NOT MEASUREMENT SENSITIVE

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PERFORMANCE SPECIFICATION

HYDRAULIC FLUID, PETROLEUM BASE, FOR PRESERVATION AND OPERATION

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

1. SCOPE

1.1 Scope. This specification covers one grade of petroleum base hydraulic fluid that is rust inhibited and used both as a preservative for hydraulic systems and components as well as being an operational fluid. The hydraulic fluid is identified by Military Symbol OHT and NATO Symbol C-635.

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 requirement documents cited in section 3 and 4 of this specification, whether or not they are listed.

2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

U.S. DEPARTMENT OF LABOR (DOL)

OSHA 29 CFR 1910.1200 - Hazard Communication; Interpretation Regarding Lubricating Oils.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BLUE, Warren, MI 48397-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A FSC 9150

(Copies of the Code of Federal Regulations (CFR) may be obtained from the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402.)

2.3 Non-Government publications. The following documents form a part of this document 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 cited 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).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D93	- Flash Points by Pensky Martens Closed Tester (DoD Adopted).
ASTM D97	- Pour Point of Petroleum Oils.(DoD Adopted).
ASTM D130	- Detection of Copper Corrosion from Petroleum Products, by the Copper Strip Tarnish Test.(DoD Adopted).
ASTM D329	- Acetone (DoD Adopted).
ASTM D445	- Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity) (DoD Adopted).
ASTM D664	- Neutralization Number by Potentiometric Titration (DoD Adopted).
ASTM D892	- Foaming Characteristics of Lubricating Oils (DoD Adopted).
ASTM D972	- Evaporation Loss of Lubricating Grease and Oils (DoD Adopted).
ASTM D1193	- Reagent Water (DoD Adopted).
ASTM D1298	- Density, Specific Gravity or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (DoD Adopted).
ASTM D1500	- ASTM Color of Petroleum Products (ASTM Color Scale) (DoD Adopted).
ASTM D1744	- Water in Liquid Petroleum Products by Karl Fischer Reagent (DoD Adopted).
ASTM D1748	- Rust Protection by Metal Preservatives in the Humidity Cabinet (DoD Adopted).
ASTM D2273	- Trace Sediment in Lubricating Oils(DoD Adopted).
ASTM D4057	- Manual Sampling of Petroleum and Petroleum Products (DoD Adopted).

ASTM D4172	- Wear Preventive Characteristics of Lubricating Fluid (Four-Ball method) Test Method for (DoD Adopted).
ASTM D4175	- Standard Terminology Relating to Petroleum, Petroleum Products, and Lubricants (DoD Adopted).
ASTM D4177	- Automatic Sampling of Petroleum and Petroleum Products (DoD Adopted).
ASTM D4636	- Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and other highly Refined Oils (DoD Adopted).
ASTM D4898	- Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis (DoD Adopted).
ASTM E200	- Standard Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis.

(Applications for copies should be address to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3217	- Standard Elastomer Stocks, Test Slabs.

(Applications for copies should be address to Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

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. Hydraulic fluids furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.1.1 Qualification period. All hydraulic fluid which satisfy the requirements of this specification shall be qualified for a period not exceeding five years from the date of its original qualification. Any change in the formulation of a qualified product will necessitate its requalification.

3.1.2 Tolerances. The hydraulic fluid supplied under contract shall have the same formulation as when qualified. The finished oil properties shall fall within permissible tolerances assigned by the qualifying activity to the product receiving qualification.

3.2 Materials. The hydraulic fluid shall be derived from petroleum fractions. These may be virgin or re-refined (recycled or reclaimed) stocks or a combination thereof. Re-refined stocks shall be as defined in ASTM D4175. The stocks shall be compound with such functional additives (anti-wear, oxidation inhibitors, corrosion inhibitors, etc.) as are necessary to meet the specified requirements. The contractor shall certify that no known or suspected human carcinogens (as defined by the National Toxicology Program's Annual Report on Carcinogens) nor toxic pollutants (as defined in 40 CFR 401, “Effluent Guidelines and Standards - General Provisions”) are present in the formulation of this fluid. Certification to this effect shall be made available to the contracting officer or the contracting officer's designated representative.

3.3 Additive materials. Additive materials shall be as specified herein.

3.3.1 Viscosity-temperature coefficient improvers. If necessary, only acrylic polymeric materials shall be added to the petroleum base stock, in quantities not to exceed 20 percent by weight, in order to adjust the viscosity of the finished fluid to the values specified in 3.4.

