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AEROSPACE MATERIAL SPECIFICATION

AMS 3832

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Revised

GLASS ROVING, EPOXY RESIN IMPREGNATED
Type "S" Glass

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

2. FORM: Continuous, multiple-strand, glass roving impregnated with a heat-curable epoxy resin system and partially processed to a "B" stage condition.

3. APPLICATION: Primarily for filament winding of rocket motor cases, pressure vessels, aircraft, and related structures.

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, insofar as practicable.

4.1 Materials:

4.1.1 Roving: The reinforcement shall be "20 End" Type "S" Glass, treated immediately after forming with a suitable high strength finish.

	min	max	Test Method
Filament Diameter, in	0.00035	- 0.00040	-
Weight, gr/yd	0.560	- 0.640	-
Tensile Strength, psi	525,000	---	ASTM D2343

4.1.2 Resin: Shall be a low pressure epoxy laminating resin modified as necessary to meet the requirements of this specification.

4.2 Splices: No splices or knots shall be introduced during the resin impregnation process.

4.3 Shelf Life: When packaged in vaporproof, heat sealed bags and stored at a temperature not higher than -18 C (-0.4 F), the preimpregnated roving shall have a shelf life of not less than 3 months after the impregnation date.

4.4 Uncured Properties of "B" Stage Epoxy Impregnated Roving: The product, as received, shall conform to the following requirements:

	min	max	
Resin Solids (Volatile Free), % by wt	17	- 23	See Note 1
Volatiles, % by wt	--	3	See Note 1
Gel Time, min.	1	- 4	See Note 2
Resin Flow, % by wt	8	- 17	See Note 3

Note 1. Volatile and Resin Content: Cut three specimens each 72 in. ± 0.1 long. Fold each specimen three times to a length of approximately 9 in. and tie loosely into an overhand bow knot. Weigh each specimen to the nearest 0.001 gram (w). Hang pieces separately on a rack and place in a circulating air oven at 135 C ± 3 (275 F ± 5.4) for 15 min., cool to room temperature in a dessicator, and reweigh each specimen (w_1). Calculate volatiles as follows:

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

where, W = original weight
W_1 = final weight

Using porcelain crucible previously brought to a constant weight by heating for 3 hr at 845 C ± 25 (1553 F ± 45), place specimens in muffle furnace for 3 hr at 565 C ± 25 (1045 F ± 45). Cool in a dessicator and reweigh (W_2). Calculate resin solids as follows:

$$\text{Resin Solids, \% by wt} = \frac{W_1 - W_2}{W_1} \times 100$$

where, W_1 = weight of sample after removing volatiles.

W_2 = final weight of the ash.

Average the results from the three specimens.

Note 2. Gel Time: Precondition a Fisher-Johns Melting Point Apparatus to 165 C ± 1 (329 F ± 1.8). Place a microscope slide on the heated block, allowing 20 - 30 sec for it to reach temperature equilibrium. Cut a piece of roving 1/4 in. ± 1/16 long. Place a sample on heated microscope slide and commence timing. Within 5 sec, place a second microscope slide over the sample. As the resin softens and during the first 30 sec, isolate a drop of resin by gently pressing on the upper slide. Observe lateral movement of the resin drop while periodically pressing on the upper slide. As the resin thickens, the lateral movement will be retarded. A sharp color change and the formation of small droplets when the cover slide is pressed indicate the gel point. Stop the timer and record the elapsed time in minutes as gel time. Report the average of three results.

Note 3. Resin Flow: Cut six lengths of roving each length 3 in. long. Weigh each specimen, consisting of two 3 in. lengths to the nearest 0.001 gram (w). With the lengths spaced 1/2 in. apart, sandwich the specimen between four layers (two on each side of the specimen) of glass cloth conforming to ASTM D2410, type 181-150 or type 181-75G. Preheat a hot plate and a 1500 g metal weight to 150 C ± 5 (302 F ± 9). Place the sandwiched material on the hot plate, cover with the metal weight, and maintain at temperature for 2 min., using a surface thermocouple to ensure maintenance of the required temperature. While still hot, remove the specimens from the sandwich, remove any excess resin, and cool in dessicator to room temperature. Reweigh each specimen to the nearest 0.001 gram (w). Calculate resin flow as follows:

$$\text{Resin Flow, wt \%} = \frac{W - W_1}{W} \times 100$$

where, W = weight of specimen before heating.
W_1 = weight of specimen after removal of excess resin.

Report the average value of the tests on the three specimens.

4.5 Cure: Product shall be capable of being fully processed by filament winding at 12 - 15 psi tension using curing temperature ranges and times recommended by the manufacturer; however, this time, exclusive of the post cure, shall not exceed five hours.

4.6 Mechanical Properties of Cured Composite Product: Specimens fabricated from the "B" stage prepreg in accordance with ASTM D2291 and cured as in 4.5 shall meet the following when tested at 23 C ± 1 (73.4 F ± 1.8). Reported values shall be the average of three tests for each property.

4.6.1 Tensile Strength, psi, min: 380,000

Specimen: ASTM D2343
Test Method: ASTM D2290