

INCH-POUND**MIL-PRF-87252C
w/Amendment 1****29 December 2004****SUPERSEDING
MIL-PRF-87252C
24 October 1997**

PERFORMANCE SPECIFICATION

COOLANT FLUID, HYDROLYTICALLY STABLE, DIELECTRIC

This specification is approved for use by all Departments
and Agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification describes the characteristics and provides the requirements for a -54 to 200°C synthetic hydrocarbon fluid for use in electronic applications. This fluid is identified by *NATO Code No. S-1748* (see 6.5).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in *sections 3* and *4* of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of these lists, document users are cautioned that they must meet all specified requirements documents cited *in sections 3* and *4* of this specification, whether or not they are listed.

2.2 Governments Documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the applicable issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to ASC/ENOS, 2530 Loop Road West, Wright-Patterson AFB OH 45433-7101 or e-mailed to Engineering.Standards@wpafb.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil/online>.

AMSC N/A**FSC 9150****DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.**

MIL-PRF-87252C**STANDARDS****FEDERAL**

FED-STD-791 - Lubricants, Liquid Fuels, and Related Products; Methods of Testing.

(Copies of federal and military specifications, standards, and handbooks are available online at <http://assist.daps.dla.mil> or from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D92 - Flash and Fire Points by Cleveland Open Cup, Standard Test Method for (DoD adopted).
- ASTM D130 - Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test, Standard Method for Detection of (DoD adopted).
- ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity), Standard Test Method for (DoD adopted).
- ASTM D664 - Neutralization Number by Potentiometric Titration, Standard Test Method for (DoD adopted).
- ASTM D877 - Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes, Standard Test Method for (DoD adopted).
- ASTM D1169 - Specific Resistance (Resistivity) of Electrical Insulating Liquids, Standard Test Method for.
- ASTM D2532 - Viscosity and Viscosity Change After Standing at Low Temperature of Aircraft Turbine Lubricants, Standard Test Method for (DoD adopted).
- ASTM D4057 - Manual Sampling of Petroleum and Petroleum Products, Standard Practice for.
- ASTM D4636 - Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils, Standard Test Method for.
- ASTM D6304 - Determination of Water in Petroleum Lubricating Oils and Additives by Coulometric Karl Fisher Titration.
- ASTM F312 - Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters.

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Order online at www.astm.org.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE), INC.

AMS 3217/2 - Test Slabs, Acrylonitrile Butadiene (NBR-L) Low Acrylonitrile, 65-75.

(Copies of this document are available from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale PA 15096-0001. Order digital standards online at <http://www.sae.org/technicalcommittees/index.htm>.)

MIL-PRF-87252C

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The dielectric coolant furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) at the time of award of contract (see 4.2 and 6.3).

3.2 Properties. The dielectric coolant shall consist of a synthetic hydrocarbon base oil with a suitable additive(s). A hydrogenated polyalphaolefin base fluid with an additive to inhibit oxidation is recommended but is not mandatory. The required properties shall be as specified in *table I*. Additional data is included in *table III* to serve as user information which shall be referred to as typical (inherent) and shall not be a requirement levied upon the supplier (see 6.1.2).

TABLE I. Properties of the finished coolant.

Characteristic	Requirement	Unit
Kinematic viscosity, centistokes (cSt)		
@ 40°C, minimum	5.0	cSt
@ 100°C, minimum	1.65	cSt
@ -40°C, maximum	300	cSt
@ -54°C, maximum	1300	cSt
Dielectric strength, minimum	35	KV
Resistivity @ 25°C, minimum	1.0×10^{10}	ohm-cm
Flash point, minimum	150	°C
Fire point, minimum	160	°C
Total acid number, maximum	0.20	mg KOH/g
Water content, maximum	50	ppm

MIL-PRF-87252C

Characteristic	Requirement	Unit
Particulate contamination size		
Range, Largest Dimension, Micrometers	Number count	
5 to 15	< 10,000	
16 to 25	< 1,000	
26 to 50	< 150	
51 to 100	< 20	
Greater than 100	< 5	

3.3 Performance

3.3.1 Corrosiveness. When tested as specified in *section 4*, the change in weight of the aluminum alloy, steel, cadmium and magnesium alloy shall be no greater than ± 0.2 milligrams per square centimeter of surface. The change in weight of the copper shall be no greater than ± 0.4 milligrams per square centimeter of surface. There shall be no pitting, etching, nor visible evidence of corrosion on the surface of the metals when viewed under a magnification of 20 diameters. Any corrosion produced on the surface of the copper shall be no greater than No. 3A of *ASTM D130*. A slight discoloration of the cadmium shall be permitted

3.3.2 Resistance to oxidation. When tested as specified in *section 4*, the viscosity of the dielectric coolant shall not have changed more than 5 percent from the original viscosity in centistokes at 40°C after the oxidation-corrosion test. The total acid number shall not have increased by more than 0.5 milligrams of potassium hydroxide per gram of sample over the total acid number of the original sample. There shall be no evidence of separation of insoluble materials or gumming of the fluid.

3.3.3 Swelling of synthetic rubber. When tested as specified in *section 4*, the volume change of the standard synthetic rubber NBR-L (*AMS 3217/2*) by the dielectric coolant shall be within the range of 0.0 to +10 percent.

3.3.4 Solid particle contamination. When tested in accordance with *section 4*, the number of solid particle contaminants per 100 milliliters of the dielectric coolant shall not exceed the number specified in *table I*.

3.3.5 Compatibility. The dielectric coolant shall be compatible with other fluids of the same type covered by this specification when tested in accordance with *section 4*.

3.3.6 Toxicity. The dielectric coolant shall have no adverse effect on the health of personnel when used for its intended purpose. The coolant shall contain no components which produce noxious vapors in such concentrations as to be an annoyance to personnel during formulation or use under conditions of adequate ventilation when exercising caution to avoid prolonged contact with the skin (consult applicable OSHA guidelines). Questions pertaining to the toxic effects shall be referred to the appropriate departmental medical service who will act as an advisor to the procuring activity.

MIL-PRF-87252C

3.3.7 Low temperature viscosity stability. The kinematic viscosity shall be tested at -54°C as specified in *section 4*. The viscosity at 3 hours and at 72 hours shall not exceed 1300 cSt.

3.3.8 Storage stability. The fully blended product shall show no separation of ingredients nor evidence of crystallization, shall be clear and transparent when examined visually, and shall conform to the requirements of *section 3* after 12 months storage as specified in 4.5.2.

3.3.9 High temperature stability. When tested in accordance with 4.5.5, the change in fluid viscosity at 40°C shall not exceed five percent; neutralization number of the fluid shall not increase more than 0.1 and there shall be no formation of precipitate or insoluble material.

3.4 Workmanship. The dielectric coolant shall be uniform in quality and free from dirt and other foreign material and shall conform to the best commercial practice applicable to the manufacture and packaging of this class of material.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.1.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.5.

4.2 Qualification inspection

4.2.1 Qualification sample. The qualification sample shall consist of two 1-gallon containers of the finished fluid, 1 quart of the base stock without additive, and 1 ounce of the oxidation inhibitor. In the event that the additive is supplied as a concentrated solution, an equivalent quantity of the solution shall be furnished.

4.2.2 Qualification tests. Qualification sample(s) shall be subjected to all the tests specified under 4.5, methods of inspection.

4.2.3 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the manufacturer shall verify, by certification, to the qualifying activity that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.3 Conformance inspection. Conformance inspection shall consist of all of the tests in *section 3* except rubber swell, oxidation stability, corrosiveness, storage stability, and the 72 hour low temperature stability test. Samples shall be labeled completely with information

MIL-PRF-87252C

identifying the purpose of the sample, name of the product, specification number, lot and batch number (see 6.8), date of sampling, and contract number.

4.4 Referee method. In the event of a solid particle contamination count failure, the referee method shall be the microscopic method *ASTM F312*.

4.5 Methods of inspection

4.5.1 Inspection. Inspection shall be in accordance with *method 9601* of *FED-STD-791*.

4.5.2 Coolant properties tests. The dielectric coolant properties shall be determined in accordance with the applicable methods specified in *table II* and 4.5.4. Physical and chemical values specified in *section 3* apply to the average of the determinations made on the samples for those values which fall within any stated repeatability or reproducibility limits of the applicable test method.

