SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3500 REV. G

Issued 1942-01
Revised 1995-08
Noncurrent 1995-08
Stabilized 2011-11

Superseding AMS3500F

Leather, Chrome-Vegetable Retanned, Cattle Hide Fuel and Hot Oil Resistant

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared "Stabilized" by SAE CE, Elastomers Committee, and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

1.1 Form: This specification covers leather tanned with chromium salts and retanned with vegetable tanning material.

1.2 Application: Primarily for parts, such as packings, washers, and back-up rings, requiring resistance to fuel and to hot, petroleum-base lubricating oil.

1.3 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 applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 471 - Rubber Property - Effect of Liquids
ASTM D 573 - Rubber - Deterioration in an Air Oven
ASTM D 2209 - Tensile Strength of Leather
ASTM D 2617 - Total Ash in Leather
ASTM D 2807 - Chromic Oxide in Leather (Perchloric Acid Oxidation)
ASTM D 2810 - pH of Leather
ASTM D 2813 - Sampling Leather for Physical and Chemical Tests
ASTM D 2868 - Nitrogen Content (Kjeldahl) and Hide Substance Content of Leather

2.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.2.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication: The product shall consist of butt ends, close trimmed from green salted steer hides, tanned with chromium salts and retanned with vegetable tanning material. The tanning process shall be such that, in retanning with vegetable tanning material, the leather will be tanned throughout so that examination of a cross-section will show no indication of a chrome streak. The tanning process shall also preserve the highest percentage of natural fiber of the butt and bring the fiber into closest contact.

3.1.1 Impreanation: Leather shall not be impregnated except for the greases and oils used in currying.

3.1.2 Color: No dyes except the tanning agents shall be used.

3.1.3 Composition: Leather shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

3.1.3.1 Hide Substance	40 - 60%	ASTM D 2868
3.1.3.2 Vegetable Tanning Material	20 - 35%	4.5.1
3.1.3.3 Petroleum Ether Extract	10 - 18%	4.5.2
3.1.3.4 Total Ash, maximum	7%	4.5.3
3.1.3.5 Chromic Oxide (Cr_2O_3), minimum	3%	4.5.4
3.1.3.6 Acidity (pH), minimum	3.0	ASTM D 2810
3.1.3.7 Glucose	None	4.5.1

3.2 Properties: Leather shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

3.2.1 As-Received:

3.2.1.1 Tensile Strength:		ASTM D 2209
Minimum Average of 5 specimens	2500 psi (17.2 MPa)	
Individual Minimum	2000 psi (13.8 MPa)	
3.2.1.2 Deflection, maximum	0.63 inch (16.0 mm)	4.5.5
3.2.1.3 Bend 180 degrees	No cracks	4.5.6
3.2.2 Fuel Resistance:		4.5.7
3.2.2.1 Deflection, maximum	0.63 inch (16.0 mm)	
3.2.2.2 Bend 180 degrees	No cracks	
3.2.3 Lubricating Oil Resistance:		4.5.8
3.2.3.1 Linear Shrinkage, maximum	1 5%	
3.2.3.2 Bend 180 degrees	No cracks	
3.2.4 Mater Resistance:		4.5.9
3.2.4.1 Deflection, maximum	0.63 Inch (16.0 mm)	
3.2.4.2 Bend 180 degrees	No cracks	
3.2.5 Dry Heat Resistance:		4.5.10
3.2.5.1 Deflection, maximum	0.63 inch (16.0 mm)	
3.2.5.2 Linear Shrinkage, maximum	5%	
3.2.5.3 Bend 180 degrees	No cracks	

3.2.6 Forming: Leather shall be capable of being formed without tearing, cracking, or noticeably wrinkling.

3.2.7 Oozing: Leather shall not ooze on flat surfaces or edges. Leather showing evidence of oozing within six months of receipt by purchaser shall be subject to rejection.

3.3 Quality:

3.3.1 Leather, as received by purchaser, shall be firm and solid, free from shoulder and belly portions and from holes, slaughter cuts, brand marks, deep wrinkles, soft, harsh, raw, or spongy spots, grub holes, and other imperfections detrimental to usage of the leather.

3.3.2 Leather shall be full grain with the flesh side smooth and free from loose flesh. Leather may be shaved to an even thickness. The grain side shall be tight, smooth, and free from soapstone, chalk, or other smoothing material.