3.3.2 Oxidation inhibitors. Oxidation inhibitors shall be added in quantities not to exceed 2 percent by weight.

3.3.3 Corrosion inhibitors. Corrosion inhibiting materials shall be added to the blend in quantities necessary to comply with the requirements of this specification. The chloride content of corrosion inhibitors calculated as calcium chloride shall be not more than 0.02 percent, the sulfate content calculated as calcium sulfate shall be not more than 0.05 percent, and the acid number shall be not more than 0.10 milligrams potassium hydroxide per gram (mg KOH/g).

3.3.4 Anti-wear agent. A maximum of 0.5 ± 0.1 percent of anti-wear agents, such as tricresyl phosphate, shall be blended in sufficient quantity to permit the finished oil to meet the lubricity requirements specified in 3.4.12. When tricresyl phosphate is used, it shall contain not more than one percent of the ortho isomer.

3.3.5 Toxic products and formulations. The material shall have no adverse effect on the health of personnel when used for its intended purpose.

3.4 Hydraulic fluid properties. The properties of the hydraulic fluid shall be as specified in table I and 3.4.1 through 3.4.14.

TABLE I. Hydraulic fluid properties.

Property	Value
Viscosity at 40°C1/ centistokes (min)1/	13
Viscosity at -40°C centistokes (max)1/	800
Viscosity at -54°C centistokes (max)	3500
Pour point °C (max)2/	-59
Flash point °C (min)	82
Acid or base number mg KOH/g (max)	0.20
Trace sediment, mL1/, (max)	0.005
Water, percent (max)	0.05

1/ Abbreviations

°C = degrees Celsius min = minimum
max = maximum mL - milliliters

2/ Pour-point depressants shall not be used.

3.4.1 Color. The hydraulic fluid shall be clear and transparent and shall not contain dye in concentration greater than 1 part of dye per 10 000 parts of fluid by weight. There shall be no readily discernible difference in the color of the finished fluid and the standard color.

3.4.2 Corrosiveness and oxidation stability.

3.4.2.1 Corrosiveness. The change in weight of cadmium-plated steel, steel, aluminum alloy, and magnesium alloy when subjected to the action of the hydraulic fluid for 168 hours (h) at 121°C shall be not greater than ± 0.2 milligram per square centimeter (mg/cm^2) of surface. The change in weight of copper shall be not more than ± 0.6 mg/cm^2 of surface. There shall be no pitting, etching, nor visible corrosion on the surface of any of the metals when viewed under magnification of 20 diameters. Any corrosion produced on the surface of the copper shall not be greater than classification 2 of the ASTM corrosion scale as specified in ASTM D130. A slight discoloration of the cadmium-plated strip will be permitted.

3.4.2.2 Resistance to oxidation. The hydraulic fluid shall not have changed more than -5 to +20 percent from the original viscosity in centistokes at 40°C after the corrosiveness and oxidation stability test. The acid number increase shall be not greater than 0.20 after oxidation. There shall be no evidence of separation of insoluble materials nor gumming of the fluid.

3.4.3 Copper strip corrosion. The corrosion produced shall be less than classification 3a of the ASTM corrosion scale as specified in ASTM D130.

3.4.4 Corrosion inhibition. The hydraulic fluid shall afford protection against corrosion of both sand-blasted and polished steel panels.

3.4.5 Low temperature stability. The hydraulic fluid shall not gel, crystallize, nor show separation.

3.4.6 Shear stability. The decrease in viscosity of the candidate hydraulic fluid at 40°C shall not be more than 2.0 percent greater than the decrease in viscosity of the shear stability reference fluid.

3.4.7 Swelling of synthetic rubber. Swelling of the Standard Synthetic Rubber L by the test fluid shall be within the range of 19 to 28 percent.

3.4.8 Evaporation loss. Evaporation loss shall not exceed 75 percent by weight.

3.4.9 Solid particle contamination.

3.4.9.1 Particle size. The number of solid contamination particles per 100 mL of the fluid shall not exceed the number specified in table II.

3.4.9.2 Gravimetric method. The sample for solid particle contamination shall not exceed 0.5 mg/100 mL.

TABLE II. Particle size.

