SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3892B

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Superseding AMS 3892A

Fibers, Carbon, Tow and Yarn For Structural Composites

1. SCOPE:

1.1 Form:

This specification and its supplementary detail specifications cover carbon fibers in the form of continuous multifilament tow and yarn.

1.2 Application:

This product has been used typically as reinforcement in composites for structural applications, but usage is not limited to such applications.

1.3 Classification:

The fibers shall be as specified in the applicable detail specifications, wherein each product is defined by form and property characteristics. An example is shown in 8.2. The product covered by each detail specification appears as part of the title.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-414	Sampling Procedure and Table for Inspection by Variables for Percent Defective
MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements

2.2 SACMA Publications:

Available from Suppliers of Advanced Composite Materials Association, 1600 Wilson Boulevard, Arlington, VA 22209.

SRM 12	Lot Acceptance of Carbon Fibers

3. TECHNICAL REQUIREMENTS:

3.1 Detail Specifications:

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

3.2 Material:

3.2.1 Construction: Carbon tow and yarn shall be formed from parallel lays of carbon filaments, lightly stranded when required, to produce a product that may be handled with care without material or property degradation. The product shall be supplied in the following forms:

3.2.1.1 Tow: Untwisted (UT) or never twisted (NT) bundle of continuous filaments.

3.2.1.2 Yarn: Tow with some degree of intentional twist in its final form twisted tow (TT).

3.2.2 Finish: A finish or treatment may be applied to the fiber during or after manufacture to improve handling or to improve properties of the resultant composite structure.

3.2.2.1 Surface Treatment: A surface treatment which normally enhances coupling of the matrix resin to the fibers may be applied to the fiber. Surface treatment differences require separate lot designations.

3.2.2.2 Sizing: Sizing may be applied to the fiber during or after manufacture to improve the handling properties during subsequent processing. Changes in sizing content or type require separate lot designations.

3.2.3 Fiber Splices: Shall be permitted and shall be appropriately identified.

3.2.4 Storage Life: The product,when packaged as in 5.1,shall be readily strippable from the spool and the filaments shall be spreadable after storage of the product as specified in the applicable detail specification.

3.3 Properties:

The product shall conform to properties shown in Table 1 and values shown in the applicable detail specifications. Tests shall be performed on the product supplied and in accordance with SRM 12, unless otherwise indicated. Alternate test methods may be used provided the methods are acceptable to purchaser.

TABLE 1 - Properties

Property	Test Procedure
Tensile Strength	
Tensile Modulus	
Ultimate Elongation	
Mass per Unit Length	
Finish Content	4.5.1
Density	
Yarn Twist [Never Twisted (NT) fiber need not be tested for twist]	
Oxidation Resistance	4.5.2

3.4 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, and free from foreign materials and from imperfections detrimental to usage of the product.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for construction (3.2.1), properties in accordance with 3.3 or as specified in the applicable detail specification, and quality (3.4) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of the product to a purchaser, when a change in ingredients 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, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Shall be in accordance with Table 2 and SRM 12, except as indicated in 4.3.1.1. The unit of product used for sampling shall be 1 pound (0.5 kg). Form 2 shall be used when tightened inspection is to be implemented. General Inspection Level IV shall be used.

TABLE 2 - Minimum Specimens per Sample

Property	Specimens per Sample
Tensile Strength	4
Tensile Modulus	4
Ultimate Elongation	4
Mass per Unit Length	1
Finish Content	1
Density	1
Yarn Twist [Never Twisted (NT) fiber need not be tested for twist]	1
Oxidation Resistance	2

4.3.1.1 For twist, the minimum number of samples per lot shall be ten.

4.3.1.2 A lot shall be all product produced in a single production run on the same equipment within a defined set of process parameters and precursor materials which have a unique identification and shall be traceable to all precursor materials used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample product shall be approved by purchaser before product for production use is supplied, unless such approval be waived by purchaser. Results of tests on production product shall be essentially equivalent to those on the approved samples.