3.3.3 Leather shall be free from hard spots or grit that will scratch polished metal surfaces.

3.4 Tolerances: A variation in thickness of ±0.016 inch (0.41 mm) will be permitted.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of leather 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 leather conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1.3), properties as received (3.2.1), and fuel resistance (3.2.2) 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 leather 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 forprocurement.

4.3 Sampling and Testing: Shal 1 be in accordance with ASTM D 2813 and as follows:

4.3.1 For Acceptance Tests: Each lot of leather shall be 100% visually examined for quality (3.3) and sampled at random for all other tests with the number of determinations for each requirement to be as specified in the applicable test procedure, or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all leather produced in a single production run under the same fixed conditions and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 square feet (46 m^2) and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan has 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 shall state that such plan was used.

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

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production leather which are essentially the same as those used on the approved sample leather. If necessary to make any 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 leather. Production leather made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Veaetable Tanning Material and Glucose: Shall be determined by procedures agreed upon by purchaser and vendor.

4.5.2 Petroleum Ether Extract: Dice 10 - 12 grams of leather into approximately 0.13 inch (3.3 mm) cubes. Place in a weighed weighing bottle and dry at 100° - 105°C (212° - 219°F) for not less than 16 hours. Cool and weigh the dried leather and bottle. Transfer the dried leather to a Soxhlet extraction thimble. Add 200 mL of petroleum ether to a weighed 250 mL flask. Assemble the Soxhlet apparatus to the flask and adjust the heat so that the siphon chamber fills in about 15 minutes. Complete 20 - 25 extraction cycles. Cool the apparatus, remove the extraction thimble, wash the siphon chamber with 25 mL of petroleum ether, and add the washings to the flask. Evaporate the ether on a steam bath, dry the flask for 30 - 35 minutes at 100° - 105°C (212° - 219°F), cool, and weigh. Calculate the petroleum ether extract (evaporation residue in the flask) as a percentage of the dried weight of the leather.

4.5.3 Total Ash: Air dry the extracted leather (from the Soxhlet thimble of 4.5.2) for 10 - 15 minutes and oven dry for 30 - 35 minutes at 100° - 105°C (212° - 219°F). Determine ash content of the extracted, dried leather in accordance with ASTM D 2617.

4.5.4 Chromic Oxide: Shall be determined in accordance with ASTM D 2807 on the ash from 4.5.3.

4.5.5 Deflection: Cut specimens approximately 0.13 x 1 x 3 inches (3.3 x 25 x 76 mm). Support specimen as a horizontal cantilever beam, with flesh side down, with 2.50 inches (63.5 mm) of free span. Attach a 45-gram weight to the midwidth of the strip at a distance of 2 inches (51 mm) from the supported end. Measure the resultant deflection from horizontal at the end of the strip. This test applies only to leather nominally 0.13 inch (3.3 mm) thick but other thicknesses shall be of the same grade of leather.

4.5.6 Bending: Specimens shall be bent at room temperature around a diameter equal to two times the nominal thickness of the leather with the flesh side of the leather on the inside of the bend.

4.5.7 Fuel Resistance: Specimens shall be immersed in ASTM Reference Fuel A for 60 minutes ± 2 at 20° - 30°C (68° - 86°F) in accordance with ASTM D 471. After removal, specimens shall be allowed to rest for 60 minutes ± 5. Deflection and bending tests shall be conducted in accordance with 4.5.5 and 4.5.6.

4.5.8 Oil Resistance: Specimens shall be immersed in ASTM Oil No. 1 for 120 seconds ± 15 at 225°C ± 3 (437°F ± 5) in accordance with ASTM D 471. Shrinkage shall be measured immediately after removal. Bending tests shall be conducted in accordance with 4.5.6.

4.5.9 Water Resistance: Specimens shall be immersed in boiling water for 10 minutes ± 1 in accordance with ASTM D 471. Shrinkage shall be measured immediately after removal. Specimens shall be allowed to rest for 60 minutes ± 5 and subjected to deflection and bending tests in accordance with 4.5.5 and 4.5.6.

4.5.10 Dry Heat Resistance: Specimens shall be aged in accordance with ASTM D 573 for 60 minutes ± 2 at 95°C ± 1 (203°F ± 2). Shrinkage shall be measured immediately after removal from the oven. Specimens shall be allowed to rest for 60 minutes ± 5 and subjected to deflection and bending tests in accordance with 4.5.5 and 4.5.6.

4.6 Reports: The vendor of leather shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the leather conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS-3500E, and quantity.