Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 3845

Issued 6-1-74
Revised

CLOTH, TYPE "E" GLASS
"B" Stage Addition Cure Polyimide-Resin-Impregnated

1. SCOPE:

1.1 Form: This specification and its supplementary detail specifications cover glass cloth impregnated with a heat-reactive, thermosetting, addition-cure polyimide resin system, the resin to be supplied in a "B" stage condition.

1.2 Application: Primarily for laminated structural parts requiring high strength and long term heat resistance at temperatures up to 450° F (232° C) and short term exposure up to 554° F (290° C).

1.3 Classification: The material shall be as specified in the applicable detail specifications, wherein each material is defined by form and property characteristics.

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., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 3618 - Resin, Polyimide, Thermosetting, High Heat 290° C (654° F) Resistant
AMS 3824 - Cloth, Type "E" Glass, Finished for Resin Laminates

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

ASTM D638 - Tensile Properties of Plastics
ASTM D790 - Flexural Properties of Plastics
ASTM D2344 - Apparent Horizontal Shear Strength of Reinforced Plastics by Short Beam Method
ASTM D2734 - Void Content of Reinforced Plastics

3. TECHNICAL REQUIREMENTS:

3.1 Detail Specifications: The requirements for a specific material shall consist of all the requirements specified herein in addition to the requirements specified in the applicable detail specification. In the case of any conflict between the requirements of this basic specification and an applicable detail specification, the requirements of the detail specification shall govern.

3.2 Material: Shall be as specified in the applicable detail specification.

3.3 Storage Life: Shall be as specified in the applicable detail specification.

3.4 Properties:

3.4.1 Uncured Properties of Impregnated Material: The product, as received, shall conform to the requirements of this specification and the applicable detail specification.

3.4.2 Properties of Cured Product: The product shall conform to the requirements of the applicable detail specification for tests at 77° F ± 5.4 (25° C ± 3) and be capable of meeting the requirements for tests at 450° F ± 9 (232° C ± 5) and at 554° F ± 9 (290° C ± 5), determined on laminates prepared as in 4.5.1. Properties of laminates of constructions other than as specified in 4.5.1 shall be as agreed upon by purchaser and vendor. The resin content, molding pressure, and cure cycle for each panel shall be reported.

3.5 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.

3.6 Tolerances: Unless otherwise specified, the width shall not vary more than + 1/2 in. (+12.7 mm), -0 from the width ordered.

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 the uncured properties (3.4.1) and the properties of the cured product tested at 77° F (25° C) 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 and the applicable detail specification are classified as qualification or periodic control tests and may be the basis for approval of the product (see 4.4.1).

4.3 Sampling:

4.3.1 Frequency of Sampling: The vendor shall sample and test the product according to the following schedule:

Property		Number of Specimens per Test min	Test Procedure
Resin Solids	Each basic unit	2	4.5.2
Volatile Content	Each basic unit	1	4.5.2
Gel Time	Each basic unit	1	4.5.3
Resin Flow	Each basic unit	1	4.5.4
Tensile Strength	Lot basis	4	4.5.5
Short Beam Shear Strength	Lot basis	4	4.5.6
Flexural Strength	Lot basis	4	4.5.7
Flexural Modulus	Lot basis	4	4.5.7
Void Content	Lot basis	3	ASTM D2734

4.3.2 The basic unit submitted for inspection shall not exceed 250 yd (228 m) in length. It shall be the full width of the broadgoods.

4.3.3 A lot shall consist of all material treated at one time without significant changes in treater settings using a single batch of resin and reinforcement and offered for acceptance at one time. An inspection lot shall not exceed 2000 yd (1828 m).

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 samples for reapproval unless purchaser grants written approval after review of a detailed statement of materials and processing used on the approved sample and those proposed. No production material made by the revised procedure shall be shipped prior to receipt of approval of such procedure.

4.5 Test Methods:

4.5.1 Preparation of Test Laminates: 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. Laminates from which tensile test specimens are cut shall be composed of eight plies and shall be not less than 14 in. (357 mm) in the warp direction. Laminates from which test specimens for all other tests are cut shall be composed of twelve plies and shall be not less than 12 in. (305 mm) square.

4.5.2 Volatile Content and Resin Solids: Accurately weigh to the nearest 0.01 g (W_1) each of four samples 4 in. x 4 in. (102 mm x 102 mm) cut on the bias of the product. Using porcelain crucibles previously brought to constant weight by igniting at 1050° F ± 45 (565.6° C ± 25), dry samples in a circulating air oven at 600° F ± 9 (315.6° C ± 5) for 10 min. ± 30 sec, cool in a desiccator, and reweigh (W_2). Burn out resin in muffle furnace for not less than 180 min. at 1050° F ± 45 (565.6° C ± 25) until fabric is white. Cool in a desiccator and reweigh. Repeat the burn out as necessary to obtain constant weight (W_3).

