METRIC

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MILITARY SPECIFICATION

HYDRAULIC FLUID, FIRE RESISTANT; LOW TEMPERATURE, SYNTHETIC HYDROCARBON BASE, AIRCRAFT AND MISSILE

This specification is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for a synthetic hydrocarbon base hydraulic fluid for use in the -54°C to +135°C temperature range in aircraft and missile hydraulic systems. This hydraulic fluid is identified by *NATO Code No. H-538* (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 this list, 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENSI, 2530 Loop Road West, Wright-Patterson AFB OH 45433-7101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A **FSC 9150**

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2.2 Government 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 issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see *6.2*).

SPECIFICATIONS

FEDERAL

P-D-680	-	Dry Cleaning and Degreasing Solvent
TT-T-656	-	Tricresyl Phosphate

MILITARY

MIL-H-5606	-	Hydraulic Fluid, Petroleum Base: Aircraft, Missile, and Ordnance
MIL-H-6083	-	Hydraulic Fluid, Petroleum Base for Preservation and Operation
MIL-PRF-46170	-	Hydraulic Fluid, Rust Inhibited, Fire Resistant Synthetic Hydrocarbon Base
MIL-PRF-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, *NATO Code Number H-537*

STANDARDS

FEDERAL

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.2.2 Other government publications. The following other Government publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

PUBLICATIONS

U.S. ENVIRONMENTAL PROTECTION AGENCY

Public Law 94-580	-	Resource Conservation and Recovery Act of 1976

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington DC 20402.)

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the acquisition activity or as directed by the contracting office.)

2.3 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted, are those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see *6.2*).

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D92	-	Flash and Fire Points by Cleveland Open Cup, Standard Test Method for (DoD adopted)
ASTM D97	-	Pour Point of Petroleum Oils, 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 F312		Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters
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 D892	-	Foaming Characteristics of Lubricating Oils, Standard Test Method for (DoD adopted)
ASTM D1298	-	Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method, Standard Test Method for (DoD adopted)
ASTM D1500	-	ASTM Color of Petroleum Products (ASTM Color Scale), Standard Test Method for (DoD adopted)
ASTM D1744	-	Water in Liquid Petroleum Products by Karl Fischer Reagent, Standard Test Method for (DoD adopted)
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 (Dod adopted)
ASTM D4172	-	Wear Preventive Characteristics of Lubricating Fluid (Four-Ball Method), Standard Test Method for (DoD adopted)
ASTM D4177	-	Automatic Sampling of Petroleum and Petroleum Products, Standard Test Method for (DoD adopted)
ASTM D4636	-	Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils, Standard Test Method for (Dod adopted)
ASTM D4898	-	Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis, Standard Test Method for (DoD adopted)
ASTM D 5306		Linear Flame Propagation Rate of Lubricating Oils and Hydraulic Fluids, Test Method for

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103.)

AEROSPACE MATERIAL SPECIFICATIONS (AMS)

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

(Applications for copies should be addressed to Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale PA 15096-0001)

(Non-Government standards and other publications are normally available from the organizations which prepare or which 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 specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 Qualification. The hydraulic fluids furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see *4.2* and *6.3*). Any change in the formulation of an approved product shall require re-qualification.

3.2 Materials. The materials used in formulating this hydraulic fluid shall consist of synthetic hydrocarbon base and shall contain additives as specified in *3.2.1*. A base oil mixture of 2 cSt and 4 cSt polyalphaolefin is suggested but is not mandatory. The hydraulic fluid shall contain no admixture of resins, soaps, gums, fatty oils, or oxidized hydrocarbons.

3.2.1 Additives. There shall be no restriction on the types of materials used as additives in the fluid except for those listed and those imposed by technical requirements of this specification. No pour point depressant materials or viscosity index improvers may be used.

3.2.1.1 Oxidation inhibitors. Oxidation inhibitors of the phenolic type shall not exceed a concentration of 2.0 percent by weight.

3.2.1.2 Anti-wear agent. Anti-wear agents, such as tricresyl phosphate (TCP) conforming to *TT-T-656*, shall be blended in sufficient quantity, not to exceed 3.0 weight percent, to permit the finished oil to meet the lubricity requirements specified in *3.3.9*. If TCP is used, the finished fluid shall contain less than 0.03 weight percent of the ortho-isomer.