Particle size range (largest dimension) micrometers	Max allowable number of particles (each determination)
5-25	10 000
26-50	250
51-100	50
over 100	10

3.4.9.3 Filtration time. The filtering time for each determination shall be 15 minutes maximum at 25 ± 5°C.

3.4.10 Specific gravity. The specific gravity shall be determined in accordance with 4.5 but shall not be limited. Samples of hydraulic fluid submitted for conformance testing shall not vary more than ± 0.008 at 15.6 ± 2°C from the specific gravity of the sample approved in qualification testing.

3.4.11 Corrosivity. The hydraulic fluid shall prevent corrosion, etching, pitting, or staining on steel disks covered with a brass clip.

3.4.12 Steel-on-steel wear. The average wear scar diameter shall not exceed one millimeter (mm) in diameter.

3.4.13 Foaming characteristics. The foaming characteristics of the hydraulic fluid shall be as specified in table III.

TABLE III. Foaming characteristics.

	Foaming tendency	Foam stability
	Foam volume, mL, at end of 5-minute blowing period (max)	Foam volume, mL at end of 10-minute settling period
At 24°C	65	0
At 94°C	65	0
At 24°C after test at 94°C	65	0

3.4.14 Storage stability. The fully blended product shall show no separation of ingredients nor evidence of crystallization. The blended product shall be clear and transparent when examined visually, and shall conform to the requirements of section 3, except particulate contamination.

3.5 Cleaning. Prior to filling, all containers shall be thoroughly cleaned, rinsed with clean filtered fluid and examined to insure absolute absence of loose solder, dirt, fibers, lint, metal particles, seaming compound, corrosion products, water, or other foreign contaminants. The bottom seam shall show no extruded seaming compound and there shall be no seaming compound on the body immediately adjacent to the side seam. Visible seaming compound, evenly distributed and forming a very fine edge at the point of contact of the seam with the body, shall not be considered a defect. When a soldered seam is used in the fabrication of the can, residual soldering flux shall not be present on the inside seam of the container.

3.6 Marking and labeling requirements. Labeling of unit and exterior containers shall be in accordance with all government regulations and shall contain the following information:

"Military Symbol OHT
NATO Code Number C-635

INSTRUCTIONS: This fluid is not interchangeable with any other type or grade of hydraulic fluid. It is compatible with MIL-PRF-87257, MIL-H-46170, and MIL-H-83282. This fluid can be mixed (compatible) with MIL-PRF-87257, MIL-H-46170 and MIL-H-83282; it can not be used as a substitute (interchangeable) for the above named hydraulic fluids.

WARNING: This fluid may contain less than trace amounts of the ortho isomer of tricresyl phosphate, which is neurotoxic. For the safe use of this product, appropriate protective measures (e.g. gloves, clothing, respirators) should be taken. Avoid inhalation, ingestion, or contact with the skin. Do not reuse containers."

3.6.1 Hazard warning label. Unit and exterior containers shall be marked with a hazard warning label prepared in accordance with the Hazard Communication Standard, 29 CFR 1910.1200. The appropriate warning shall convey the specific physical and health hazards including target organ effects of the material.

3.7 Workmanship. The hydraulic fluid shall be a clear, transparent product, homogeneous in appearance, and free from visible sediment and suspended matter.

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).

4.2 Qualification inspections. Qualification inspections shall consist of tests for all of the requirements specified in section 3.

4.3 Conformance inspections. Conformance inspections shall consist of tests for all of the requirements specified in section 3, except the following:

a. Corrosiveness and oxidation stability (see 3.4.2).
b. Shear stability (see 3.4.6).
c. Storage stability (see 3.4.14).

Unless otherwise specified (see 6.2), the sample representative of each fifth batch shall be subjected to tests for all of the requirements specified in section 3 except the following:

d. Shear stability (see 3.4.6).
e. Storage stability (see 3.4.14).

TABLE IV. Test methods.

Test	ASTM test method
Pour point (see 3.4)	D97
Flash point (see 3.4)	D93
Acid no. (see 3.3.3)	D664
Trace sediment (see 3.4)	D2273
Viscosity (see 3.4)	D445
Water (see 3.4)	D1744
Corrosiveness and oxidation stability (see 3.4.2) 1/	D4636
Evaporation loss (see 3.4.8)	D972
Specific gravity (see 3.4.10)	D1298
Steel-on-steel wear (see 3.4.12)	D4172
Foaming characteristics (see 3.4.13)	D892

1/ Metal squares shall be washed at room temperature with aliphatic naphtha followed by acetone conforming to ASTM D329, instead of 1,1,1 trichloroethane.