TABLE II. Test methods for dielectric coolant properties.

Characteristic	Test Method	
	FED-STD-791	ASTM
Viscosity ^{1/}		<i>D445</i>
Total Acid Number		<i>D664</i>
Dielectric Strength		<i>D877</i>
Resistivity		<i>D1169</i>
Flash Point		<i>D92</i>
Fire Point		<i>D92</i>
Water Content		<i>D6304</i>
Low Temperature Viscosity Stability		<i>D2532</i>
Corrosiveness and Oxidation Stability ^{2/}		<i>D4636</i>
Rubber Swell	<i>3603</i>	
Storage Stability of Fluids and Lubricants	<i>3465</i>	

^{1/} Initial viscosity reading at -54°C shall be taken at 1.5 hours.

^{2/} Test conditions: 168 hours at 121°C. Substitute heptane or acetone as the solvent.

4.5.3 Solid particle examination. Particle contamination shall be measured by the use of automatic particle counters employing the light interruption principle or by the microscopical method to the limits specified in *table I*. The operating directions in the manual for the respective instruments shall be used.

MIL-PRF-87252C

4.5.4 Compatibility. Samples of candidate dielectric coolant in amounts of 20 ml, 100 ml, and 180 ml shall be mixed with samples from each of the fluids previously approved under this specification. Total volume of each mixture shall be 200 ml. Mixtures shall be prepared in 250-ml stoppered flasks. The flasks shall be thoroughly shaken and then stored in an oven at 135°C for 2 hours. At the end of this time, none of the mixtures shall show any signs of sediment, turbidity, or crystallization. The samples shall then be stored at -54°C for a period of 2 hours. Slight turbidity at this time, which later disappears, will be permitted in the samples.

4.5.5 High temperature stability

4.5.5.1 Apparatus. Thermal stability characteristics of the coolant fluid shall be determined using the following test apparatus: a 50-ml, round-bottom flask or a test tube (25 mm x 50 cm) with standard taper 24/40 (Ace Glass Inc., Vineland NJ 08360 or equivalent); a 75° angle adapter (24/40, Ace Glass or equivalent); gas inlet tube (6 mm OD Pyrex tubing); and a high-temperature bath capable of maintaining a temperature of $200 \pm 2^\circ\text{C}$.

4.5.5.2 Procedure. Place 25 ml of candidate fluid in flask or test tube fitted with 75° angle adapter and gas inlet tube. The height of the gas inlet tube should be adjusted to within 1.0 cm above the level of the fluid. Place a 2.5 cm length of 1/4-inch OD stainless steel tubing, type 304 in the fluid. Heat the fluid for 100 hours at a temperature of $200 \pm 2^\circ\text{C}$ while maintaining a 1 liter per hour flow of dry nitrogen (lamp grade) on the surface of the fluid via the gas inlet tube. Upon completion of the test, the fluid shall meet the requirements of 3.3.9.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity with the Military Service or Defense Agency, or within the Military Service's Systems Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

MIL-PRF-87252C**6. NOTES**

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 Intended Use. The material covered by this specification is intended for use as a heat transfer medium in closed military systems and capable of functioning as a dielectric fluid over the temperature range of -54°C to 200°C. Dielectric coolant is used to cool military aircraft systems, including radar, aircraft avionics systems, missiles, and navigation systems.

6.1.1 Storage conditions. Prior to use in the intended equipment, the product may be stored under conditions of covered or uncovered storage in geographic areas ranging in temperature from -54°C to +50°C.

6.1.2 Additional data for typical properties of the finished coolant. Additional data is included in *table III* to serve as user information which will be referred to as typical (inherent) and will not be a requirement levied upon the supplier.

TABLE III. Typical properties of the finished coolant.

