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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3672

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Revised

PLASTIC MOLDING COMPOUND, EPI-BIS EPOXY
Glass Fiber Reinforced, Structural

1. SCOPE:

1.1 Form: This specification covers a chopped-glass-fiber filled EPI-BIS epoxy resin molding compound.

1.2 Application: Primarily for high-pressure compression and transfer molding of parts with good properties up to 135°C (275°F).

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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2825 - Material Safety Data Sheets

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

ASTM D638 - Tensile Properties of Plastics
ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics
ASTM D731 - Molding Index of Thermosetting Molding Powder
ASTM D790 - Flexural Properties of Plastics and Electrical Insulating Materials
ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D1895 - Apparent Density, Bulk Factor, and Pourability of Plastic Materials
ASTM D2584 - Ignition Loss of Cured Reinforced Resins
ASTM D3123 - Spiral flow of Low-Pressure Thermosetting Molding Compounds
ASTM F501 - Aerospace Materials Response to Flame, with Verticle Test Specimen (for Aerospace Vehicles Standard Conditions)

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

2.3.2 Military Specifications:

MIL-R-60346 - Roving, Glass, Fibrous

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a modified epoxy resin filled with chopped glass roving and processed to a "B" stage condition.

3.1.1 Resin: Shall be an epoxy resin and curing agent composition modified as necessary to meet the requirements of 3.2.

3.1.2 Roving: Shall be chopped "E" glass fiber roving conforming to MIL-R-60346, Type I, Class 1.

3.1.3 Storage Life: The compound shall meet the requirements of 3.2 when tested at any time up to 4 months from date of receipt by purchaser, provided it has been stored in the original, sealed container at not higher than -18°C (0°F).

3.1.4 Shelf Life: Shall meet the requirements of 3.2 when tested after exposure continuously to relative humidity not higher than 60% and a temperature not higher than 30°C (85°F) for not less than 5 days.

3.2 Properties: The compound shall conform to the following requirements:

3.2.1 Uncured Compound: Shall be as follows; tests shall be performed on the compound as received, after warming to above the dew point in its sealed moisture proof container prior to sampling, in accordance with the test methods specified herein:

3.2.1.1	Resin Content	37% ± 3	ASTM D2584
3.2.1.2	Roving Length	0.5 in. ± 0.1 (12.7 mm ± 0.25)	Visual
3.2.1.3	Compound Flow	Preproduction Value ± 10%	ASTM D731
		Preproduction Value ± 5 in.	ASTM D3123

3.2.2 Cured Product: Shall be as specified in Table I; tests shall be performed in accordance with the specified ASTM methods on specimens cut from test panels prepared as in 4.5.1. Specimens for elevated temperature tests shall be held at the test temperature for not less 10 min. prior to testing. Values for tensile strength and modulus and flexural strength and modulus shall be the average of five specimens for each test; no individual value shall be less than 90% of the minimum average value specified.

TABLE I

Test Number		Test Temperature 77°F ± 9	Test Temperature 275°F ± 9	
1	Tensile Strength, min avg	25,000 psi	19,000 psi	ASTM D638
2	Flexural Strength, min avg	52,000 psi	35,000 psi	ASTM D790
3	Flexural Modulus,	2,600,000 psi	1,900,000 psi	ASTM D790
4	Coefficient of Linear Thermal Expansion	19 to 24 x 10^{-6} in. per in, per deg F	--	ASTM D696
5	Specific Gravity	1.80 to 1.90	--	ASTM D792

TABLE I (SI)

Test Number		Test Temperature 25°C ± 5	Test Temperature 135°C ± 5	
1	Tensile Strength, min avg	170 MPa	130 MPa	ASTM D638
2	Flexural Strength, min avg	360 MPa	240 MPa	ASTM D790
3	Flexural Modulus, min avg	18 GPa	13 GPa	ASTM D790
4	Coefficient of Linear Thermal Expansion	34 to 43 x 10^{-6} (mm/mm)/deg C	--	ASTM D696
5	Specific Gravity	1.80 to 1.90	--	ASTM D792

3.2.2.1 Flame Resistance: Time to extinguish, defined as the total of flame time and glow time, shall not exceed 5.0 sec average or 6.0 sec individual. Burn length shall not exceed 6.0 in. (150 mm) average or 7.2 in. (180 mm) individual. Specimens shall be tested in the vertical position with 60 sec ± 1 flame exposure in accordance with 4.5.2.