4.4 Sampling.

4.4.1 Sampling for tests (except particulate contamination). Samples for tests, except particulate contamination, shall be taken in accordance with ASTM D4057 or D4177.

4.4.2 Sampling for determination of particle size contamination. The sample size and number of determinations per sample for the respective containers shall be as specified in table V. Should the particle count on any individual determination be considered excessive, two additional determinations on another sample from the same container may be used. The container shall be thoroughly shaken for approximately one minute immediately prior to withdrawing each 100 mL portion for all determinations. The arithmetic average of the two closer particle counts shall be considered the particle count for the sample.

TABLE V. Sampling for particle size contamination.

Container size	Sample size, mL	Determinations per sample
1 pint (pt) (0.473 liters (L))	100	1
1 quart (qt) (0.946 L)	100	1
1 gallon (gal) (3.785 L)	200	2
5 gal (18.9 L)	300	3
55 gal (208.2 L)	600	6

4.4.3 Examination of filled containers. Filled containers shall be examined with regard to fill, closure, sealing, and leakage. Any container having one or more defects or under the required fill shall be rejected.

4.5 Methods of qualification inspection. Qualification inspection shall consist of the tests for all of the requirements specified in section 3. Tests shall be in accordance with table IV and with 4.5.1 through 4.5.10.2.2 as applicable. Unless otherwise specified (see 6.2), reagent water conforming to the requirements for type III of ASTM D1193 and reagent-grade chemicals shall be used in all tests. Blank determinations shall be run and corrections applied when necessary.

4.5.1 Color of finished hydraulic fluid. The color of the hydraulic fluid shall be compared with a standard sample prepared by adding one part of dye, Passaic Color and Chemical Company's “Oil Red 235”, or equivalent, to 10 000 parts of an oil not darker than 5 ASTM color. The color comparison shall be made using the sample container and procedures specified in ASTM D1500. Nonconformance to 3.4.1 shall constitute failure of this test.

4.5.2 Copper strip corrosion. Test shall be in accordance with ASTM D130 at 100°C for 72 h.

4.5.3 Corrosion inhibition. Six test panels, three polished and three sandblasted, shall be prepared in accordance with ASTM D1748. Panels shall be tested in accordance with ASTM D1748 for 100 ± 1 h, at 49 ± 1°C and 95 to 100 percent relative humidity. Nonconformance to 3.4.4 shall constitute failure of this test.

4.5.4 Shear stability. One 30 mL sample of the candidate fluid and one 30 mL sample of the reference fluid shall be subjected to sonic oscillation (see 6.11). The respective fluids shall be tested consecutively in the same apparatus and under the same test conditions. Each test shall be of 30 minute duration. The test temperature shall be 40°C. The apparatus shall be regulated so that the decrease in viscosity of the reference fluid is approximately 15 percent at 40°C. Nonconformance to 3.4.6 shall constitute failure of this test.

4.5.5 Swelling of synthetic rubber. Three samples of Standard Synthetic Rubber L conforming to SAE AMS 3217 shall be prepared. Samples shall be approximately 2.5x5.1x0.19 centimeters (cm). The water displacement of each test sheet shall be determined to the nearest 1 mg using distilled water at 24 ± 3°C. A container shall be filled with approximately 20 mL of sample fluid for each gram (g) of total weight of test sheets. Each test sheet shall be blotted dry with filter paper, then sheets shall be immersed completely in sample in container. The container shall be stored in an oven at 70 ± 1°C for 168 ± 0.5 h. During the test period, a ratio of 20 mL of oil to each gram of test sheet shall be maintained. Added oil shall be the same temperature as the test fluid when added. At the end of the storage period, the sample shall be cooled to 24 ± 3°C. Test sheets shall be removed from the sample fluid and shall be wiped to remove most of the adhering sample. The sheets shall be dipped in alcohol and shall be wiped or blotted dry using filter paper (or soft cloths). Within 5 minutes of drying test sheets, the water displacement of each sheet shall be redetermined as specified above. The three test sheet results shall be averaged. The synthetic rubber used in this test shall be no older than 6 months from the date of manufacture. The test shall be considered invalid if the volume percentage of swell for the individual samples differ from each other by more than 5 percent. Nonconformance to 3.4.7 shall constitute failure of this test.