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

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

where, W_1 = original weight of sample
W_2 = weight of specimen after drying
W_3 = weight of ash

4.5.3 Gel Time: Cut sufficient 2 in. x 2 in. (51 mm x 51 mm) pieces across the roll width to make a sample approximately 0.200 in. (5.08 mm) thick. Place the sample between sheets of cellophane or other suitable film and insert between the platens of a press which has been stabilized at the temperature specified in the applicable detail specification. Apply sufficient pressure to form a bead of resin around the sample. Timing shall begin as soon as pressure is applied. The resin bead shall be probed at intervals with a wire. Gelling will be preceded by the appearance, during probing, of long strands of resin. Probing shall be continued until these long strands of resin no longer occur; the elapsed time shall be recorded as gel time.

4.5.4 Wet Resin Flow: Cut four 4 in. square (102 mm square) pieces on the bias of the weave and weigh to the nearest 0.01 g (W_4). Stack samples between separator sheets approximately 6 x 8 in. (152 x 203 mm) of aluminum foil or equivalent. If the sample tends to stick to the separator sheets after curing, it is permissible to use a nonvolatile 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 cure. Place samples and separator sheets between press platens preheated to the temperature specified in the applicable detail specification, taking care that the edges of all pieces remain properly aligned. Apply pressure of 15 psi ± 5 (103 kPa ± 35) on the sample and hold at heat for 5 min. ± 0.5, taking care that the edges of all pieces remain properly aligned. Remove sample and cool in desiccator. Remove separators and resin flash by trimming sample to original 4 in. x 4 in. (102 mm x 102 mm) size, taking care not to remove any reinforcing fibers. Weigh sample to nearest 0.01 g (W_5).

$$\text{Resin flow, \%} = 100 \times \frac{W_4 - W_5}{W_4}$$

where, W_4 = original weight of sample

W_5 = weight of sample after trimming

4.5.5 Tensile Strength: Shall be determined in accordance with ASTM D638, except that the specimen in Fig. 1 shall be used, at the test temperatures specified in the applicable detail specification.

4.5.6 Short Beam Shear Strength: Shall be determined in accordance with ASTM D2344, except that a flat specimen shown in Fig. 2 shall be used, at the test temperatures specified in the applicable detail specification.

4.5.7 Flexural Strength: Shall be determined in accordance with ASTM D790 at the test temperatures specified in the applicable detail specification.

4.6 Reports:

4.6.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests to determine conformance to the acceptance test requirements and a statement that the product conforms to all other technical requirements of this specification and the applicable detail specification. This report shall include the purchase order number, material specification number, vendor's material designation, cure cycle for each test panel, quantity, lot number, and roll number.

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.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen, cut from the same panel or a newly prepared panel. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product 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 The product shall be shipped in rolls with 3 in. (76 mm) nominal ID.

5.1.2 All material shall be interleaved with a colored separator in a manner to provide an outer wrapping with not less than 2 in. (51 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 the following information:

CLOTH, TYPE "E" GLASS, "B" STAGE ADDITION CURE POLYMIDE RESIN IMPREGNATED
AMS 3845/ *
PURCHASE ORDER NUMBER _____
MANUFACTURER'S DESIGNATION _____
DATE OF MANUFACTURE _____
ROLL NUMBER, SEQUENTIAL _____
DATE OF SHIPMENT _____
LOT NUMBER _____
QUANTITY _____

*Insert applicable detail specification number

5.1.4 Each roll shall be shipped in sealed vapor barrier bags and packaged in outer cartons in such a manner as to insure that the product, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any normal hazard. Each roll shall be shipped in a separate container. The rolls shall be supported by the core.

5.1.5 Package Identification: Each container shall be legibly marked with the following information, except storage temperature may be as agreed upon by purchaser and vendor.

CLOTH, TYPE "E" GLASS, "B" STAGE POLYIMIDE RESIN IMPREGNATED, STYLE 181 SERIES FABRIC
AMS 3845/ *
DATE OF IMPREGNATION _____
PURCHASE ORDER NUMBER _____
DATE OF SHIPMENT _____
LOT NUMBER _____
MANUFACTURER'S NAME _____
PERISHABLE - STORE BELOW _____ (See applicable detail specification)
QUANTITY _____

*Insert applicable detail specification number

5.1.6 The product shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

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

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

8. NOTES:

8.1 Definition of "Capability": The words "shall be capable of" are used to indicate characteristics or properties required in the product but for which testing of each lot is not required. However, if such testing is performed, material not conforming to the requirements may be rejected.