



# AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

## AMS 3500C

Superseding AMS 3500B

Issued 1-1-42

Revised 6-15-75

### LEATHER, CHROME - VEGETABLE RETANNED Fuel and Hot Oil Resistant

#### 1. SCOPE:

- 1.1 Form: This specification covers leather, tanned first 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.

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., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

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

ASTM D471 - Change in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids

ASTM D573 - Accelerated Aging of Vulcanized Rubber by the Oven Method

ASTM D2209 - Tensile Strength of Leather

ASTM D2617 - Total Ash in Leather

ASTM D2807 - Chromic Oxide in Leather (Perchloric Acid Oxidation)

ASTM D2810 - pH of Leather

ASTM D2813 - Sampling Leather for Physical and Chemical Tests

ASTM D2868 - Nitrogen Content (Kjeldahl) and Hide Substance

#### 3. TECHNICAL REQUIREMENTS:

- 3.1 Material and Fabrication: The product shall consist of butt ends close trimmed from green salted steer hides, tanned first 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 Impregnation: 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.

SAE Technical Board rules provide that: "All technical reports, including standards prepared and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

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

Ø 3.1.3.1	Hide Substance	40 - 60%	ASTM D2868
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, max	7%	4.5.3
3.1.3.5	Chromic Oxide (Cr <sub>2</sub> O <sub>3</sub> ), min	3%	4.5.4
3.1.3.6	Acidity (pH), min	3.0	ASTM D2810
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 the specified test methods, insofar as practicable:

3.2.1 As-Received:

3.2.1.1 Tensile Strength: ASTM D2209

Minimum Average of 5 specimens      2500 psi  
(17.2 MPa)

Individual Minimum      2000 psi  
(13.8 MPa)

3.2.1.2 Deflection, max      0.63 in.      4.5.5  
(16.0 mm)

3.2.1.3 Bend 180 deg (3.14 rad)      No cracks      4.5.6

3.2.2 Fuel Resistance:      4.5.7

3.2.2.1 Deflection, max      0.63 in.  
(16.0 mm)

3.2.2.2 Bend 180 deg (3.14 rad)      No cracks

3.2.3 Lubricating Oil Resistance:      4.5.8

3.2.3.1 Linear Shrinkage, max      15%

3.2.3.2 Bend 180 deg (3.14 rad)      No cracks

3.2.4 Water Resistance:      4.5.9

3.2.4.1 Deflection, max      0.63 in.  
(16.0 mm)

3.2.4.2 Bend 180 deg (3.14 rad)      No cracks

SAENORM.COM : Click to view the full PDF of AMS3500C

3.2.5 Dry Heat Resistance:

4.5.10

- 3.2.5.1 Deflection, max 0.63 in.  
(16.0 mm)
- 3.2.5.2 Linear Shrinkage, max 5%
- 3.2.5.3 Bend 180 deg (3.14 rad) 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 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 fabrication or to performance of parts.

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 permissible variation in thickness of  $\pm 0.016$  in. (0.41 mm) will be permitted.

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 composition (3.1.3), properties as received (3.2.1), and fuel resistance (3.2.2) 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 are classified as qualification or periodic control tests.

Ø 4.3 Sampling: Shall be in accordance with ASTM D2813.

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 for reapproval a statement of the proposed changes in material and processing and, when requested, sample revised material. No production material made by the revised procedure shall be shipped prior to receipt of reapproval.

4.5 Test Methods:

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

4.5.2 Petroleum Ether Extract: Dice 10 - 12 g of leather into approximately 0.13 in. or 3 mm cubes. Place in a weighed weighing bottle and dry at 210° - 220° F or 99° - 104° C 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 cm<sup>3</sup> of petroleum ether to a weighed 250-cm<sup>3</sup> 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 cm<sup>3</sup> of petroleum ether, and add the washings to the flask. Evaporate the ether on a steam bath, dry the flask for 30 - 35 min. at 210° - 220° F or 99° - 104° C, 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 min. and oven dry for 30 - 35 min. at 210° - 220° F or 99° - 104° C. Determine ash content of the extracted, dried leather in accordance with ASTM D2617.

4.5.4 Chromic Oxide: Shall be determined in accordance with ASTM D2807 on the ash from 4.5.3.

4.5.5 Deflection: Cut specimens approximately 0.13 x 1 x 3 in. or 3 x 25 x 75 mm. Support specimen as a horizontal cantilever beam, with flesh side down, with 2.50 in. (63.5 mm) of free span. Attach a 45-g weight to the midwidth of the strip at a distance of 2 in. (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 in. or 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 min.  $\pm 2$  at 68° - 86° F (20° - 30° C) in accordance with ASTM D471. After removal, specimens shall be allowed to rest for 60 min.  $\pm 5$ . 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 sec  $\pm 15$  at 437° F  $\pm 5$  (225° C  $\pm 2.8$ ) in accordance with ASTM D471. 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 min.  $\pm 1$  in accordance with ASTM D471. Shrinkage shall be measured immediately after removal. Specimens shall be allowed to rest for 60 min.  $\pm 5$  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 D573 for 60 min.  $\pm 2$  at 200° F  $\pm 2$  (93.3° C  $\pm 1.1$ ). Shrinkage shall be measured immediately after removal from the oven. Specimens shall be allowed to rest for 60 min.  $\pm 5$  and subjected to deflection and bending tests in accordance with 4.5.5 and 4.5.6.