3.2.1.3 Blending fluid. Blending fluids, such as diesters, shall be blended in a concentration not to exceed 35 percent by weight but in sufficient quantity to meet the rubber swell, as specified in 3.3.4, and viscosity requirements at -54°C as specified in *table I*.

3.2.1.4 Color. The fluid shall contain red dye in concentration not greater than 1 part of dye per 10,000 parts of oil by weight.

3.3 Finished fluid. The properties of the finished fluid shall be as specified in *table I* and *3.3.1* through *3.3.14*.

3.3.1 Specific gravity. The specific gravity of the hydraulic fluid shall be determined but shall not be limiting. Samples of the hydraulic fluid submitted for quality conformance tests shall not vary more than ±0.008 at 15.6°C/15.6°C from the specific gravity of the sample originally approved for qualification.

3.3.2 Corrosiveness and oxidation stability. When tested as specified in *4.4.2*, the change in weight of steel, aluminum alloy, magnesium alloy, and cadmium-plated steel subjected to the action of the hydraulic fluid shall not be greater than ±0.2 milligrams per square centimeter of surface. The change in weight of copper under the same conditions shall be no greater than ±0.6 milligrams per square centimeter of surface. There shall be no pitting, etching, nor visible corrosion on the surface of the metals when viewed under magnification of 20 diameters. Any corrosion produced on the surface of the copper shall not be greater than No. 3 of the ASTM copper corrosion standards (*ASTM D130*). A slight discoloration of the cadmium shall also be permitted.

3.3.2.1 Resistance to oxidation. When tested as specified in *4.4.2*, the fluid shall not have changed more than 10 percent from the original viscosity in centistokes at 40° C after the oxidation corrosion test. The neutralization number shall not have increased by more than 0.20 over the acid or base number of the original sample. There shall be no evidence of separation of insoluble materials nor gumming of the fluid.

3.3.3 Low temperature stability. When tested as specified in *4.4.2* for 72 hours at a temperature of -54° C ± 1°C, the fluid shall show no evidence of gelling, clouding, crystallization, solidification, or separation of ingredients.

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3.3.4 Swelling of synthetic rubber. When tested as specified in *4.4.2*, the volume increase of the standard synthetic rubber NBR-L (as referenced in *AMS 3217/2*) by the fluid shall be within the range of 19.0 to 30.0 percent.

3.3.5 Solid particle contamination. When tested in accordance with *4.4.2*, the number of solid contaminant particle per 100 ml of the fluid shall not exceed the number specified in *table II*, nor shall the weight of the residue exceed 0.3 mg. The filtering time for each determination shall be 15 minutes maximum.

3.3.6 Foaming characteristics. The foaming characteristics of the hydraulic fluid shall not exceed the limits indicated in *table III* when tested as specified in *4.4.2*.

TABLE I. Properties of finished fluid.

Property	Requirement	Unit
Kinematic viscosity (cSt)		
@ 40°C, minimum	6.7	cSt
100°C, minimum	2.0	cSt
-40°C, maximum	550	cSt
-54°C, maximum	2500	cSt
Flash point, minimum	170	°C
Fire point, minimum	180	°C
Neutralization number, maximum	0.20	mg KOH/gm
Evaporation loss, maximum	20	wt. %
Bulk modulus (isothermal secant) 0 to		
6.9 x 10^4 kPa at 40°C (min)	1.379 x 10^6	kPa
10,000 psi at 100°F (min)	200,000	psi
Pour point, maximum	-60	°C

TABLE II. Solid contaminant particle.

Particle size range (largest dimension), micrometers	Allowable number (max) each determination, automatic count
5-15	10,000
16-25	1,000
26-50	150
51-100	20
Over 100	5

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TABLE III. Foaming characteristics of hydraulic fluid.

Test Temperature	Foaming tendency Foam volume, ml, at end of 5-min blowing period	Foam stability Foam volume, ml, at end of 10-min settling period
25° C	65 ml (max)	Complete collapse [1/]

[1/] *A ring of small bubbles around the edge of the graduate may be considered complete collapse*.

3.3.7 Water content. The fluid shall contain less than 100 ppm total water when tested as specified in *4.4.2*.

3.3.8 Flammability

3.3.8.1 High temperature - high pressure spray ignition. If ignited, when the test flame is applied as specified in *4.4.2*, the test fluid shall not continue to burn when the source of ignition is removed.

3.3.8.2 Flame propagation. When tested as specified in *4.4.2*, the flame propagation rate shall be not more than 0.5 cm/sec.

3.3.9 Lubricity. When tested in accordance with *4.4.2*, wear values for hydraulic fluid shall be as specified in *table IV*.

TABLE IV. Wear values.

Load (kg)	Scar diameter mm (max)
1	0.21
10	0.30
40	0.65

3.3.10 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 *4.4.2*.

3.3.11 Compatibility. The hydraulic fluid shall be compatible in all concentrations with each of the fluids approved under this specification when tested as specified in *4.4.3*. The hydraulic fluid shall be miscible with *MIL-H-5606, MIL-H-6083, MIL-PRF-46170,* and *MIL-PRF-83282* fluids in all proportions from -54°C to 135°C, in that no formation of resinous gums, sludges, or insoluble materials will occur.

3.3.12 High temperature stability. When tested in accordance with *4.4.5*, 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.

3.3.13 Color of finished fluid. There shall be no readily discernible difference in the color of the finished fluid and the standard color when tested as specified in *4.4.7*.

3.3.14 Low temperature viscosity stability. The kinematic viscosity shall be tested at -54°C as specified in *table V*. The viscosity at 3 hours and at 72 hours shall not exceed 2500 cSt.

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4. VERIFICATION

4.1 Classification of inspection

a. Qualification inspection (see *4.2).*

b. Conformance inspection (see *4.3*).

4.2 Qualification inspection

4.2.1 Qualification inspection sample. The qualification sample shall consist of two one-gallon containers of the finished fluid, one quart of the base stock(s) without additives, one quart of the blending fluids used, one ounce of the antiwear additive, one ounce of the oxidation inhibitor, and one ounce each of any additional additives used in the finished fluid. In the event that additives are supplied as concentrated solutions, 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 in *table V*.

TABLE V. Conformance Tests.

Inspection	Paragraph Requirement	Test Method
Pour Point	*3.3*	4.4.2
Flash Point	*3.3*	4.4.2
Fire Point	*3.3*	4.4.2
Neutralization number	*3.3*	4.4.2
Evaporation (finished fluid)	*3.3*	4.4.2
Viscosity (finished fluid)	*3.3*	4.4.2
Specific gravity	*3.3.1*	4.4.2
Low temperature stability	*3.3.3*	4.4.2
Solid particle contamination	*3.3.5*	4.4.6
Foaming characteristics	*3.3.6*	4.4.2
Water content	*3.3.7*	4.4.2
Lubricity	*3.3.9*	4.4.2
Color of finished fluid	*3.3.13*	4.4.7
Low temperature viscosity stability [1/]	*3.3.14*	4.4.2

[1/] *The 72-hour test is not required during conformance inspection. The 3-hour test is required.*

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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 the determination of the solid particle contamination count (see *4.4.6*) and testing the sample against all requirements specified in *table V*. In the event of a solid particle contamination count failure, the referee method shall be the microscopic method detailed in *ASTM F312*. Samples shall be labeled completely with information identifying the purposes of the sample, name of product, specification number, lot and batch number, date of sampling, and contract number.

TABLE VI. Sample for Particle Contamination.

Container	Sample Size (ml) [1]/	Number of Determinations per sample
8 ounces	100	1
1 quart	100	1
1 gallon	200	2
5 gallons	300	3
55 gallons	600	6

1/ *Each determination shall be made on 100 ml portions of the sample. Should the particle count on any individual determination be considered excessive, the two additional determinations on another sample from the same container may be used. The container shall be thoroughly shaken immediately prior to withdrawing each 100 ml portion for such additional determinations. The arithmetic average of the two closer particle counts shall be considered the particle count for the sample.*

4.4 Method of inspection and test

4.4.1 Inspection. Inspection shall be in accordance with *Method 9601b* of *FED-STD-791* of this specification.

4.4.2 Tests. The hydraulic fluid properties shall be determined in accordance with the applicable methods specified in *table VII* and *4.4.3* through *4.4.7*. Physical and chemical values specified in *section 3* apply to the average of the determinations made on the samples.

4.4.3 Compatibility. Samples of candidate fluid 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 agitated 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 sign 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, that later disappears will be permitted in the samples. Compatibility tests described herein shall also be conducted with representative fluids qualified to *MIL-H-5606* and *MIL-PRF-83282*.

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TABLE VII. Test Methods for Hydraulic Fluid Properties.

Characteristic	Test Method	
	FED-STD-791	**ASTM**
Pour point		*D97*
Flash point		*D92*
Fire point		*D92*
Color		*D1500*
Evaporation [1/]	*350*	
Specific gravity		*D1298*
Viscosity [2/]		*D445*
Solid particle contamination [3/]	*3012*	
Foaming		*D892*
Water		*D1744*
Neutralization number		*D664*
High temperature-high pressure spray ignition	*6052*	*D4636*
Corrosiveness and oxidation stability [4/]	*3603*	
Swelling of synthetic rubber [5/]	*3458*	
Low temperature stability	*3465*	*D2532*
Storage stability		*D4172*
Low temperature viscosity stability		
Lubricity [6/]		*D5306*
Flame Propagation		

1/ *Test temperature 135°C. Test time, 6.5 hours*
2/ *Initial viscosity reading at -54°C shall be taken at 1.5 hours.*
3/ *Particulate contamination may also be measured by the use of automatic particle counters in lieu of the optical procedure detailed in method 3012. HiAC counter, Models PC-202, PC-203, PC-305, or equivalent, counting to the limits specified in table II. Directions in the manual for the respective instruments shall be followed.*
4/ *Bath, constant temperature, 135°C. Test time 168 hours.*
5/ *Use standard NBR-L (see 3.3.4 and 6.4) within 6 months of date of manufacture.*
6/ *A 10 ± 0.5 ml sample shall be used, and the test shall be conducted for 1 hour at each load specified in table IV.*

4.4.4 Bulk modulus

4.4.4.1 Apparatus. The bulk modulus of the hydraulic fluid shall be determined using a calibrated, precision capillary pycnometer of the type shown on *figure 1* (modified 21 T 50 Jerguson pressure gauge). A suitable pressure vessel and auxiliary equipment for this determination are shown on *figures 2* and *3*.

4.4.4.2 Procedure. The pycnometer volume to capillary diameter ratio shall be chosen to provide a precision of measurement for liquid density of ±2 parts in 10,000. The pycnometer shall be charged with candidate fluid to the top of the capillary at 40°C and atmospheric pressure, and determination made as follows: insert the pycnometer in the high-pressure pycnometer housing so that the capillary tube is visible through the window of the pressure vessel and parallel to the outside vertical surfaces of the pressure vessel. Assemble the pressure vessel containing the pycnometer, place it in a 40°C constant-temperature bath, allow equilibrium to be reached, and take volume reading at atmospheric pressure. (Since the precision of the unit depends on visual readings, care must be taken to avoid errors due to parallax and distortion in the pressure vessel window and the walls of the constant-temperature bath.)

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Increase nitrogen pressure to a new level and, after a 1-hour soak take a third reading. For any pressure change, the secant bulk modulus is defined by the following equation:

$$\text{Bulk modulus} = \frac{V\Delta P}{\Lambda V + \Lambda V_g}$$

Where: V = the original volume of the fluid

DV = the observed volume change due to DP increase in pressure
DP = the pressure change between the two measurements in kPa
DV_g = the correction factor

The correction factor (DV_g) considers the bulk modulus of glass in determining the true volume of the pycnometers at pressures above atmospheric. The bulk modulus of Pyrex glass is 3.28×10^7 kPa.

$$\text{Therefore:} \quad DV_g = \frac{V\Lambda P}{3.28x10^7}$$

4.4.5 High temperature stability

4.4.5.1 Apparatus. Thermal stability characteristics of the hydraulic fluid shall be determined using the following test apparatus: a 50 ml round bottom flask (Ace Glass Inc., Vineland, NJ 08360 or equivalent); a 75° angle adapter (standard taper 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 175 ± 2°C.

4.4.5.2 Procedure. Place 25 ml of candidate fluid in flask fitted with 75° angle adapter and gas inlet tube. The height of the glass inlet tube should be adjusted to within 1.0 cm above the level of the fluid. Place a 2.5 cm length of ¼-inch OD stainless steel tubing, type 304 in the fluid. Heat the fluid for 100 hours at a temperature of 175 ± 2°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 *3.3.12*.

4.4.6 Solid particle examination. Particle contamination should be measured by the use of automatic particle counters employing the light interruption principle. The automatic counters shall count particles to the limits specified in *table I*. The operating directions in the manual for the respective instrument shall be used. A gravimetric determination shall also be made in accordance with *ASTM D4898* using a single 0.45 micron, cellulose, membrane filter with the following step inserted at the end of *paragraph 8.8*: "After removing the upper half of the filter holder, use the last 50 ml of solvent to wash the test fluid from the periphery of the filter."

4.4.7 Color of finished fluid. The color of the hydraulic fluid shall be compared with a standard sample prepared by adding 1 part of dye "Oil red 235" (see *6.1.4*) to 10,000 parts of an oil not darker than *ASTM D1500* color number 1.0.

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 Department or Defense Agency, or within the Military Department's System 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.

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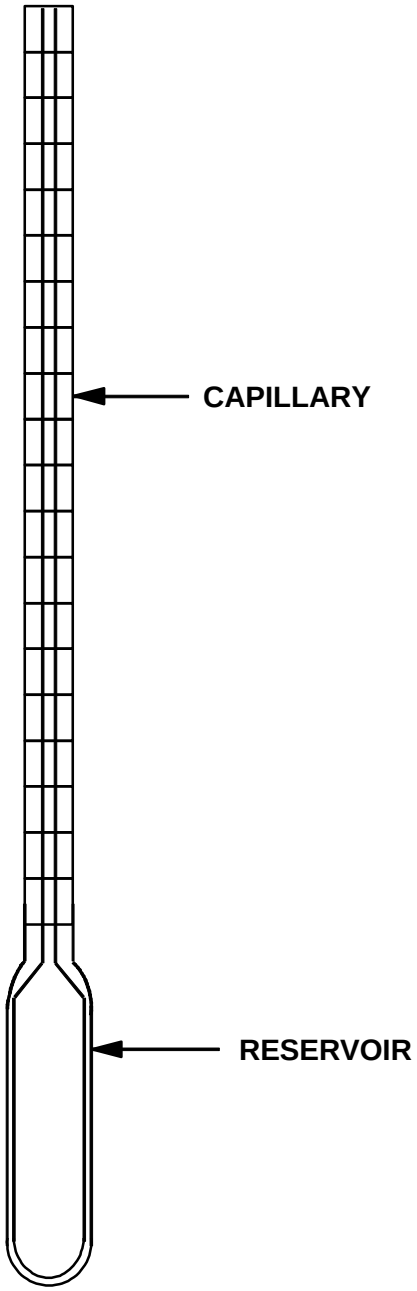