4.4.2 Vendor shall use ingredients, manufacturing procedures and equipment, and methods of inspection on production product which are essentially the same as those used on the approved sample product. If necessary to make any significant 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 ingredients and/or processing and, when requested, sample product. Production product made by the revised procedures shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Finish Content: Shall be determined in accordance with SRM 12. An inert atmosphere shall be maintained until the sample has cooled to below 100 °C (212 °F). A standard of unsized fiber shall be periodically tested to monitor conditions such that no fiber is being degraded.

4.5.2 Oxidation Resistance of Fiber: Shall be determined as follows: If the fiber contains a sizing, the test shall be conducted on the sized fiber and the weight of finish, determined in 4.5.1, shall be subtracted from the weight determined herein. Samples shall be run in duplicate.

4.5.2.1 Specimen Preparation: Form approximately 2 grams of yarn or tow into a loop approximately 2 inches (51 mm) in diameter, dry in a suitable oven at 75 °C ± 1 (167 °F ± 2) for not less than 16 hours, and weigh (W_d) to the nearest 0.1 milligram.

4.5.2.2 Procedure: Place the dry specimen in a circulating-air oven, with at least one change of air per minute, in a manner to prevent damage to the specimen; expose for the time and temperature specified in the applicable detail specification. After hot air exposure, weigh the specimen to the nearest 0.1 milligram.

4.5.2.3 Calculation: Determine the weight percent loss under the specified conditions as shown in Equation 1 and Equation 2.

$$W_{1a}(\text{unsized fiber}) = \frac{W_d - W_a}{W_d} \times 100 \qquad \text{(Eq.1)}$$

$$W_{1a}(\text{sized fiber}) = \frac{W_d - W_a}{W_d} \times 100 - \text{wt \% of finsh (See 4.5.1)} \qquad \text{(Eq.2)}$$

where:

W_{1a} = percent weight loss in hot air due to oxidation
W_d = fiber weight after drying (mg)
W_a = fiber weight after hot air exposure (mg)

4.6 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and the lot average test results and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3892B and the applicable detail specification number and its revision letter, if any, vendor's identification, treatment or finish, date of manufacture, and net weight of fiber included in the shipment. The date of manufacture shall be defined as the date of initiation of manufacture of a given lot of fiber.

4.7 Resampling and Retesting:

Shall be in accordance with SRM 12.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The product shall be supplied in continuous lengths on spools. Winding shall be uniform and provide for proper unreeling. Outer ends shall be secured.

5.1.2 Spools:

5.1.2.1 Identification: Each spool shall be legibly marked with a label on the inside surface of the core, or with a tag suitably attached to the spool, showing not less than the following information:

FIBERS, CARBON, TOW AND YARN
AMS 3892B/*
MANUFACTURER'S IDENTIFICATION_____
LOT NUMBER _____
TYPE OF FINISH _____
NOMINAL NET WEIGHT _____

* Insert applicable detail specification number and revision letter.

5.1.2.2 Spool Wrap: Each spool of product shall be packaged to protect it from damage and contamination.

5.1.3 Exterior Packaging:

5.1.3.1 Individually wrapped spools of product shall be packaged in an exterior shipping container so that the spools, during normal handling, shipping, and storage, will be protected from exposure to moisture, weather, or any other normal hazard.

5.1.3.2 Each shipping container shall be permanently and legibly marked with not less than the following information:

FIBERS, CARBON, TOW AND YARN
AMS 3892B/*
PURCHASE ORDER NUMBER
MANUFACTURER'S IDENTIFICATION
NET WEIGHT
NUMBER OF SPOOLS
GROSS WEIGHT

* Insert applicable detail specification number and revision letter.

5.1.4 Packages of the product 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 product to ensure carrier acceptance and safe delivery.

5.1.5 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-2073-1, Commercial Level, unless Level A is specified in the request for procurement.

6. ACKNOWLEDGMENT:

A vendor shall mention this specification number and the detail specification number and their revision letters, if any, in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Product not conforming to this specification or an applicable detail specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 The change bar (|) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification.