AEROSPACE MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York, N.Y. 10017

AMS 3830

Issued 11-1-67
Revised

SILICA CLOTH
"B" Stage Phenolic Resin Impregnated High Pressure Molding

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. FORM: Rolls of silica cloth or tape impregnated with phenolic resin and partially processed to a "B" stage condition.

3. APPLICATION: Primarily for tape wrapping into contoured laminates for use as thermal insulators and ablative components.

4. TECHNICAL REQUIREMENTS: When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.

4.1 General:

4.1.1 Material: Unless otherwise specified, the product shall be furnished in rolls of resin impregnated silica cloth partially processed to a "B" stage condition capable of being wrapped, or otherwise assembled, and fully processed by molding at 1000 psi pressure and 300 - 350 F (148.9 - 176.7 C) temperature.

4.1.1.1 The silica cloth shall contain not less than 98.5% silica and shall be produced from glass cloth conforming to the latest issue of MIL-Y-1140, cloth number 184-150.

4.1.1.2 The resin used for impregnating the silica cloth shall be a heat resistant phenolic resin formulated to meet the requirements of the latest issue of MIL-R-9299, Type II, Class 2.

4.1.1.2.1 Unless otherwise specified, the vendor shall further define the properties of the "A" resin by establishing procurement limits for the following characteristics: viscosity, non-volatile matter, pH, specific gravity, water, formaldehyde, and gel time. The purchaser shall be advised of these limits and they shall become a part of this specification as applicable to that specific vendor.

4.1.1.3 The resin as employed for impregnating shall contain no solid fillers or catalysts unless approved by purchaser.

4.1.2 Shelf Life: The preimpregnated material shall have a shelf life of not less than 3 months when stored at a temperature not higher than 45 F (7.2 C). It may be tested at any time during this period for conformance to this specification.

4.2 Uncured Properties of Impregnated Cloth: Unless otherwise specified, the material, when received by the purchaser, shall conform to the following requirements:

Resin Solids (Volatile Free), % by wt	27 - 33	See Note 2
Volatiles, % by wt	4 - 6	See Note 2
Resin Flow, %	3 - 15	See Note 3
Chang Index	28 - 32	See Notes 1 and 4
Advancement Index	0.87 - 0.93	See Notes 1 and 5
Tack, lb, min	2	See Note 6
Drape	Pass	See Note 7

Note 1. Values outside the specified range shall not be cause for rejection if all other requirements of this specification are met.

Note 2. Volatile and resin content shall be determined by accurately weighing (W_1) 4 x 4 in. specimens (or equivalent area) cut from the product. Using porcelain crucibles previously brought to constant weight by igniting at 1550 F ± 50 (843.3 C ± 28), dry specimens in an air circulating oven at 325 F ± 10 (162.8 C ± 5.6) for 20 min., cool in a desiccator, and reweigh (W_2).

Burn out resin in muffle furnace for 3 hr at 1550 F ± 50 (843.3 C ± 28). Cool in a desiccator and reweigh. Repeat 1550 F (843.3 C) burn out, as necessary, to obtain constant weight (W_3).

$$\text{Volatile Content, \%} = \frac{W_1 - W_2 \times 100}{W_1}$$

$$\text{Resin Solids (Volatile Free), \%} = \frac{W_2 - W_3 \times 100}{W_2}$$

where: W_1 = Original Weight

W_2 = Weight of Material After 20 min. at 325 F (162.8 C).

W_3 = Weight of Ash.

Note 3. Cut four 4 x 4 in. panels and weigh to the nearest 0.01 g (W_1). Stack panels between 2 separator sheets, approximately 6 x 8 in., of aluminum foil or equivalent and reweigh samples and foil to nearest 0.01 g (W_2).

Note. If the sample tends to stick to the separator after curing, it is permissible to use a non-volatile mold release agent. Such agents may be used only under conditions such that they do not undergo a weight loss of greater than 0.005 g during curing.

