

CANCELLED

AERONAUTICAL MATERIAL SPECIFICATION

AMS 3535 B

Society of Automotive Engineers, Inc.
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BARRIER MATERIAL, WATER VAPOR RESISTANT, FLEXIBLE, OPAQUE

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. APPLICATION: Primarily for envelopes or bags for enclosing aircraft engines, accessories and spare parts when desiccated for shipment or storage.
3. MATERIAL: Shall be an opaque, flexible, moisture resistant sheet consisting of one or more plies.
4. TECHNICAL REQUIREMENTS:
 - 4.1 Water Vapor Transmission Rate: Shall not exceed 0.05 g of water per 100 sq in. per 24 hr when determined as follows:
 - 4.1.1 Humidity Cabinet: Shall be the General Foods Water Vapor Transmission Cabinet or equivalent. The cabinet shall provide a relative humidity of $90\% \pm 2$ at $100\text{ F} \pm 0.5$, with no condensation on the test dishes or in the space in which the dishes are placed. Circulation over the test dishes shall be negligible.
 - 4.1.2 Test Dishes and Brass Template: Shall be made as shown in Figure 1, or be the equivalent.
 - 4.1.3 Specimens:
 - 4.1.3.1 As Received: Two representative samples of the film, each 6 in. square, shall be selected. Four equidistant parallel folds shall be placed in each square by alternating the direction of folding on each successive fold so that the apex of each successive fold is facing an opposite side of the sheet, in accordion style. The folded square shall then be created by placing it between two 6 x 10 in. flat, rigid plates and applying a total weight of 36 lb (6 lb per in. of length of fold) for 1 minute. The center of gravity of the weight shall be over the center of the sample. The squares shall be opened and the folding and creasing under weight repeated, making the second series of four folds perpendicular to the original folds. A circular specimen shall then be cut from the center of the creased square.
 - 4.1.3.2 Heat Sealed: Four representative samples of the film, each 4 x 6 in. shall be selected. Two samples are then heat sealed along the 6 in. length in a fin type seal approximately 1 in. wide, made in accordance with good commercial practice and otherwise meeting the requirements of 4.2. Two such samples are prepared and allowed to rest, after formation of the seals, for not less than 24 hr at room temperature before testing. A circular specimen shall be cut from each sample so that the joint of the seal falls on a diameter of the specimen. These specimens are to be tested with the fin on the external surface of the test dish assembly.

Section 7C of the SAE Technical Board rules provides that: "All technical reports, including standards approved 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 Committee will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

4.1.3.3 After Oil Exposure: Two samples after treatment as in 4.5 shall be wiped clean of oil and a circular specimen cut from each.

4.1.4 Procedure:

- 4.1.4.1 A 50 ml beaker shall be filled with 8 mesh anhydrous calcium chloride (minimum 96% as CaCl_2) and then emptied into a thoroughly cleaned test dish. The calcium chloride shall be spread evenly over the bottom surface of the dish and the test specimens placed over the calcium chloride, concentric with the rim of the dish. The brass template (Figure 1) shall be carefully placed over the specimen, taking care to have the template centralized with respect to the dish top before allowing it to come into contact with the specimen.
- 4.1.4.2 A wax mixture consisting of 60% amorphous wax and 40% paraffin wax shall be heated in a porcelain casserole to at least 212 F. It shall then be poured through a 20 mesh screen to remove any large pieces of foreign matter that may be in the wax.
- 4.1.4.3 The wax mixture shall be poured into the annular space between the template and the rim of the test dish, filling this space approximately flush with the top of the template. The dish shall then be cooled to harden the wax sufficiently so that the template can be removed. Care shall be taken not to cool the dish so long as to make the wax hard and brittle. The template shall be removed by inserting a screw driver under an ear of the template and giving a slight twist, tending to press the wax against the dish and at the same time raising the template. This shall be done on three ears of the template. An difficulty experienced in extracting the template from the dish can be overcome by first rubbing the edge of the template with petrolatum before pouring the wax.
- 4.1.4.4 After the template has been removed, the assembly shall be inspected for loose pieces of wax, etc., and examined for flaws in the seal. It shall then be conditioned in the humidity cabinet as follows, according to the construction of the material being tested, any surface coating 0.001 in. or more in thickness being considered a ply, but no laminate being considered a ply: Material of 1 or 2 plies, 24 hr; material of 3 or more plies, 48 hours. Assemblies shall then be removed from the humidity cabinet, cooled to room temperature in a suitable desiccator containing anhydrous calcium chloride or its equivalent, and weighed on an analytical balance. The assembly shall then be replaced in the humidity cabinet for a period of 68 hr, removed, cooled as before and reweighed. The cycle of exposure in the humidity cabinet, cooling and weighing shall be repeated at intervals of 24 hr thereafter until 2 consecutive weighings indicate that a practically constant rate of moisture transmission has been attained.

