



# AEROSPACE MATERIAL SPECIFICATION

## AMS 3679

Society of Automotive Engineers, Inc.

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Revised

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

### INSULATION, THERMAL, HIGH-TEMPERATURE Alumina-Silica Fiber

#### 1. SCOPE:

- 1.1 **Form:** This specification covers alumina-silica fiber thermal insulation blankets, in the form of flat sheets or rolls.
- 1.2 **Application:** Primarily to provide thermal insulation at continuous hot-face temperatures up to 2300° F (1260° C).
- 1.3 **Classification:** The blanket shall be classified according to average fiber diameter as follows:

Type	Average Fiber Diameter	
	Inch	(Micrometres)
I	0.00055	14.0
II	0.00022	5.6
III	0.00010	2.5
IV	0.00006	1.5

- 1.3.1 The type supplied shall be as specified.

#### 2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 **SAE Publications:** Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

##### 2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

- 2.2 **ASTM Publications:** Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM C167 - Thickness and Density of Blanket- or Batt-Type Thermal Insulating Materials

ASTM C177 - Thermal Conductivity of Materials by Means of the Guarded Hot Plate

ASTM D1448 - Micronaire Reading of Cotton Fibers

ASTM D1682 - Breaking Load and Elongation of Textile Fabrics

ASTM D2130 - Diameter of Wool and Other Animal Fibers by Microprojection

- 2.3 **Government Publications:** Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

##### 2.3.1 Military Specifications:

MIL-B-5924 - Batting, Insulation, Glass Fiber

SAE Technical Board rules provide that: "All technical reports, including standards approved by the Board, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committee members will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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2.4 Other Publications: Available from D. Van Nostrand Co., Division of Litton Educational Publishing Co., 450 West 33rd St., New York, New York 10001.

F. D. Snell and C. T. Snell, "Colorimetric Methods of Analysis," 3rd ed., Vol. II - Inorganics, 1948.

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication: The product 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 following percentages by weight, determined by colorimetric methods in accordance with Snell and Snell, "Colorimetric Methods of Analysis," Vol. II or by other approved analytical method:

	min	max
Aluminum Oxide (Al <sub>2</sub> O <sub>3</sub> )	45.0	55.0
Silicon Dioxide (SiO <sub>2</sub> )	45.0	55.0
Other Inorganics	--	5.0

3.1.1 The blanket may contain up to 5.5% by weight of an appropriate organic binder, unless otherwise specified, for providing improved handling and fabrication characteristics. The binder content shall be determined in accordance with MIL-B-5924.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

3.2.1 Norminal Thickness: 0.1 to 2.0 in. (3 to 51 mm) ASTM C167

3.2.2 Nominal Density: 2 to 24 lb per cu ft (32.0 to 384.4 kg/m<sup>3</sup>) ASTM C167

3.2.3 Average Fiber Diameter: ASTM D1448 or ASTM D2130

	Inch	(Micrometre)
Type I	0.00055	14.0
Type II	0.00022	5.6
Type III	0.00010	2.5
Type IV	0.00006	1.5

3.2.4 Linear Shrinkage After Heating, Max: 2% 4.5.1

3.2.5 Embrittlement: No Separation 4.5.2

3.2.6 Thermal Conductivity: Shall be acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor. ASTM C177 is the preferred method of test.

- 3.2.7 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.
- 3.2.8 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 D1682, Method 1C or the method described in 4.5.3 are recommended methods of test.
- 3.2.9 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.
- 3.3 Quality: The product shall be uniform in quality and condition, clean, and free from foreign materials and from imperfections detrimental to fabrication or to performance.
- 3.4 Size: Widths and lengths shall be as agreed upon by purchaser and vendor except that no piece shall be less than 48 in. (1.2 m) in length, unless otherwise specified. Usable widths and lengths shall in no case be less than those specified.
- 3.5 Tolerances:
  - 3.5.1 The variation from the ordered nominal thickness and density shall be not greater than  $\pm 10\%$ .
  - 3.5.2 The tolerance on average fiber diameter shall be as follows:

Type	Tolerance, Plus and Minus	
	Inch	(Micrometre)
I	0.00004	1.0
II	0.00002	0.5
III	0.00002	0.5
IV	0.00001	0.3

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests:
  - 4.2.1 Acceptance Tests: Tests to determine conformance to binder content (3.1.1), thickness (3.2.1), density (3.2.2), average fiber diameter (3.2.3), linear shrinkage after heating (3.2.4), quality (3.3), size (3.4), and tolerance (3.5) requirements are classified as acceptance or routine control tests.
  - 4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification or periodic control tests.

- 4.3 Sampling: Sufficient material shall be taken at random from each lot of material to perform all required tests, with the exceptions of thickness (3.2.1) and thermal conductivity (3.2.6), in triplicate. Thermal conductivity measurements shall be made on duplicate samples. A lot shall be all product produced in a single production run from the same batch of raw materials under the same fixed conditions and submitted for vendor's inspection at one time.
- 4.4 Approval:
- 4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material 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 material which are essentially the same as those used on the approved sample material. If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material or processing, and, when requested, sample revised material. No production material made by the revised procedure shall be shipped prior to receipt of reapproval.
- 4.5 Test Methods:
- 4.5.1 Shrinkage After Heating: Support a 1 x 12 in. or 25 x 300 mm specimen in the as-received thickness in a horizontal position and heat at  $2300^{\circ}\text{F} \pm 50$  ( $1260^{\circ}\text{C} \pm 28$ ) for  $4\text{ hr} \pm 0.2$ . Measure the length of the specimen at room temperature before and after heating.
- 4.5.2 Embrittlement: Heat a 0.5 x 3.0 in. or 15 x 75 mm specimen in the as-received thickness at  $2300^{\circ}\text{F} \pm 50$  ( $1260^{\circ}\text{C} \pm 28$ ) for  $1\text{ hr} \pm 0.1$ . Cool to room temperature and bend the specimen  $180\text{ deg}$  ( $3.14\text{ rad}$ ) around a rod having a diameter which is 0.250 in. (6.35 mm) times the thickness of the specimen in 0.100 in. (2.54 mm).
- 4.5.3 Breaking Strength (Alternate Method): Suspend a 1 x 12 in. or 25 x 300 mm specimen in the as-received thickness in a vertical position. Attach a mass of 9 g for each 0.100 in (2.54 mm) of thickness to the lower end of the specimen. Allow the weight to hang free for at least 60 seconds.
- 4.6 Reports:
- 4.6.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance tests of this specification and a statement that the product conforms to the other technical requirements. This report shall include the purchase order number, material specification number, vendor's material designation, date of manufacture, lot number, and quantity.
- 4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, supplier's material designation, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.