Place panels and separator sheets between press platens preheated to 300 F ± 5 (148.9 C ± 2.8) taking care that the edges of all panels remain properly aligned. Apply pressure of 3200 lbs ± 80 (200 psi ± 5 on panels) and hold for 10 min. while maintaining press platens at 300 F ± 5 (148.9 C ± 2.8). Remove sample and cool in desiccator. Weigh sample with separators to nearest 0.01 g (W_3). Remove separators and resin flash, trimming sample to original 4 x 4 in. size, taking care not to remove any reinforcing fibers. Weigh laminate to nearest 0.01 g (W_4).

$$\text{Resin Flow, \%} = 100 \times \frac{W_1 - (W_2 - W_3) - W_4}{W_1 - (W_2 - W_3)}$$

Note 4. Mix 15 ± 1 g of material with 50 ml of acetone and agitate thoroughly for approximately 10 minutes. Then decant to a 125 ml glass stoppered Erlenmeyer Flask which has been tared to the nearest 0.1 g. (If the liquid shows suspended particles or cloudiness, it will be necessary to filter through filter paper.) Stopper the flask as soon as all the liquid is decanted or filtered into it. Weigh the flask and contents to the nearest 0.001 g (W_1). Obtain the tare weight of an aluminum drying dish (or equivalent) to 0.0001 g (W_2) and carefully pour about 1 g of the solution into the dish. Restopper the flask immediately and re-weigh (W_3). Evaporate most of the acetone from the aluminum dish on an electric hot plate and then place in an oven at 275 F ± 15 (135 C ± 8.3) for 5 minutes. Cool the dish in a desiccator and reweigh to 0.0001 g (W_4). The resin solids content of the solution is then:

$$\text{Resin Solids, \%} = \frac{(W_4 - W_2) \times 100}{W_1 - W_3}$$

If the resin solid content of the solution is less than 4%, discard the solution and prepare another solution by mixing a larger sample for a longer time. Place the flask containing the remaining solution on the pan of a triple beam balance capable of weighing to the nearest 0.1 gram. Add acetone from a squeeze bottle until:

$$\frac{\text{\% Resin Solids} \times (\text{Weight Original Solution})}{4} = \text{Weight Final Solution}$$

Pipette two 25 ml aliquots of this adjusted (4% solids) solution into clean dry 125 ml Erlenmeyer flasks. Quickly titrate the first to an approximate end point (cloudy) with distilled water. Rapidly titrate the second to within 1 ml of this approximation and determine the end point carefully. Report the number of ml of distilled water used for the titration as the Chang Index.

Note 5. Equipment: Double beam infrared spectrophotometer.
Sealed. matched sodium chloride cells with a 0.20 mm path length.

Procedure: Cut sample into 1/2 x 1/2 in. squares. Put 6.0 g of sample into 36 ml of spectro grade acetone and stir occasionally for not less than 10 minutes.

Collect the filtrate passed through a high retention filter paper. Rinse the sample and reference cells with spectro grade acetone. Repeat three times. Dry each cell with dry nitrogen and fill the reference cell with spectro grade acetone. Fill the sample cell with the filtrate. Set the spectrophotometer for double beam operation with a normal slit program and a scanning rate not greater than 1.0 micron per minute. Use a linear transmission recording paper.

Balance the spectrophotometer and set at 12.2 microns. Insert the reference and sample cells. Observe the transmission and adjust the concentration of the remaining filtrate by adding or evaporating acetone at room temperature until the transmission is between 40% and 45%.

Replace the filtrate in the sample cell with filtrate of correct concentration and scan the spectrum from 8.0 to 15.0 microns.

Calculation: Remove the recording paper from the instrument. Determine the transmission values by dropping a perpendicular line from the 100% transmission line to the curve peaks at the 9.8 and 12.2 micron bands.

