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400 Commonwealth Drive, Warrendale, PA 15096-0001

# AEROSPACE MATERIAL SPECIFICATION

**SAE**

**AMS 3006E**

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Superseding AMS 3006D

Submitted for recognition as an American National Standard

## ALCOHOL-WATER MIXTURES

### 1. SCOPE:

#### 1.1 Form:

This specification covers mixtures of methyl alcohol and/or ethyl alcohol with water in the form of liquids.

#### 1.2 Application:

The alcohol-water mixture has been used typically as an additive to prevent freezing of water used in aircraft power plant injection systems, but usage is not limited to such applications.

#### 1.3 Classification:

Mixtures shall be identified as Type 1, Type 2, Type 3, or Type 4 depending on composition as listed in 3.1.

#### 1.4 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.

- 1.4.1 Precautions: THIS MATERIAL IS A DEADLY POISON IF TAKEN INTERNALLY. It cannot be made nonpoisonous. Avoid prolonged breathing of vapor. It is unlawful to use this fluid in any article of food, beverage, or medicinal or toilet preparation for human use.

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## 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 publications shall be the issue in effect on the date of the purchase order.

### 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2825 Material Safety Data Sheets  
AMS 3002 Alcohol, Denatured Ethyl  
AMS 3004 Alcohol, Methyl

### 2.2 ASTM Publications:

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

ASTM D 512 Chloride Ion in Water  
ASTM D 516 Sulfate Ion in Water  
ASTM D 1293 pH of Water  
ASTM D 1298 Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method  
ASTM D 1888 Particulate and Dissolved Matter in Water  
ASTM D 4057 Manual Sampling of Petroleum and Petroleum Products  
ASTM E 1 ASTM Thermometers

### 2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-290 Packaging of Petroleum and Related Products

## 3. TECHNICAL REQUIREMENTS:

### 3.1 Product: (R)

Mixtures shall be composed of materials conforming to 3.1.1, 3.1.2, and 3.1.3, as applicable, and shall conform to the requirements shown in Table 1. Specific gravity at 15/4 °C (59/39 °F) shall be determined in accordance with ASTM D 1298 and freezing point shall be determined in accordance with 4.5.

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(R) TABLE 1 - Mixture Properties

Mixture Type	Composition Parts by Volume Before Mixing	Specific Gravity	Initial Freezing Point, Max
1	Methyl Alcohol 48 to 52 Water 48 to 52	0.9255 to 0.9340	-43 °C (-45 °F)
2	Methyl Alcohol 24 to 26 Ethyl Alcohol 24 to 26 Water 48 to 52	0.9255 to 0.9380	-36 °C (-33 °F)
3	Methyl Alcohol 38 to 42 Water 58 to 62	0.9425 to 0.9500	-30 °C (-22 °F)
4	Methyl Alcohol 58 to 62 Water 38 to 42	0.9050 to 0.9150	-54 °C (-65 °F)

3.1.1 Methyl Alcohol: Shall conform to AMS 3004.

3.1.2 Ethyl Alcohol: Shall conform to AMS 3002.

3.1.3 Water: Shall conform to the requirements shown in Table 2; it shall be treated by a softening or a demineralization process or shall be distilled if necessary to ensure conformance:

TABLE 2 - Water Properties

	Min	Max	Test Method
Total Solids, ppm	--	175	ASTM D 1888
pH	6.0	8.0	ASTM D 1293
Chlorides, ppm	--	15	ASTM D 512
Sulfates, ppm	--	10	ASTM D 516

3.2 Mixing and Preparation of Water and Alcohol Mixtures:

3.2.1 Water and alcohol shall both be at a temperature within the range of 10 to 32 °C (50 to 90 °F) and within 5 °C (9 °F) of each other before mixing.

3.2.2 Alcohol-water mixtures shall be prepared by thoroughly mixing the required components and shall be filtered through a medium with pores having no dimension greater than 10 microns (0.01 mm) unless each component is filtered, before mixing, through such medium.

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### 3.3 Quality:

Water-alcohol mixtures, as received by purchaser, shall be clear and free from suspended matter or other contaminants detrimental to usage of the mixture. The mixture shall be colorless unless otherwise required by government rules and regulations.

## 4. QUALITY ASSURANCE PROVISIONS:

### 4.1 Responsibility for Inspection:

(R)

The vendor of water-alcohol mixtures 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 mixture conforms to the applicable requirements of this specification.

### 4.2 Classification of Tests:

Tests for all technical requirements are acceptance tests and preproduction tests and shall be performed prior to or on the initial shipment of water-alcohol mixture to a purchaser, on each lot, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 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 and Testing:

(R)

Shall be in accordance with ASTM D 4057. A lot shall be all mixture of one type, as specified, 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 5000 gallons (18,927 L).

### 4.4 Approval:

4.4.1 Sample mixtures shall be approved by purchaser before the mixture for production use is supplied, unless such approval be waived by purchaser. Results of tests on production mixtures 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 water-alcohol mixtures which are essentially the same as those used on the approved sample. 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 mixtures. Production mixtures made by the revised procedure shall not be shipped prior to receipt of reapproval.

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#### 4.5 Test Methods:

Procedure for determining freezing points shall be as follows:

##### 4.5.1 The following reagents, apparatus, and procedure shall be used:

Anhydrous calcium chloride

Acetone

Dry ice

ASTM low cloud and pour point thermometer conforming to ASTM E 1

1 x 8 inch (25 x 203 mm) test tube and 1-1/2 x 8 inch (38 x 203 mm) test tube

1/8 inch (3.2 mm) diameter wire agitator

Two-hole rubber stopper and 1 inch (25 mm) stopper

4.5.1.1 Place 50 to 75 mL of the alcohol-water mixture to be tested in a 1 x 8 inch (25 x 203 mm) test tube and close with a 2-hole rubber stopper. Insert the thermometer through one hole of the stopper so that the bulb is at approximately the mid-depth of the liquid. Insert through the second hole a 1/8 inch (3.2 mm) diameter wire agitator having two horizontal loops about 2 inches (51 mm) apart and surrounding the thermometer. Place a small amount of anhydrous calcium chloride in a second 1-1/2 x 8 inch (38 x 203 mm) test tube. Stopper this test tube with a stopper having a hole large enough to receive the test tube containing the mixture. Place the first tube within the second so that an air jacket is formed.

4.5.1.1.1 Prepare a bath of acetone and dry ice. The bath shall be insulated and shall be agitated by a motor driven stirrer. Adjust the temperature of the bath to approximately 11 C (20 F) degrees below the anticipated freezing point of the alcohol-water mixture.

4.5.1.1.2 Immerse the tube assembly from 4.5.1.1 into the bath. Stir the alcohol-water mixture constantly during the test. Mechanical agitation may be used. Record temperature at 1-minute intervals and plot against time to form a cooling curve. The freezing point shall be taken as the point of definite break in the contour of the curve when ice crystals begin to form, unless this break is followed by a rise in temperature; in such cases, the freezing point shall be taken as the highest point to which the temperature rises, during continued cooling, after the first minimum temperature at which ice crystals begin to form.

#### 4.6 Reports:

The vendor of alcohol-water mixtures shall furnish with each shipment a report showing the composition and the quantitative results of tests on the lot of alcohol-water from which the order was filled and stating that the mixture conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3006E, type number, and quantity.