Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3844

Issued 7-16-79
Revised

CLOTH, TYPE E-GLASS, STYLE 7781 FABRIC
Hot-Melt, Addition-Type, Polyimide Resin Impregnated

1. SCOPE:

1.1 Form: This specification covers one type of glass cloth impregnated with a heat-reactive, thermosetting, hot-melt, addition-type polyimide resin system, furnished in continuous rolls of full width material.

1.2 Application: Primarily for structural laminates requiring high strength and heat resistance for long-term service up to 230°C (450°F) and short-time service up to 260°C (500°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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2825 - Material Safety Data Sheets
AMS 3824 - Cloth, Type "E" Glass, Finished for Resin Laminates

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 D695 - Compressive Properties of Rigid Plastics
ASTM D790 - Flexural Properties of Plastics and Electrical Insulating Materials
ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D2344 - Apparent Horizontal Shear Strength of Reinforced Plastics by Short Beam Method
ASTM D2584 - Ignition Loss of Cured Reinforced Resins
ASTM D2734 - Void Content of Reinforced Plastics
ASTM D3531 - Resin Flow of Carbon Fiber-Epoxy Prepreg

2.3 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

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be the reinforcement specified in 3.1.1, impregnated with the resin system specified in 3.1.2, supplied in rolls of full width impregnated cloth or slit tape, as ordered.

3.1.1 Reinforcement: Shall be Type "E" Glass, Style 7781 Fabric, conforming to AMS 3824, treated with a suitable finish to produce the required performance characteristics with the resin system specified herein.

3.1.2 Resin: Shall be a 100% reactive, hot-melt, resin system formed by co-reaction of bis-maleimide monomer with a tri-functional monomer and an aromatic diamine, resulting in a thermosetting resin system which thermally cures to form a polyimide structure.

3.2 Storage Life: The impregnated cloth shall have a storage life of not less than three months from the date of shipment when stored or shipped in a barrier container and maintained at a temperature below 4°C (40°F).

3.3 Working Life: The impregnated cloth shall meet the requirements of 3.4 and 3.5 when tested, after warming to room temperature, at any time up to five days after removal from refrigerated storage.

3.4 Properties of Uncured Product: The impregnated cloth, as supplied, shall conform to the following requirements; tests shall be performed on the product supplied, sampled in accordance with 4.3.1 after warming to above the dew point, and tested in accordance with specified test methods:

Resin Content	33% by wt ± 3	4.5.2
Resin Flow	12% ± 3	4.5.3
Tack	Shall obtain tack under slight heating (will adhere to itself)	

3.5 Properties of Cured Laminate: Shall be as specified in Table I, determined on specimens cut from a test laminate prepared as in 4.5.1. Specimens for elevated temperature tests shall be tested after exposure at the test temperature for 30 min. ± 1. For tests 1 through 6, property values specified are the minimum average for 5 determinations per test; no individual value shall be less than 90% of the minimum average value specified.

TABLE I

Test Number	Property	Test Temperature 77°F ± 9	Test Temperature 450°F ± 9	Test Method
1	Tensile Strength, min avg	55,000 psi	50,000 psi	4.5.4
2	Edgewise Compressive Strength, min avg	45,000 psi	30,000 psi	ASTM D695
3	Edgewise Compressive Modulus, min avg	3,000,000 psi	2,500,000 psi	ASTM D695
4	Flexural Strength, min avg	70,000 psi	60,000 psi	ASTM D790
5	Flexural Modulus, min avg	3,000,000 psi	2,500,000 psi	ASTM D790
6	Short-Beam Shear Strength, min avg	6,000 psi	4,000 psi	4.5.5
7	Specific Gravity At 73°/73°F	Qualification Value ± 0.10	–	ASTM D792
8	Void Content, max	5.0%	–	ASTM D2734, Method A

TABLE I (SI)

Test Number	Property	Test Temperature 25°C ± 5	Test Temperature 230°C ± 5	Test Method
1	Tensile Strength, min avg	379 MPa	345 MPa	4.5.4
2	Edgewise Compressive Strength, min avg	310 MPa	207 MPa	ASTM D695
3	Edgewise Compressive Modulus, min avg	20,685 MPa	17,235 MPa	ASTM D695
4	Flexural Strength, min avg	483 MPa	414 MPa	ASTM D790
5	Flexural Modulus, min avg	20,685 MPa	17,235 MPa	ASTM D790
6	Short-Beam Shear Strength, min avg	41.4 MPa	27.6 MPa	4.5.5
7	Specific Gravity at 23°/23°C	Qualification Value ± 0.10	–	ASTM D792
8	Void Content, max	5.0%	–	ASTM D2734, Method A

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

3.7 Tolerances: Unless otherwise specified, the width shall not vary more than +1/2 in. (+13 mm), -0 from the width ordered.

4. QUALITY ASSURANCE PROVISIONS:

4.1 The vendor of the impregnated cloth 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 ensure that the cloth conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the requirements specified in Table II are classified as acceptance tests and shall be performed on each lot.

TABLE II

Property	Paragraph or Table Reference	Sampling	Minimum Number of Specimens per Test
Resin Content, Uncured	3.4	Every Roll	2
Resin Flow	3.4	Lot Basis	4
Resin Content, Cured	4.5.1.2.3	Lot Basis	2 from each test laminate
Specific Gravity, Cured	Table I, Test 7	Lot Basis	2 from each test laminate
Void Content, Cured	Table I, Test 8	Lot Basis	2 from each test laminate
Flexural Strength	Table I, Test 4	Lot Basis	5
Flexural Modulus	Table I, Test 5	Lot Basis	5
Short-Beam Shear Strength	Table I, Test 6	Lot Basis	5

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the initial shipment of impregnated cloth to a purchaser, when a change in material 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, qualification test material shall be submitted to the cognizant qualification 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: Each lot of impregnated cloth shall be sampled at random on the sampling basis specified in Table II, using the number of specimens specified therein for each test. Samples for the test panels required for testing the cured product shall be taken in approximately equal amounts from three locations in the lot, selected randomly. There shall be no more than 500 yd (450 m) of cloth, full width, represented in any one test panel; lots of greater quantity shall require one panel for each 500 yd (450 m) or portion thereof. In addition, a dielectric test panel shall be prepared in accordance with 4.5.1.2.3 and submitted with each lot for dielectric testing by purchaser.