Convert the transmission values to absorbance values. Absorbance equals the log (1/transmission)

$$\text{Advancement Index} = \frac{\text{Absorbance Value at the 12.2 Micron Band}}{\text{Absorbance Value at the 9.8 Micron Band}}$$

Note 6. Equipment: Pneumatic splicing press with 1 in. diameter aluminum contact pads. The press shall be capable of applying 50 lb ± 5 load. Heated parallel plates with opening of 0.070 - 0.125 in. and capability of being controlled at 200 F ± 5 (93.3 C ± 2.8).

Procedure: Cut two 1 x 4 in. strips with the 4 in. dimension in the warp direction. (Material shall have been stabilized at 75 F ± 5 (23.9 C ± 2.8) in a sealed container for 2 - 3 hr prior to cutting.)

Place specimens on a 1 x 8 in. steel sheet (approximately 0.020 in. thick) so that they longitudinally overlap not less than 1 inch. Insert assembled specimens on the sheet between heated plates maintained at 200 F ± 5 (93.3 C ± 2.8), so that the overlapped section is at the center of the heated space. Heat for 60 ± 2 seconds.

Remove specimens from heater and immediately place in splice press. Lower weight gently and press for 60 sec ± 5 with 50 lb ± 5 load.

Note. Time to transfer from heater to splice press shall not exceed 5 seconds.

Remove specimen from press and from steel sheet. Test, within 15 min. of having made splice, in tensile-shear at an extension rate of 2 in. per minute. Load specimen to failure recording ultimate load to nearest 0.1 pound.

Room in which test is performed shall be controlled to 75 F ± 5 (23.9 C ± 2.8).

Note 7. Specimens approximately 2 in. wide by 10 in. long shall be cut from straight or bias tape. They shall be free of splices, breaks, or obvious defects.

Material shall be stabilized to room temperature of 75 F ± 5 (23.9 C ± 2.8). Then holding specimen at both ends, bend rapidly 180 deg around a 1 in. diameter rod. Material shall not split, flake resin, crack, or break.

4.3 Cured Properties: Unless otherwise specified, the material when molded at 1000 psi into a flat laminate and cured at 300 - 350 F (148.9 - 176.7 C) for 60 min., shall conform to the following requirements.

Specific Gravity, min	1.70	ASTM D792
Flexural Ultimate, psi, min	17,000	ASTM D790
Flexural Modulus, psi, min	2.0×10^6	ASTM D790
Compressive Strength, psi, min	30,000	ASTM D695
Tensile Strength, psi, min	9,000	ASTM D638

5. TESTING FREQUENCY: Unless otherwise specified, the vendor shall test the material according to the following schedule:

Resin Solids	Every master roll
Volatiles	Every master roll
Resin Flow	Every master roll
Tack	Every master roll
Drape	Every master roll
Chang Index	Every master roll
Advancement Index	Every master roll
Specific Gravity	Lot basis
Flexural Strength	Lot basis
Flexural Modulus	Lot basis
Compressive Strength	Lot basis
Tensile Strength	Lot basis

5.1 A lot shall consist of all material treated at one time without significant changes in treater settings of a single batch of resin and reinforcement, and offered for acceptance at one time. Unless otherwise specified, a lot shall not exceed 2000 pounds.

5.2 A master roll is the basic unit offered for acceptance, but shall not exceed 100 yards in length. It shall be the full width of the broadgoods.

6. QUALITY:

6.1 The product shall be uniform in quality and condition, and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.

6.2 Slitting, if ordered, shall be accomplished so that no ragged or frayed edges are produced. No polyethylene shreds or other foreign material shall be evident on the slit edges.

6.3 The length of tape shall be the maximum consistent with quality processing and raw material limitations.

6.4 Method of splicing shall be approved by purchaser. The strength of the splice shall be at least equal to that of parent material. Splices shall be made in such a manner that the joint can be incorporated into the part without detrimental effects in processing or end use of the product. The effects of the splice shall not be discernible during nondestructive testing of the part.