4.1.4.5 The unit of moisture transmission shall be grams of moisture per 100 sq in. of area per 24 hr, and shall be calculated as follows:

$$\text{Transmission Rate} = \frac{(W_2 - W_1) \times 2400}{T \times A}$$

Where:

W_1 = Weight (in grams) before exposure period

W_2 = Weight (in grams) after exposure period

T = Exposure period (in hours)

A = Area (in square inches) of opening

4.1.4.6 Test results on the three types of specimens shall be averaged separately. In case of a variance greater than 20% in either sealed, folded, or oil immersed specimens, a duplicate set of tests shall be run to determine whether this difference is due to an error in the procedure or to non-uniformity of sheet.

4.2 Heat Sealability and Seal Strength: Material shall be capable of being heat sealed by commercially available sealing equipment to form a seal whose water vapor transmission rate is not greater than that specified in 4.1. The seal shall be capable of withstanding static load of not less than 2 lb per in. length of seam, when tested as follows:

4.2.1 Each specimen shall be prepared by heat sealing two 1 in. wide strips with a lap of approximately 1 in., the seal being across the width of the specimen and in a plane perpendicular to the plane of the remainder of the specimen. Specimens shall be allowed to rest, after formation of the seals, for not less than 24 hr at room temperature before testing. Specimens shall be clamped in the jaws of testing apparatus with seal midway between jaws and with line of seal perpendicular to direction of load. Each seal shall withstand a load of 2 lb for 1 hr at $77\text{ F} \pm 5$, without separation of more than 1/4 in. occurring at seam line and without mechanical destruction of the water vapor resistant ply. Failure of any of 6 specimens to withstand such loading shall be cause for rejection of material.

4.3 Corrosion: There shall be no evidence of corrosion on steel and aluminum panels when tested as follows:

4.3.1 Polished aluminum and low carbon steel panels, each 1/16 x 2 x 4 in. shall be packaged individually, using a closely fitting envelope fabricated of the barrier material. After insertion of the panels, the excess air shall be removed from each envelope and the envelopes closed by heat sealing. The resulting containers shall be placed horizontally in an oven on a flat surface to give maximum contact area between the material and the panel. After heating for 48 hr at $150\text{ F} \pm 2$, the panels shall be examined for corrosion and staining. Failure is defined as any corrosion or staining in excess of that which can be rubbed off with a clean cotton cloth.

- 4.4 Resistance to Blocking: The material shall not block at a temperature of 150 F \pm 2 when tested as follows:
- 4.4.1 Three 4 x 4 in. specimens of the material shall be so arranged that two heat sealable surfaces face each other while the third specimen is placed so that the heat sealable surface is in contact with either one of the other specimens. The specimens shall then be placed on a smooth, hard, flat surface and a 2 x 2 in. resilient pad of 1/8 in. cork board centered on top of the specimens. A flat bottom, 12 lb weight having a 2 x 2 in. base shall be placed on the pad. The assembly shall be placed in an oven maintained at 150 F \pm 2. After 24 hr, the weight shall be removed and the specimen allowed to cool for 4 hr at room temperature. Failure is defined as any visual evidence of mechanical damage to the surface after separation.
- 4.5 Oil Resistance: After being immersed in ASTM Oil No. 1 for 24 hr at 150 F \pm 2, the material shall have a water vapor transmission rate not higher than that specified in 4.1. This exposure shall not appreciably lower the physical properties of the material.
- 4.6 Bursting Strength: The bursting strength shall be not less than 55 psi, determined in accordance with ASTM D774-46. Average of values of six tests shall be not less than the specified minimum.
5. QUALITY: Material shall be uniform in quality and condition, clean, and free from foreign materials and from defects detrimental to fabrication or to performance of parts.
6. REPORTS:
- 6.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report stating that the product meets the requirements of this specification. This report shall include the purchase order number, material specification number, vendor's identification, size, quantity, and date of manufacturer.
- 6.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.
7. PACKAGING AND MARKING:
- 7.1 Unless otherwise specified, material shall be supplied on rolls of the specified width. When specified as flat cut stock, it shall be wrapped completely in clean paper. All rolls and flat stock shall be packed in exterior containers of suitable strength and rigidity to prevent damage to edges of the material.