AEROSPACE
MATERIAL SPECIFICATIONS

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AMS 3159B
Superseding AMS 3159A

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LEAK TEST SOLUTION
Liquid Oxygen Compatible

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 use in detecting leaks in liquid oxygen propulsion systems where a leak test solution (bubble fluid) is desirable.

3. TECHNICAL REQUIREMENTS:

3.1 General:

3.1.1 Composition: The composition of the solution is optional with the manufacturer. It shall not contain oils, fats, or other materials capable of reacting with gaseous or liquid oxygen.

3.1.2 Leak Detecting Properties: This solution shall be capable of detecting various sizes of leaks by a readily visible formation of foam or bubbles at the location of the leak when used on surfaces having temperatures between +35 F (+1.7 C) and +160 F (+71.1 C).

3.1.3 Appearance: The solution shall be essentially colorless. A light yellow color will be acceptable provided that the color is no deeper than that of a 0.2% aqueous solution of K_2CrO_4.

3.1.4 Odor: The solution shall not produce objectionable odor.

3.1.5 Toxicity: Ingredients shall be free from vapors that are harmful or discomforting to personnel. The solution shall not irritate the skin.

3.1.6 Flammability: The solution and its evaporation residue shall be noncombustible.

3.1.7 Mold Growth: The solution shall not support mold growth within the container during use or storage.

3.2 Properties: When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.

3.2.1 Turbidity: The solution shall be free of sediment and suspended matter when examined with transmitted light.

3.2.2 Evaporation Residue: The residue shall be not greater than 1.00% of the solution by weight when evaporated to dryness at a temperature not higher than 212 F (100 C) and dried to constant weight at a temperature not higher than 230 F (110 C).

3.2.3 Foaming Ability: Material shall be capable of meeting either of the following requirements; in case of dispute, results of the test of 3.2.3.1 shall govern.

3.2.3.1 The solution shall exhibit an initial foam height of not less than 200 mm and a foam height of 200 mm or more after standing for 5 min. when tested in accordance with ASTM D1173 except that the temperature shall be 68 - 86 F (20 - 30 C).

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3.2.3.2 The solution shall exhibit an initial foam volume of not less than 100 ml which shall persist to not less than 85 ml when tested as follows: Place 15 ml ± 0.5 of the solution in a clean, dry, glass-stoppered 250 ml graduated glass cylinder; cylinder, stopper, and solution shall be at a temperature of 68 - 86 F (20 - 30 C). Stopper the cylinder and shake by inversion, rotating the cylinder, in a vertical plane, about the mid-point of its longitudinal axis, without translational motion, for 1 min. so that 30 inversions are completed; one inversion consists of rotating the cylinder 180 deg in one direction and then 180 deg in the opposite direction to its original, upright position. Place the cylinder on a table, remove the stopper, and wait 5 seconds. Determine the net volume of foam (total volume minus volume of liquid). This is the initial foam volume. Wait 5 min. ± 0.5 and again determine the net volume of foam. This is the final foam volume.

3.2.4 Spreading and Wetting Ability: The solution shall have wetting and spreading properties as evidenced by a surface tension of less than 25 dynes per cm when tested in accordance with ASTM D1331, Method A.

Ø 3.2.5 pH Value: The pH value of the leak test solution shall be between 6 and 8.

3.2.6 Impact Sensitivity: The evaporation residue shall not be sensitive to impact when in contact with liquid oxygen and tested under hammer impact energy of 356 ft-lb per sq in. obtained by dropping a 20 lb weight onto a hammer having a diameter of 0.50 in. using a testing procedure acceptable to the purchaser. The impact test sample shall be obtained by evaporating a sufficient quantity of solution to dryness as in 3.2.2 to produce a 0.01 in. min thickness of residue under the hammer. An equivalent alternate procedure may be used when agreed to by the purchaser.

3.2.7 Corrosiveness: The material shall not be corrosive to metals when tested as follows using the metals specified in Table I.

TABLE I

Metals	Surface and Condition
Aluminum Alloy Sheet	Bare 2024-T3
Low Carbon Steel	Cadmium Plated, AMS 2400
Copper	Soft Annealed
Magnesium Alloy	AZ31B

3.2.7.1 Two panels, approximately 2 x 4 x 0.040 in., shall be prepared of each metal specified in Table I. Panels shall exhibit clean uniform surfaces when examined under 10X magnification prior to test. Panels shall be degreased in trichloroethylene vapor. A clean bristle brush shall be used to apply leak test solution to one of each pair of panels. Approximately 1/2 the area of each panel shall be covered with the solution in an irregular manner. Similar panels shall be placed together in sandwich style with the leak test solution between them.

3.2.7.2 The sandwiched panels shall be exposed individually in a horizontal position at alternate intervals of 16 hr in a humidity cabinet and 8 hr in air at approximately 100 F (38 C) for a total of 7 days. Humidity cabinet shall be maintained at 120 F ± 2 (48.9 C ± 1.1) and 95 - 100% relative humidity.

3.2.7.3 Panels shall be washed with warm tap water and a bristle brush and dried with a clean cloth. Panel surfaces which were in contact with the leak test solution shall be examined under 10X magnification for corrosion. Staining of panels shall not be cause for rejection.