

CARBON (GRAPHITE) FIBER TAPE AND SHEET
Epoxy Resin Impregnated
G 200,000 (1380) Tensile, 18,000,000 (124) Modulus, 120 (250)

1. SCOPE:

- 1.1 Form: This specification covers one type of epoxy-resin-impregnated carbon (graphite) fibers in the form of tape and sheet.
- 1.2 Application: Primarily for use in structural composites requiring high tensile strength up to 120°C (250°F).
- 1.3 Classification: G 200,000 psi (1380 MPa) tensile strength, 18,000,000 psi (124 GPa) tensile modulus carbon (graphite) fiber impregnated with epoxy resin for service up to 120°C (250°F).

2. APPLICABLE DOCUMENTS: See AMS 3894 and the following:

- 2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

- AMS 3729 - Epoxy Resin Matrix, Thermosetting, Moderate Temperature Resistant, Unfilled
- AMS 3892/9 - Tow, Carbon (Graphite) Fiber for Structural Composites, GA 500 (3445) Tensile Strength, 33 (221) Tensile Modulus

2.1.2 Aerospace Recommended Practices:

- ARP 1610 - Physical-Chemical Characterization Techniques, Epoxy Adhesive and Prepreg Resin Systems

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

ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

SAE Technical Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

AMS documents are protected under United States and international copyright laws. Reproduction of these documents by any means is strictly prohibited without the written consent of the publisher.

3. TECHNICAL REQUIREMENTS:

- 3.1 Basic Specification: The complete requirements for procuring the product described herein shall consist of this document and the latest issue of the basic specification, AMS 3894.
- 3.2 Material: The product shall be AMS 3892/9 high tensile strength carbon (graphite) fibers impregnated with epoxy resin formulated to meet the requirements specified herein.
- 3.2.1 Epoxy Resin: Shall be a thermosetting formulation meeting the requirements of AMS 3729 and capable of impregnating carbon fiber tape or sheet.
- 3.2.1.1 Epoxy Resin DSC: Resin in the uncured prepreg shall give an exotherm peak temperature at 5°C/min. of 202° - 222°C (396° - 432°F), determined in accordance with ARP 1610.
- 3.2.2 Storage Life: The product shall meet the requirements of this specification when tested at any time up to 6 months from date of receipt by purchaser provided it has been stored in the original unopened containers at not higher than -18°C (0°F).
- 3.2.3 Working Life: The product shall meet the requirements of this specification when tested after continuous exposure for up to 20 days within the relative humidity and temperature limits shown in Fig. 1.

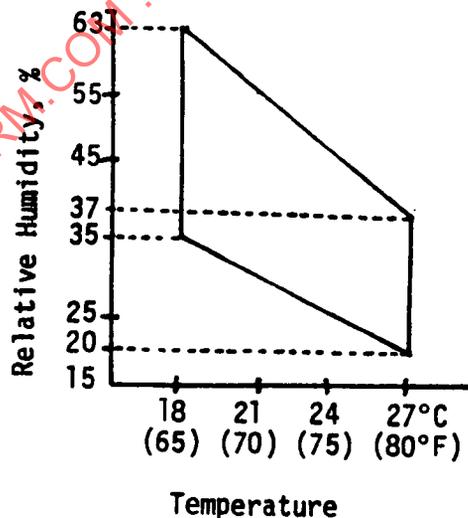


Figure 1

3.3 Properties of Uncured Impregnated Product: Shall be as follows: tests shall be performed on the product after warming to above the dew point prior to sampling and in accordance with test methods listed in the basic specification:

- | | | |
|-------|--|--|
| 3.3.1 | Volatile Content, % of resin weight, max | 1.5 |
| | Test temperature: 150°C + 5 (300°F + 10) | |
| | Test time: 15 - 60 min. | |
| 3.3.2 | Resin Solids Content, % by weight | Preproduction Value ± 3 |
| 3.3.3 | Resin Flow, % by weight | 5 - 25 |
| 3.3.4 | Gel Time, min. | Preproduction Value $\pm 10\%$ |
| 3.3.5 | Tack | Shall adhere for not less than 30 min. |

3.4 Properties of Cured Laminates: Shall be as follows, determined on specimens cut from a test panel prepared as specified in the basic specification. The specific cure cycle is given in 3.4.1 and Fig. 2. The cured laminates shall be tested in accordance with test methods specified in the basic specification.

