

ALCOHOL-WATER MIXTURES

1. SCOPE:

- 1.1 **Form:** This specification covers mixtures of methyl alcohol or ethyl alcohol, or both, with water in the form of liquids.
- 1.2 **Application:** Primarily for use as an additive to prevent freezing of water used in aircraft power plant injection systems.
- 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 **Precautions:** THIS MATERIAL IS A DEADLY POISON IF TAKEN INTERNALLY. It cannot be made non-poisonous. 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 following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) 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
AMS 3002 - Alcohol, Denatured Ethyl
AMS 3004 - Alcohol, Methyl

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

- ASTM D270 - Sampling Petroleum and Petroleum Products
- ASTM D512 - Chloride Ion in Water and Waste Water
- ASTM D516 - Sulfate Ion in Water and Waste Water
- ASTM D1293 - pH of Water
- ASTM D1298 - Density, Specific Gravity, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- ASTM D1888 - Particulate and Dissolved Matter in Water
- ASTM E1 - ASTM Thermometers

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-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Product: Mixtures shall be composed of materials conforming to 3.1.1, 3.1.2 and 3.1.3 below, as applicable, and shall conform to the following requirements:

Mixture Type	Composition Parts by Volume before mixing	Specific Gravity at 15/4°C (59/39°F) (ASTM D1298)	Initial Freezing Point, max (See 4.5)
1	Methyl Alcohol 48 - 52 Water 48 - 52	0.9255 - 0.9340	-42.8°C (-45°F)
2	Methyl Alcohol 24 - 26 Ethyl Alcohol 24 - 26 Water 48 - 52	0.9255 - 0.9380	-35.6°C (-32°F)
3	Methyl Alcohol 38 - 42 Water 58 - 62	0.9425 - 0.9500	-30.0°C (-22°F)
4	Methyl Alcohol 58 - 62 Water 38 - 42	0.9050 - 0.9150	-53.9°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 following requirements; it shall be treated by a softening or a demineralization process or shall be distilled if necessary to ensure conformance:

	min	max	Test Method
Total Solids, ppm	--	175	ASTM D1888
pH	6.0	8.0	ASTM D1293
Chlorides, ppm	--	15	ASTM D512
Sulfates, ppm	--	10	ASTM D516

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° - 32°C (50° - 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 a 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 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 mixture conforms to the applicable 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 on each lot, prior to or on the initial shipment of water-alcohol mixture to a purchaser, when a change in composition or processing, or both, 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, the contracting officer, or the request for procurement.

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4.3 Sampling: Shall be in accordance with ASTM D270, unless otherwise specified.

∅ 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 5,000 gal (19,000 L) and may be packaged in smaller quantities and delivered separately under the basic lot approval as long as lot identity is maintained.

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 material or processing, or both, 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 (ASTM E1)

1 x 8 in. (25 x 200 mm) test tube and 1-1/2 x 8 in. (38 x 200 mm) test tube

1/8 in. (3 mm) diameter wire agitator

Two hole rubber stopper and 1 in. (25 mm) stopper

4.5.1.1 Place 50 - 75 ml of the alcohol-water mixture to be tested in a 1 x 8 in. (25 x 200 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 in. (3 mm) diameter wire agitator having two horizontal loops about 2 in. (50 mm) apart and surrounding the thermometer. Place a small amount of anhydrous calcium chloride in a second test tube 1-1/2 x 8 inches (38 x 200 mm). 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 deg (20 F deg) 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 min. 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 three copies of 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 of this specification. This report shall include the purchase order number, lot number, AMS 3006C, type 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-water mixture for production use. Each request for modification of product formulation shall be accompanied by a revised data sheet for the proposed formulation.
- 4.7 Resampling and Retesting: If any sample used in the above tests fails to meet the specified requirements, disposition of the water-alcohol 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 water-alcohol represented and no additional testing shall be permitted. Results of all tests shall be reported.
5. PREPARATION FOR DELIVERY:
- 5.1 Packaging and Identification:
- 5.1.1 Alcohol-water mixture shall be packaged in suitable containers of a type and size agreed upon by purchaser and vendor.