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400 Commonwealth Dr., Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3002D

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Superseding AMS 3002C

ALCOHOL, DENATURED ETHYL

1. SCOPE:

1.1 Form: This specification covers a denatured ethyl alcohol in the form of a liquid.

1.2 Application: Primarily for use as an additive to prevent freezing of water used in aircraft power plant injection systems.

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.

1.3.1 Precautions: THIS MATERIAL IS A DEADLY POISON IF TAKEN INTERNALLY. THERE IS NO ANTIDOTE. Repeated inhalations have the same effect as internal consumption.

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 documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2825 - Material Safety Data Sheets

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM D86 - Distillation of Petroleum Products
ASTM D1298 - Density, Relative Density (Specific Gravity) or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D4057 - Manual Sampling of Petroleum and Petroleum Products

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-290 - Packaging of Petroleum and Related Products

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall be as follows; aldehydes plus ketones shall be determined as acetaldehyde in accordance with 4.5.1 or other method acceptable to purchaser:

	Percent	
	min	max
Specially Denatured Ethyl Alcohol (3.1.2)	95.0	--
Water	--	5.0
Aldehydes + Ketones (as acetaldehyde) (4.5.1)	--	0.05
Sulfur and Sulfur Compounds (as S)	--	0.03
Acidity (as acetic acid)	--	0.01

3.1.1 Nonvolatile residue shall not exceed 5.0 mg per 100 millilitres.

3.1.2 Specially denatured ethyl alcohol shall be prepared by adding, to ethyl alcohol, denaturants of such type and in such amounts as will provide a product conforming to rules and regulations of the locality in which the product is purchased and to the requirements of this specification.

3.2 Properties: Alcohol shall conform to the following requirements:

3.2.1 Specific Gravity: Shall be 0.7933 - 0.8162 at 15°/4°C (59°/39°F), determined in accordance with ASTM D1298.

3.2.2 Distillation Range: Alcohol shall be 95% distilled between 75° and 80°C (167° and 176°F), determined in accordance with ASTM D86.

3.2.3 Corrosion: There shall be no evidence of pitting or black stain on a freshly-polished 3.5-inch (89-mm) diameter hemispherical copper dish when 100 mL of the alcohol is evaporated to dryness by heating on a steam bath; a slight amount of brown stain is acceptable.

3.2.4 Miscibility: Alcohol shall be miscible with distilled water in all proportions.

3.2.5 Odor: Shall be characteristic; there shall be no residual odor after evaporation from filter paper saturated with the alcohol.

3.3 Quality: Alcohol, as received by purchaser, shall be clear and free from suspended matter or other contaminants detrimental to usage of the alcohol. Alcohol shall be colorless unless otherwise required by government rules and regulations.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of alcohol shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the alcohol conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests and shall be performed prior to or on the initial shipment of alcohol to a purchaser, on each lot, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 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: Shall be in accordance with ASTM D4057. A lot shall be all Ø alcohol from the same batches of raw materials processed in one continuous run and presented for vendor's inspection at one time. A lot shall not exceed 5,000 gallons (18,927 L) and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.4 Approval:

4.4.1 Sample alcohol shall be approved by purchaser before alcohol for production use is supplied, unless such approval be waived by purchaser. Results of tests on production alcohol 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 alcohol which are essentially the same as those used on the approved sample alcohol. 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 material and/or processing and, when requested, sample alcohol. Production alcohol made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Aldehydes Plus Ketones: The following reagent, apparatus, and procedure are recommended to determine the percentage of aldehydes plus ketones as acetaldehyde:

4.5.1.1 Reagent: 0.5N hydroxylamine hydrochloride ($NH_2OH \cdot HCl$) containing no free hydrochloric acid. Dissolve 35 grams of CP $NH_2OH \cdot HCl$ in water, add sufficient 0.5N sodium hydroxide to neutralize any free hydrochloric acid, and dilute to one litre. The amount of sodium hydroxide needed may be calculated from the amount needed to render a sample of the hydroxylamine hydrochloride neutral to bromophenol blue. The pH of the finished solution should be 3.045 - 3.055.

4.5.1.2 Apparatus: An electrical pH meter with standard glass electrode and standard calomel electrode. The meter should be standardized against a standard buffer having a pH in or near the working range.

4.5.1.3 Procedure: Add 1 mL of 0.5N $NH_2OH \cdot HCl$ to 10 mL of distilled water in a 50 mL beaker. Adjust the pH meter to the temperature of the resulting solution and determine the pH. This should be within the range 3.65 - 3.80. Add 10 mL of the alcohol to be tested and mix thoroughly. The temperature of the solution will rise to approximately 35°C (95°F) and, with continued stirring, drop to approximately 30°C (86°F) in the 5 minute period which should be allowed for reaction. At the end of 5 minutes, adjust the pH meter to the temperature of the solution and determine the pH. The percentage of aldehydes plus ketones is determined from a curve of change in pH versus concentration. The curve may be plotted from the following data:

Aldehydes + Ketones (as acetaldehyde)	Decrease in pH
0.0000	0.00
0.0125	0.63
0.0250	0.89
0.0375	1.04
0.0500	1.14

4.6 Reports: The vendor of alcohol shall furnish with each shipment a report showing the composition and the quantitative results of tests on the lot of alcohol from which the order was filled and stating that the alcohol conforms to the other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 3002D, formula number, and quantity.

4.6.1 A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of alcohol for production use. Each request for modification of alcohol formulation shall be accompanied by a revised data sheet for the proposed formulation.