3.3 Quality: The molding compound, as received by purchaser, shall be uniform in quality and condition, clean, and free from foreign materials and from contaminants detrimental to usage of the molding compound.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the compound shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the compound conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each lot:

Requirements	Reference Paragraph
Resin Content	3.2.1.1
Roving Length	3.2.1.2
Compound Flow	3.2.1.3
Flexural Strength at 25°C	3.2.2 Test No. 2
Flexural Modulus at 25°C	3.2.2 Test No. 3
Specific Gravity, cured	3.2.2 Test No. 5
Quality	3.4

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of the product to a purchaser, when a change in material 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 requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient compound shall be taken at random from each lot to perform all required tests. The number of specimens for each test shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all compound produced in a single production run from the same batches of polymer and chopped roving and presented for vendor's inspection at one time. A lot shall not exceed 500 lb (225 kg) and may be packaged and delivered in small quantities under a basic lot approval as long as the lot identification is maintained.

4.3.1.1 When a statistical sampling plan and acceptance quality level (AQL) have 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 4.6.1 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 compound shall be approved by purchaser before compound for production use is supplied, unless such approval be waived by purchaser. Results of tests on production compound shall be essentially equivalent to those on the approved samples.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production compound which are essentially the same as those used on the approved sample compound. 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 material and processing and, when requested, sample compound. Production compound made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Specimen Preparation: Each package of compound to be sampled shall be allowed to warm above the dew point before opening the sealed package for sampling. Immediately after sampling, the package shall be resealed and returned to proper storage.

4.5.1.1 Tests for Uncured Product: Shall be performed on room temperature molding compound immediately after sampling.

4.5.1.2 Tests for Cured Product: Shall be performed on specimens cut from test panels 0.125 in. ± 0.010 (3.12 mm ± 0.25) or 0.250 in. ± 0.010 (6.25 ± 0.25 mm) thick and of sufficient size to produce the required specimens. Test panels shall be molded using the following parameters:

Mold temperature	325°F ± 10 (162°C ± 5)
Mold pressure	3,000 psi ± 100 (20,700 kPag ± 700)
Cure time	12.5 min. ± 2.5

4.5.1.2.1 Tensile Specimens: Shall be in accordance with ASTM D638, Type I, with 2.00 in. (50 mm) gage length and cross section of 0.125 x 0.500 in. (3.12 x 12.50 mm).

4.5.1.2.2 Flexural Specimens: Shall be 0.125 x 1.000 x 4.00 in. (3.12 x 25 x 100 mm) or 0.250 x 0.500 x 4.00 in. (6.25 x 12.50 x 100 mm).

4.5.2 Flame Resistance: Shall be determined in accordance with ASTM F501, using three specimens, 0.060 in. ± 0.010 (1.50 mm ± 0.25) thick x 3.0 x 12.0 in. (75 x 300 mm), with the 12 ± in. (300-mm) dimension vertical.

4.6 Reports:

4.6.1 The vendor of the compound shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the compound conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3672, vendor's product identification, lot number, size or part number, and quantity.

4.6.1.1 A material safety data sheet conforming to AMS 2825 or equivalent shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of compound for production use. Each request for modification of formulation shall be accompanied by a revised data sheet for the proposed formulation.

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, AMS 3672, contractor or other direct supplier of compound, supplier's compound number, part number, and quantity. When compound for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of compound to determine conformance to the requirements of this specification, and shall include in the report a statement that the compound conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the compound may be based on the results of testing three additional specimens cut from the same test panels, or from newly prepared test panels cured to the same parameters, for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the compound represented and no additional testing shall be permitted. Results of all tests shall be reported.