4.3.1.1 A lot shall consist of all cloth treated at one time without significant changes in treater setting using a single batch of resin and reinforcement and presented for vendor's inspection at one time. An inspection lot shall not exceed 2000 yd (1825 m) of full width product.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) for the impregnated cloth 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 Qualification Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample impregnated cloth shall be approved by purchaser before cloth for production use is supplied, unless such approval be waived. Results of tests on production impregnated cloth 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 cloth which are essentially the same as those used on the approved sample impregnated cloth. 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 and processing and, when requested, sample impregnated cloth. Production cloth made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

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

4.5.1.1 Tests of Uncured Product: Specimens shall be cut from test cloth and tested immediately as specified in the applicable test procedure.

4.5.1.2 Preparation of Test Laminate Panels:

4.5.1.2.1 Laminate panels from which tensile test specimens are to be cut shall be composed of eight plies and shall be not less than 14 in. (350 mm) in the warp direction. Laminates from which test specimens for all other tests are to be cut shall be composed of 12 plies and shall be not less than 12 in. (305 mm) square.

4.5.1.2.2 All test laminates shall be layed up with the warp parallel and unnested so that the satin shafts of the warp always face the top of the layup and shall be molded under appropriate pressure and cured in accordance with the resin manufacturer's recommendation. The report shall include the cure and postcure parameters for each test laminate panel.

4.5.1.2.3 A dielectric test panel, 0.540 in. 0.040, -0, (13.72 mm 1.0, -0) approximately 6 x 6 in. (150 x 150 mm) shall be prepared essentially the same as the panels in 4.5.1.2.2 and shall exhibit essentially the same resin content, specific gravity, and void content.

4.5.2 Resin Content, Uncured and Cured: Shall be determined in accordance with ASTM D2584, using 620°C ± 25 (1150°F ± 50).

4.5.3 Resin Flow: Shall be determined in accordance with ASTM D3531, using a platen press preheated to 175°C ± 3 (347°F ± 5) and a pressure of 15 psig ±5 (103 kPag ± 35), holding at heat and pressure for 15 min. ± 5.

4.5.4 Tensile Strength: Shall be determined in accordance with ASTM D638, using the specimen shown in Fig. 1 of this specification.

4.5.5 Short-Beam Shear Strength: Shall be determined in accordance with ASTM D2344, using the specimen shown in Fig. 2 of this specification.

4.6 Reports:

4.6.1 The vendor of impregnated cloth 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 cloth conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number, vendor's material designation, cure cycle for each test panel and panel parameters, quantity, lot number, and roll number.

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

4.6.2 The vendor of finished or semi-finished parts or assemblies shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of impregnated cloth, part number, and quantity. When impregnated cloth for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of cloth to determine conformance to the requirements of this specification, and shall include in the report a statement that the cloth 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 impregnated cloth may be based on the results of testing three additional specimens for each original nonconforming specimen. These specimens shall be cut from additional or newly prepared panels using the same procedures and curing cycles as used on the original panels. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the impregnated cloth represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Impregnated cloth shall be shipped in rolls with ID not less than 3 in. (75 mm).

5.1.2 Impregnated cloth shall be interleaved with a suitable non-adhering, colored separator in a manner to provide an outer wrapping with not less than 2 in. (50 mm) overlap.

5.1.3 Each roll shall be identified by attached removable tags using characters of such size as to be clearly legible and which will not be obliterated by normal handling. Each tag shall show not less than the following information:

CLOTH, TYPE "E" GLASS, STYLE 7781 FABRIC, HOT-MELT, ADDITION-TYPE, POLYIMIDE RESIN IMPREGNATED
AMS 3844
MANUFACTURER'S MATERIAL DESIGNATION _____
PURCHASE ORDER NUMBER _____
DATE OF IMPREGNATION _____
DATE OF SHIPMENT _____
LOT NUMBER _____
ROLL NUMBER, SEQUENTIAL _____
QUANTITY _____

5.1.4 Each roll shall be shipped in a sealed vapor barrier bag. Sufficient desiccant shall be added to each sealed bag to maintain the dew point below 4°C (40°F) for the storage life specified.

5.1.5 The protected rolls shall be packed in an exterior shipping container in such manner that the product will be protected, during shipment and storage, from exposure to weather or any other normal hazard. Each roll shall be shipped in a separate container and shall be supported by the core.

5.1.6 Each exterior shipping container shall be legibly marked with not less than the information specified in 5.1.3, with the following additional markings:

APPROPRIATE WARNINGS OR PRECAUTIONARY NOTICES
PERISHABLE - STORE BELOW 4°C (40°F)

5.1.7 Exterior containers shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the cloth to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.8 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.4, 5.1.5, and 5.1.7 will be acceptable if it meets the requirements of Level C.

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

7. REJECTIONS: Cloth not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 For direct U.S. Military procurement, purchase document should specify not less than the following:

Title, number, and date of this specification
Width of cloth desired
Quantity of cloth desired
Applicable level of packaging (See 5.1.8)

8.2 Products meeting the requirements of this specification have been classified under Federal Stock Class FSCN 9330.