AEROSPACE RECOMMENDED PRACTICE

ARP1674™ REV. A

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Reaffirmed 2022-06

Superseding ARP1674

Automated Manufacture of Continuous Multi-Ply Carbon Fiber/Epoxy Resin Impregnated Broadgoods

RATIONALE

ARP1674A has been reaffirmed to comply with the SAE Five-Year Review policy.

THIS REVISION CONTAINS ONLY EDITORIAL CHANGES.

1. SCOPE:

1.1 This document describes a manufacturing method for processing unidirectional carbon fiber/epoxy resin impregnated sheet and tape into multi-ply broadgoods and tape produced on an automated cross-plying machine. Broadgoods or tape of two or more ply configurations may be processed, where ply orientations of 0°, 45°, 90°, and 135° (as examples) may be automatically layed in a programmed sequence. In all configurations, the 0° ply direction is parallel to the length of the broadgoods roll or sheet, or tape.

1.2 Automated manufacture of continuous multi-ply product of two or more repetitive layers ensures sequential ply orientations at a reduction in manhour expenditure for hand layup of each ply.

2. APPLICABLE DOCUMENTS: The following publications form a part of this document to the extent specified herein. The latest issue of Aerospace Material Specifications 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 3894 - Carbon (Graphite) Fiber Tape and Sheet, Epoxy Resin Impregnated
AMS 3895 - Broadgoods and Tape, Multi-Ply Graphite Fiber/Epoxy Resin Impregnated, Uniform Fiber
AMS 3898 - Interleaf Carrier Material, Composite Tape

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3. TECHNICAL REQUIREMENTS:

3.1 Detail Manufacturing Instruction Sheet: The processing requirements for a specific product should consist of all the requirements specified herein in addition to the requirements specified in the applicable detail manufacturing instruction sheet (DMIS) for that particular ply count and fiber orientation construction. Manufacturing and quality assurance department personnel should approve each DMIS in writing prior to its use.

3.2 Material:

3.2.1 Construction: Multi-ply broadgoods and tapes should consist of a continuous layup of individual plies of epoxy-resin-impregnated carbon fiber tape and sheet conforming to the requirements of AMS 3894 and its applicable detail specification. The multi-ply product, processed to this ARP, should conform to the construction requirements specified in AMS 3895 and its applicable detail specification.

3.2.1.1 When specified, the broadgoods product may be processed in sheet form of specified length and width.

3.2.2 Processed Product: The product, processed in accordance with this ARP, should conform to all requirements specified in AMS 3895. The product, on completion of processing, should be packaged in heat-sealed bags and maintained at a temperature not exceeding -18°C (0°F), as required by AMS 3895.

3.3 Designation: The product should be designated as specified in AMS 3895.

3.4 Separator Material:

3.4.1 Broadgoods for Hand Layup: The product should be interleaved with a suitable nonadherent film and should conform to the requirements of AMS 3895.

3.4.2 Broadgoods for Machine Layup: The product should be interleaved with a nonadherent film conforming to the applicable detail specification of AMS 3898 and to AMS 3895 as specified.

3.5 Take-Up Spools: Broadgoods material take-up spools shall be not less than 52 in. (1300 mm) in length. Hub diameter should be not less than 24 in. (600 mm).

3.6 Ambient Conditions: During this processing operation, the facility temperature should be maintained at 20°C ± 5 (70°F ± 10), and relative humidity should be lower than 70 percent.

3.7 Safety:

3.7.1 Safety glasses and protective clothing should be worn at all times.

3.7.2 Leather gloves should be worn at all times when changing or handling slitter blades.

3.7.3 All switches that control the processing should be maintained in the "OFF" position at all times unless required otherwise by the applicable detail manufacturing instruction sheet.

3.7.4 If at any time during processing, there should be an unusual occurrence which would affect the safety of the operator, this operation shall be immediately terminated. Supervision shall be notified. Operation shall not be resumed until authorized by supervision.

3.8 Multi-Ply Broadgoods Manufacture:

3.8.1 Machine Preparation for Start Up:

3.8.1.1 Each broadgoods run should have a detail manufacturing instruction sheet (3.1) complete and available to operating personnel. The DMIS should specify all machine parameter settings and applicable required options for the run.

3.8.1.2 Adjust all switches to the "OFF" position.

3.8.1.3 Turn on the main electrical power.

3.8.1.4 Disengage the separation (carrier) drive mechanism.

3.8.1.5 Adjust all switches and pressure settings as required by the DMIS. Ensure that the exact machine parameter settings and applicable required options settings are in compliance with the DMIS for the particular broadgoods run.

3.8.2 Inspection Prior to Start Up: Quality assurance personnel should verify that each setting and option is in compliance with the DMIS.

3.8.3 Special Machine Operations:

3.8.3.1 Placement of the impregnated tape during laydown should be observed for unusual or abnormal conditions.

3.8.3.2 Fiber orientation should be verified at the start of each ply laydown and periodically during the run.

3.8.3.3 Broadgoods edge trimmers should be maintained in excellent operating condition to ensure compliance with edge dimension requirements and to prevent fouling of the slitter blades.

3.8.3.4 Separator film removal from individual tape plies should be monitored to prevent any condition that would permit separator film tearing or stripping and to prevent separator fragments from remaining on the product.

3.8.3.5 Observe the operation of the multi-ply compaction rolls for any unusual condition that would permit back-wrapping on the rolls or wrinkle build-up.

3.8.3.6 Observe the operation of the take-up spooling to ensure exact broadgoods placement and uniform spooling.

3.8.3.7 Observe the operation of the machine for any unusual condition that would permit continued manufacture of nonacceptable product. If any such condition exists, the operation shall be immediately terminated, unless correction can be accomplished without causing an unsafe condition. Identify the defective areas in accordance with the requirements of AMS 3895. Correct the condition and proceed with processing the product.

3.8.4 Machine Start-Up and Processing:

3.8.4.1 Begin machine operation and process in accordance with the DMIS requirements.

3.8.4.2 Terminate the machine operation if an unsafe condition occurs (See 3.7.4 and 3.8.3.7) or if a condition occurs which would permit continued manufacture of nonacceptable product (See 3.8.3.7).

3.8.5 Machine Shut-down: Terminate the machine operations at the end of each run of product in accordance with DMIS.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The quality assurance department personnel should be responsible for conducting the required inspections. All inspection records required by AMS 3894, AMS 3898, and AMS 3895 and the associated applicable detail specifications should be retained as specified therein.

4.2 Quality Assurance Inspections:	Paragraph
4.2.1 Approval of the DMIS in writing prior to use.	3.1
4.2.2 Verify use of AMS 3894 and AMS 3898 (when required) materials and configuration specified by AMS 3895.	3.2.1
4.2.3 Verify configuration: fiber directions and ply orientations	3.2.1
4.2.4 Verify sheet form length and width.	3.2.1.1
4.2.5 Verify product designation.	3.3
4.2.6 Verify usage of correct separator material.	3.4
4.2.7 Verify processing temperature and relative humidity.	3.6
4.2.8 Verify that the DMIS requirements are met prior to machine start-up, during processing, and during machine shut-down.	3.8.1 3.8.2 3.8.3 3.8.4 3.8.5