FIGURE 1. Precision capillary pycnometer

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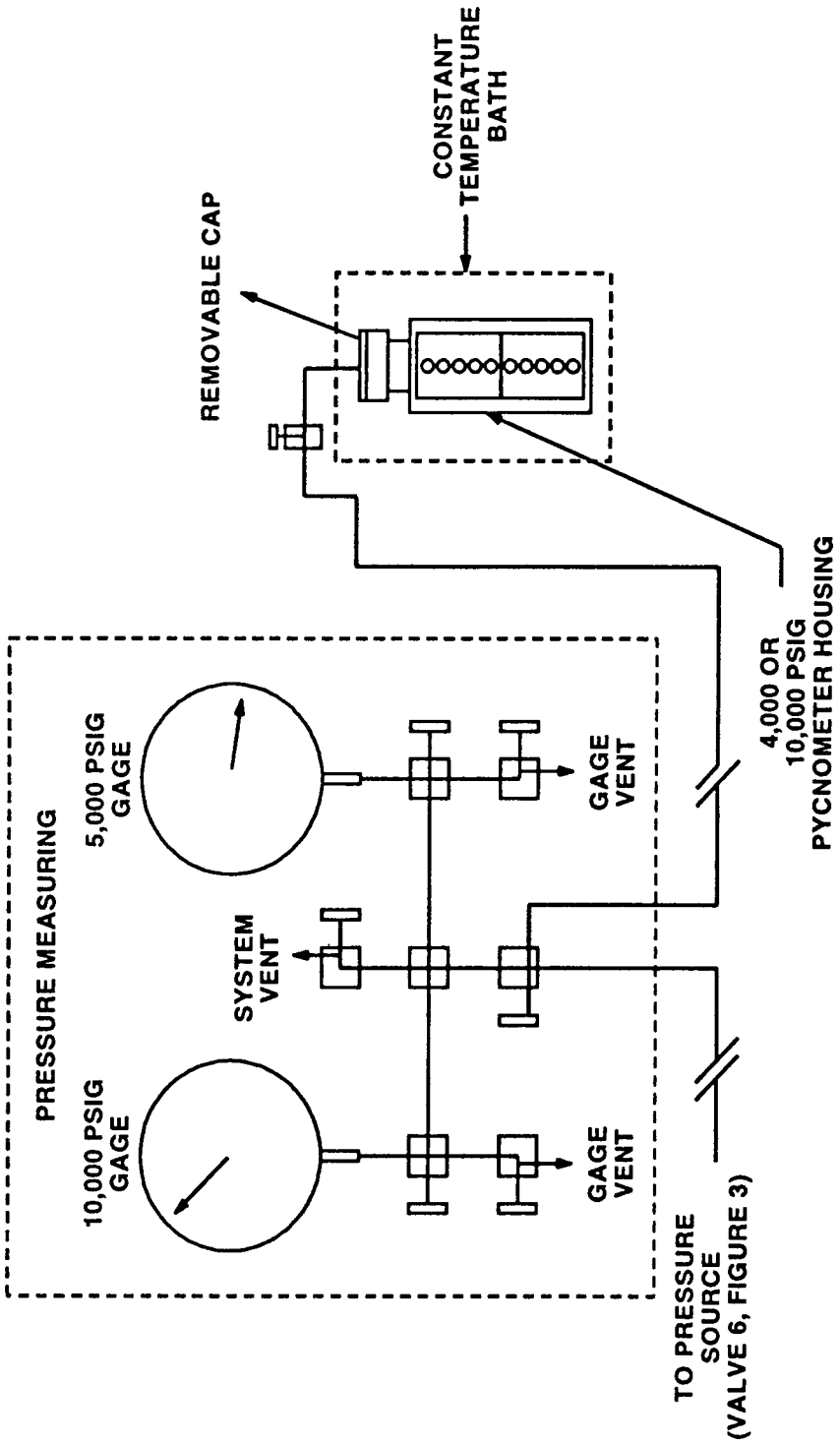


FIGURE 2. Diagram of bulk modulus equipment.

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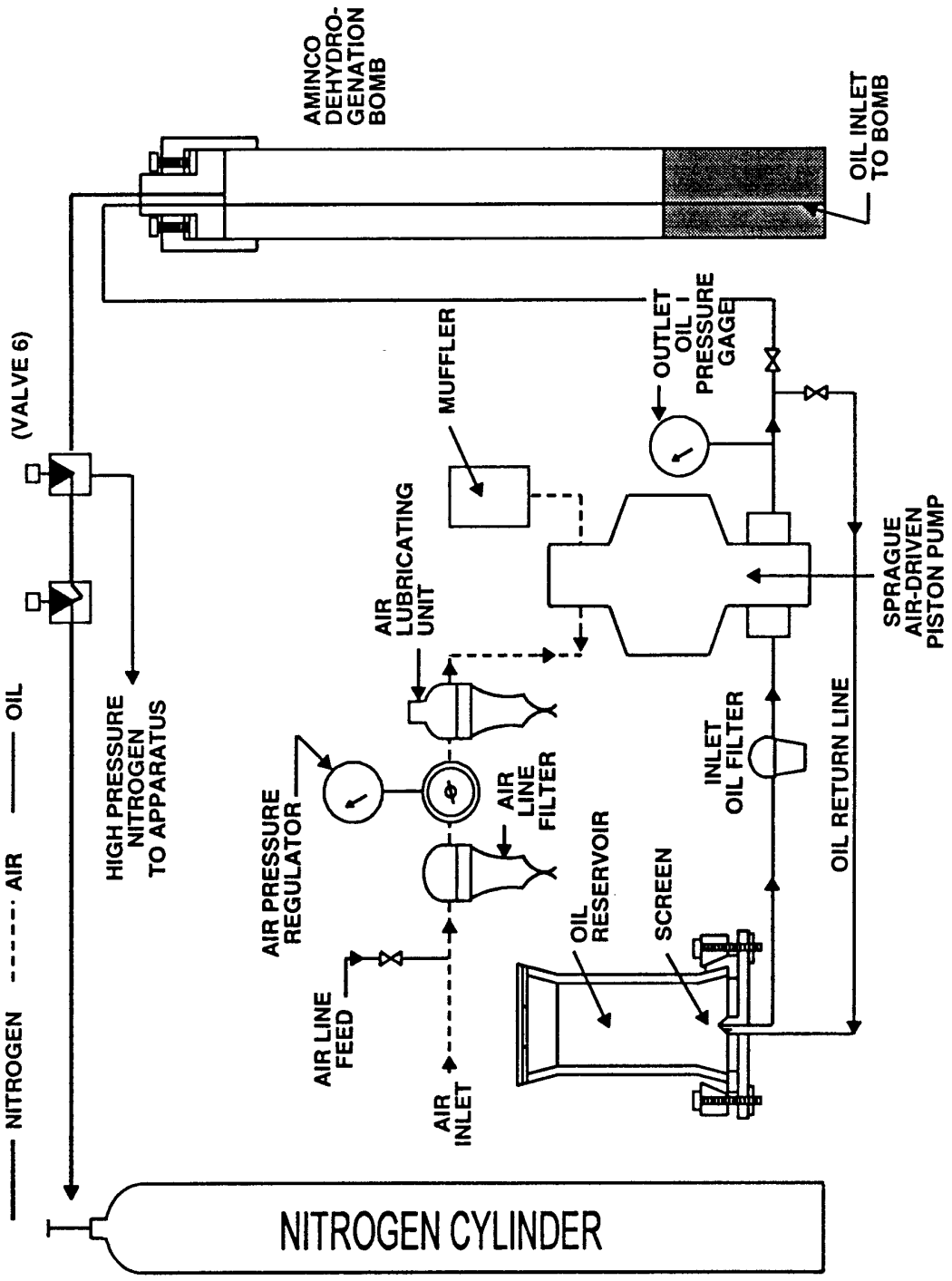


