix number is specified, Suffix 1 or Suffix 2 shall apply.

NOTE 2: Shall be determined by a method acceptable to purchaser.

NOTE 3: Determined at a mean temperature of 500 °F (260 °C).

NOTE 4: Calculated values based on core tests.

NOTE 5: 1800 °F (982 °C) for silica (quartz) core or facing.



3.3 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, and free from foreign materials and from imperfections detrimental to usage of the product.

3.4 Sizes:

Widths and lengths shall be as agreed upon by purchaser and vendor except that no piece of a roll shall be less than 48 inches (1.2 m) in length. Usable widths and lengths shall in no case be less than those specified.

3.5 Tolerances:

(R)

The variation from the ordered nominal thickness and density shall be not greater than ±10%.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

(R)

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for binder content (3.1.2), thermal conductivity (3.2.1), linear shrinkage after heating (3.2.2), sizes (3.4), and tolerances (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements are
(R) preproduction tests and shall be performed prior to or on the initial shipment of insulation to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when
(R) requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

(R)

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient insulation shall be taken at random from each lot to perform all required tests, with the exception of thermal conductivity (3.2.1); the number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three. Thermal conductivity measurements shall be made on duplicate samples.

4.3.1.1 (R) A lot shall be all insulation produced in a single production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time.

4.3.1.2 (R) When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample insulation shall be approved by purchaser before insulation for production use is supplied, unless such approval be waived by purchaser. Results of tests on production insulation shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production insulation which are essentially the same as those used on the approved sample insulation. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing, and when requested, sample insulation. Production insulation made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 (R) Shrinkage After Heating: Support a 1 x 12 inch (25 x 305 mm) specimen in the as-received thickness in a horizontal position and heat at maximum use temperature shown in Table 2 ±50 °F (±28 °C) for 4 hours ± 0.2. Measure the length of the specimen at room temperature before and after heating.

4.5.2 (R) Embrittlement: Heat a 0.5 x 3.0 inch (13 x 76) specimen in the as-received thickness at maximum use temperature shown in Table 2 ±50 °F (±28 °C) for 1 hour ± 0.1. Cool to room temperature and bend the specimen 180 degrees around a rod having a diameter which is 0.250 inch (6.35 mm) times the thickness of the specimen, rounded off to the nearest tenth of an inch ± 0.001 (nearest multiple of 2.54 mm ± 0.03).

4.5.3 Breaking Strength (Alternate Method): Suspend a 1 by 12 inch (25 by 305 mm) specimen in the as-received thickness in a vertical position. Attach a mass of 9 grams for each 0.100 inch (2.54 mm) of thickness to the lower end of the specimen. Allow the weight to hang free for at least 60 seconds.