Characteristic	Inherent Value
Specific gravity	
@ 25°C (77°F)	0.789
@ 15.6°C (60°F)	0.800
Coefficient of thermal expansion (cm ³ /cm ³ °C)	8.1 x 10 ⁻⁴
Thermal conductivity (cal-cm/s-cm ² °C)	
@ -40°C (-40°F)	4.5 x 10 ⁻⁴
@ 0°C (32°F)	3.8 x 10 ⁻⁴
@ 150°C (302°F)	3.0 x 10 ⁻⁴
Specific Heat (cal/g/°C)	
@ -40°C (-40°F)	0.48
@ 25°C (77°F)	0.53
@ 75°C (167°F)	0.55
@ 149°C (300°F)	0.65

MIL-PRF-87252C

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Quantity desired.
- d. Type and capacity of containers (see 5.1).

6.2.1 Purchase unit. The fluid covered by this specification should be purchased by volume, the unit being a US gallon of 231 cubic inches at 15°C (60°F).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in *QPL-87252* whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products and letter of authorization may be obtained from AFRL/MLBT Bldg 654, Rm. 136, 2941 Hobson Way, Wright-Patterson AFB OH 45433-7750.

6.3.1 Qualification information. It is understood that the material furnished under this specification subsequent to final approval should be of the same composition and should be equal to products upon which approval was originally granted. In the event that the fluid furnished under contract is found to deviate from the composition of the approved product, or that the product fails to perform satisfactorily, approval of such products will be subject to immediate withdrawal from the Qualified Products List.

6.3.2 Data to accompany qualification samples. The samples will be accompanied by a material safety data sheet, a test report from the manufacturer or a commercial laboratory, and letter containing complete information as to the following:

- a. Source and type of base stock and additive materials used.
- b. The formulation and composition of the finished fluid.
- c. Laboratory data showing quantitative results of all the tests required by this specification except storage stability. Separate qualification inspections will be required for each base stock used. The samples will be plainly identified by securely attached durable tags or labels marked with the following information:

MIL-PRF-87252C

Sample for qualification inspection

COOLANT FLUID, HYDROLYTICALLY STABLE, DIELECTRIC

Name of ingredient (for ingredient material)

Name of manufacturer

Product code number

Date of manufacture

Submitted by (name) and (date) for qualification inspection in accordance with the requirements of *MIL-PRF-87252* under the authorization of (reference authorizing letter) (see 6.3).

6.4 Samples of synthetic rubber. Samples of standard synthetic rubber NBR-L will subscribe to the formulation appearing in *AMS 3217/2*. A suggested source (material) is the Akron Rubber Development Laboratory (ARDL) 300 Kenmore Blvd, Akron OH 44301.

6.5 International agreements. The provisions of *1.1* of this specification are the subject of international standardization agreement (*ASCC 15/1* and *STANAG 1135*). When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Office (DepSO) so that appropriate action may be taken with respect to the international agreement concerned.

6.6 Disposal actions. The accumulated waste fluid will be disposed of through a waste oil recovery program unless prohibited by local law. Otherwise, the product will be disposed of in accordance to local law and regulations promulgated by the US Environmental Protection Agency under *Public Law 94-580*, Resource Conservation and Recovery Act of 1976. This material, when uncontaminated, is not considered a hazardous material under Federal EPA or Federal Department of Transportation regulations. The disposal of this material when contaminated will be governed by the identity of the contaminant, weight percent of contaminate and whether it is considered a hazardous material. Local laws may be more restrictive than Federal laws and will supersede Federal laws.

6.7 Subject term (key word) listing

Dielectric coolant

Liquid coolant

Synthetic hydrocarbon

Synthetic rubber

6.8 Definitions

6.8.1 Bulk lot. A bulk lot (batch) is an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single isolated container; or manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

6.8.2 Packaged lot. A packaged lot is an indefinite number of 55-gallon drums, or smaller unit containers (such as a one-gallon can) of identical size and type that is offered for acceptance and filled with a homogeneous mixture of material from one isolated container; or filled with a

MIL-PRF-87252C

homogeneous mixture of material manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment with no change in ingredient material.

6.9 Amendment notations. The margins of this specification are marked with vertical lines where changes were made to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

Custodians:

Army - CR4

Navy - AS

Air Force - 11

Preparing Activity:

Air Force - 11

(Project No. 9150-1304)

Review Activities:

Army - MI

Navy - SH

Air Force - 68

DLA-GS

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