FIGURE 3. Auxiliary equipment.

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6. NOTES

6.1 Intended use. The hydraulic fluid covered by this specification is intended for use from -54°C to +135°C in automatic pilots, shock absorbers, brakes, flap-control mechanisms, missile hydraulic servo- controlled systems, and other hydraulic systems using synthetic sealing material.

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 temperatures from -57°C to +49°C (-70°F to +120°F).

6.1.2 This fluid is completely compatible with *MIL-H-5606, MIL-H-6083, MIL-PRF-83282* and *MIL-PRF-46170* hydraulic fluids. It may be interchangeable with these fluids for some applications. The selection of the fluids to be used depends on the requirements of the operational system.

6.1.3 Cleaning agents

6.1.3.1 Chlorinated solvents. Chlorinated solvents should not be used for cleaning hydraulic components. Residual solvent contaminates the hydraulic fluid and may lead to corrosion.

6.1.3.2 Recommended solvents. The recommended solvents are *P-D-680*, type II (Stoddard solvent) or other petroleum distillate type solvents.

6.1.4 Oil red dye source. "Oil red 235" is manufactured by Passaic Color and Chemical Company.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Issue of *DoDISS* to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see *2.2.1* and *2.2*).

c. Quantity.

d. *FAR Clause 52.223-3.*

6.2.1 Basis of purchase. The fluid covered by this specification should be purchased by volume, the unit being a U.S. gallon of 231 cubic inches at 15.6°C.

6.2.2 List of qualified products. Products considered acceptable under this specification are listed in *QPL-87257* and subsequent revisions thereto.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have prior to the time set for opening of bids, been tested and approved for inclusion into the applicable QPL whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, 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 orders for the products covered by this specification. The activity responsible for the QPL is AFRL/MLSE, Bldg 652, 2179 12th St., Rm 122, Wright-Patterson AFB OH 45433-7718, and information pertaining to qualification of products may be obtained from that activity.

6.3.1 Qualification information. It is understood that the material furnished under this specification subsequent to final approval will be of the same composition and will 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 approval product, or that the product fails to perform satisfactorily, approval of such products will be subjected to immediate withdrawal from the QPL.