3.4.1 Cure Cycle:

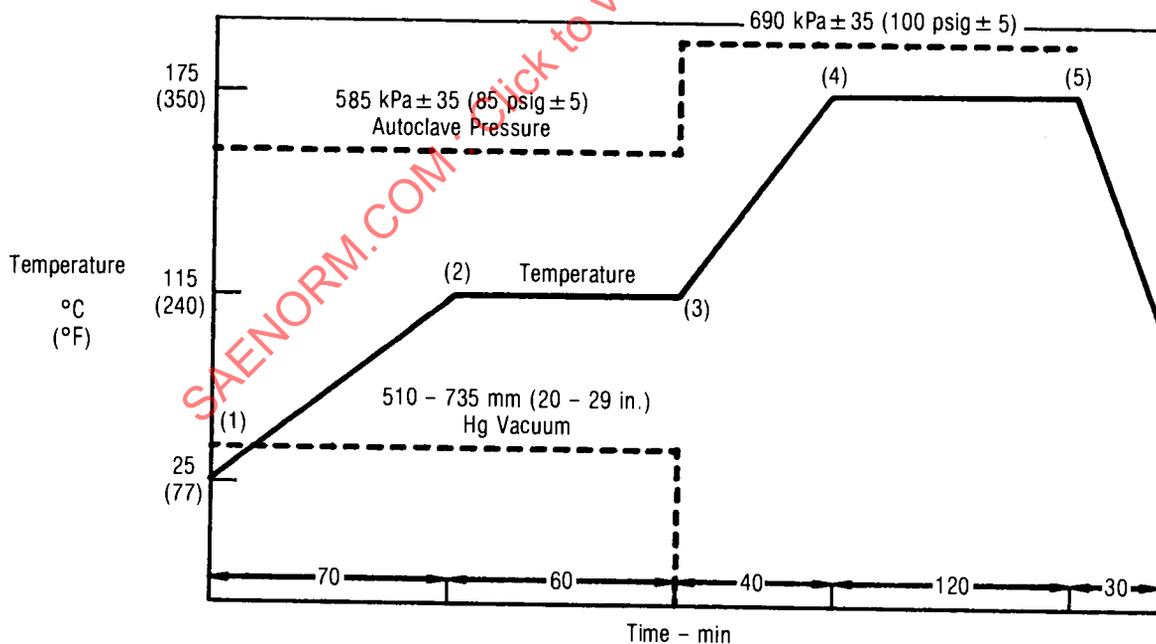


Figure 2

- 3.4.1.1 While maintaining 20 - 29 in. (500 - 735 mm) of mercury vacuum, pressurize autoclave to 85 psig \pm 5 (585 kPa \pm 35).
- 3.4.1.2 Raise part temperature to 115°C \pm 5 (240°F \pm 10) in 20 to 120 min. Hold at 115°C \pm 6 (240°F \pm 10) for 60 - 70 min. while maintaining 20 - 29 in. (500 - 735 mm) of mercury vacuum and 85 psig \pm 5 (585 kPa \pm 35) autoclave pressure.
- 3.4.1.3 After completion of hold at 115°C \pm 5 (240°F \pm 10), increase autoclave pressure to 100 psig \pm 5 (690 kPa \pm 35). When 95 psig (655 kPa) pressure is reached, vent vacuum lines to atmosphere and increase temperature to 177°C \pm 5 (350°F \pm 10) in 15 to 80 minutes.
- 3.4.1.4 Hold at 175°C \pm 5 (350°F \pm 10) for 110 - 130 min. while maintaining 100 psig \pm 5 (690 kPa \pm 35) autoclave pressure.
- 3.4.1.5 Cool under not less than 10 psig (70 kPa) autoclave pressure to 93°C (200°F) in not less than 30 minutes.
- 3.4.2 Post Cure: To raise the resin matrix glass transition temperature and obtain optimum laminate mechanical properties, a post cure cycle is required.
- 3.4.2.1 Autoclave Post Cure: Continue the 175°C \pm 5 (350°F \pm 10) hold for an additional 4 to 4.5 hr at not less than 10 psig (70 kPa) pressure. Cool as described in 3.4.1.
- 3.4.3 Mechanical Properties: Shall be as specified in Table I.
- 3.4.4 Density: Shall be determined on the test laminate used to determine mechanical properties; values for each test laminate shall be reported. Fiber density and cured resin density shall also be reported.
- 3.4.5 Void Content: Shall be not greater than 1%.
4. QUALITY ASSURANCE PROVISIONS: See AMS 3894.
5. PREPARATION FOR DELIVERY: See AMS 3894 and the following:
- 5.1 Exterior package marking shall indicate storage temperature of -18°C (0°F) maximum.
6. ACKNOWLEDGMENT: See AMS 3894.
7. REJECTIONS: See AMS 3894.
8. NOTES: See AMS 3894.

This specification is under the jurisdiction of AMS Committee "C C".