SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3006 REV. H

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Superseding AMS3006F

Alcohol-Water Mixtures

RATIONALE

AMS3006H results from a five year review of this specificiation.

STABILIZED NOTICE

This document has been declared “Stabilized” by the AMS B Finishes, Processes, and Fluids Committee and will no longer be subject to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist. Users of this document should refer any certification issues (e.g. exceptions listed on the certification report) to the cognizant engineering organization for their disposition. CAUTION: In many cases the purchaser is not the cognizant engineering organization (i.e. purchaser may be a sub tier supplier).

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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:

This 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:

Alcohol mixtures covered by this specification are classified as follows:

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.

1.3.1 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.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

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

AMS 3002	Alcohol, Denatured Ethyl
AMS 3004	Alcohol, Methyl

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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

3. TECHNICAL REQUIREMENTS:

3.1 Product:

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.

TABLE 1 - Mixture Properties

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

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) degrees 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.

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:

The vendor of water-alcohol mixtures shall supply all samples for vendor's tests and shall be responsible for the performance of 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:

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.

4.3 Sampling and Testing:

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.

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 two-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 alcohol-water 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 one-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 3006H, type number, and quantity.

4.7 Resampling and Retesting:

If any sample used in the above tests fails to meet the specified requirements, disposition of the alcohol-water mixture may be based on the results of testing three additional samples for each original nonconforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the alcohol-water mixture represented. Results of all tests shall be reported.