6.3.2 Data to accompany qualification samples. The samples will be accompanied by a test report from the manufacturer or a commercial laboratory containing complete information as to the following: source and type of

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base stock and additive materials used, the formulation and composition of the finished fluid, and 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. Submission of the material safety data sheet is a requirement. One copy of the material safety data sheet will be sent with each sample submitted for test. The samples, material safety data sheets and reports will be forwarded to AFRL/MLSE, Bldg 652, 2179 12th St, Rm 122, Wright-Patterson AFB OH 45433-7718. The samples will be plainly identified by securely attached durable tags or labels marked with the following information:

Sample for Qualification Inspection
HYDRAULIC FLUID, FIRE RESISTANT; LOW TEMPERATURE, SYNTHETIC HYDROCARBON BASE, AIRCRAFT AND MISSILE METRIC, *NATO CODE NUMBER H-538.*
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-87257* under authorization of (reference authorizing letter) (see *6.3*)

6.3.2.1 Formulation Sheets. An example of a satisfactory form for the formulation sheet, indicating the percent by weight and purpose of each ingredient, is as follows:

Base stock(s) (composition and source)	percent
Blending Fluid (composition and source)	percent
Anti-wear additive (manufacturer's name and no.)	percent
Oxidation inhibitor (manufacturer's name and no.)	percent
Other additives (manufacturer's name and no.)	percent

6.4 Standard rubber samples. Samples of the standard synthetic rubber NBR-L (see *3.3.4*) for the test specified in *table VII* may be obtained from either Precision Rubber Products, Phoenix AZ, or the University of Akron, Akron OH.

6.5 International standardization agreements. Certain provisions of this specification (see *1.1*) are the subject of international standardization agreements, *ASCC Air Standards 15/1* and 15/7 and *NATO STANAGs 1135* and *3748*. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.6 Contractual notes. In addition to Qualification and Quality Conformance Testing, the Air Force will perform final acceptance testing on each contract awarded. Specific requirements and instructions addressing this matter will be called out in each contract. Questions in regard to this action should be forwarded to: Commander, SA-ALC/SFTT, 1014 Billy Mitchell Blvd, Ste 1, Kelly AFB TX 78241-5603.

6.7 Disposal actions

6.7.1 Background. 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 U.S. Environmental Protection Agency under *Public Law 94-580, Resource Conservation and Recovery Act of 1976.*

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6.7.2 Handling and safety precautions. Personnel handling the product will wear appropriate impervious clothing to prevent repeated or prolonged skin contact. Local appraisal is required for exact health and safety implications and to prescribe precise application of protective clothing. If skin or clothing becomes moistened with the product, personnel will promptly wash with soap or mild detergent and water. Respirators are not required unless there is an inhalation exposure to mists. Personnel will wear protective clothing when using the product and when cleaning up spills.

6.7.3 Depot-type operations. Additionally, the used product, which has been drained from the hydraulic systems, will be combined with unused, but contaminated fluid from partially full containers and then recycled.

6.7.4 Container disposal. Tops from one-time-use containers will be discarded with ordinary refuse. Containers will be made as empty as possible using gravity draining, after which they are to be crushed and buried in a permitted sanitary landfill or incinerated with general refuse. No special decontamination procedures are required for empty containers or their lids.

6.8 Definitions

6.8.1 Bulk lot. A bulk lot (batch) is an indefinite quantity of 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.

6.9 Subject term (keyword) listing

Airborne engine compressors, Hydraulic fluid for
Aircraft hydraulic fluid
Aircraft and missile hydraulic systems
Fire resistant hydraulic fluid, low temperature
Hydraulic fluid
Hydraulic fluid for aircraft and missiles
Hydraulic system
Missiles hydraulic fluid
Synthetic hydrocarbon base
Synthetic hydraulic fluid

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes. The changes are due to Acquisition Reform initiatives requiring Government specifications to be performance-based.

Custodians:
Army - CR4
Navy - AS
Air Force - 11

Review Activities:
Army - MI, AL, AR, EA
Navy – SH, OS
Air Force – 68
DLA-PS, GS

Preparing Activity:
Air Force - 11

(Project 9150-0821)

International Interest:
NATO (See *6.5*)
ASCC

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.
   NOTE: This form may not be used to request copies f documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waiver any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER**	**2. DOCUMENT DATE (YYMMDD)**
	MIL-PRF-87257B	**97/12/08**

3. DOCUMENT TITLE
HYDRAULIC FLUID, FIRE RESISTANT; LOW TEMPERATURE, SYNTHETIC HYDROCARBON BASE, AIRCRAFT AND MISSILE

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(If applicable)*	e. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code)	
ASC/ENSI AF CODE 11	(1) Commercial (937) 255-0175	(2) AUTOVON 785-0175
c. ADDRESS *(Include Zip Code)* 2530 LOOP ROAD WEST WRIGHT-PATTERSON AFB OH 45433-7101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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