4.5.6 Solid particle contamination.

4.5.6.1 Particle size. Particle size shall be determined by a commercial standard practice agreed upon by the procuring activity and the manufacturer (see 6.2). Nonconformance to 3.4.9.1 and table II shall constitute failure of this test.

4.5.6.2 Gravimetric method. A gravimetric determination shall also be made, in accordance with ASTM D4898, using two 0.45 micrometer (Fm) filter membranes. Nonconformance to 3.4.9.2 shall constitute failure of this test.

4.5.6.3 Filtration time. Using a single 0.45 Fm filter in a filtration apparatus, 100 mL of the sample fluid shall be measured into the filtration apparatus. Within one minute after pouring the sample into the funnel, suction of 36 to 43 cm of mercury shall be applied to the filtration apparatus and the timer shall be started. When the first dry spot appears on the membrane filter, the timer shall be stopped and the suction source shall be disconnected. Nonconformance to 3.4.9.3 shall constitute failure of this test.

4.5.7 Low temperature stability. A sample of oil shall be placed in a cold chamber at -54°C for 72 h. The presence of a dense cloud that does not settle shall not be cause for rejection.

4.5.8 Storage stability. One gallon of fluid shall be stored in a glass jar for 12 months at 24 ± 3°C. The sample shall be stored in such a manner so as to exclude all light from the sample.

4.5.9 Corrosivity. Test shall be conducted in accordance with Appendix A of this specification.

4.5.10 Corrosion inhibitors. Chloride and sulfate content of the corrosion inhibitors shall be determined as specified in 4.5.10.1 through 4.5.10.2.2.

4.5.10.1 Chloride content.

4.5.10.1.1 Reagents. Prepare reagent solutions in accordance with the applicable sections of ASTM E200. The following reagents shall be used.

0.1 Normal (N) potassium thiocyanate (KCNS): 9.70 g KCNS per L of solution.
0.1 N silver nitrate ($AgNO_3$): 16.99 g $AgNO_3$ per L of solution.
Saturated solution of ferric ammonium sulfate ($FeNH_4(SO_4)_2 \bullet 12\ H_2O$)

4.5.10.1.2 Procedure. The following procedure shall be followed:

a. Weigh a 50 ± 0.5 g sample of sulfonate into a 250 mL beaker.
b. Add 50 mL of ethyl ether and stir occasionally until sample is dissolved.
c. Transfer to a 250 mL separatory funnel using an additional 50 mL of ethyl ether for this purpose.
d. Add 25 mL of HNO_3 (1 HNO_3 : 9 H_2O), shake vigorously, allow to settle, and draw the acid layer into another 250 mL separatory funnel.
e. Extract the ether layer with three additional portions of dilute HNO_3 combining the acid extracts in the second separatory funnel.
f. Wash with one 50 mL portion of ether. Draw the acid layer into a 250 mL beaker, discard ether layer and wash out funnel with a few mL of water, adding this to the beaker.
g. Add a few drops of methyl orange indicator to the beaker, neutralize with 35 percent sodium hydroxide (NaOH) and make just acid with dilute HNO_3 (pink color), then add 5 mL more of concentrated HNO_3.
h. Add an excess of 0.1 N $AgNO_3$ and 1 mL of nitrobenzene.
i. Add 5 mL of saturated ferric ammonium sulfate solution.
j. Shake the mixture and titrate with 0.1 N KCNS.

$$\text{Calcium chloride, percent} = \frac{[(A \times N_1) - (B \times N_2)] \times 0.0555 \times 100}{W}$$

where: A = mL of $AgNO_3$ solution added.
B = total mL of KCNS solution added.
N_1 = normality of $AgNO_3$ solution used.
N_2 = normality of KCNS solution used.
W = grams of sample used.

4.5.10.2 Sulfate content.

4.5.10.2.1 Reagents. The following reagents shall be used:

Ethyl ether.
Hydrochloric acid (3HCl : $7H_2O$) containing 35 mL of saturated (at room temperature) bromine water per liter.
Ammonium chloride 1 percent solution.
Barium chloride 100 g $BaCl_2 \bullet 2H_2O$ per liter.

4.5.10.2.2 Procedure. The following procedure shall be followed:

a. Weigh a 20 ± 0.01 g sample of sulfonate into a 100 mL beaker.
b. Transfer into a 250 mL separatory funnel using approximately 100 mL ethyl ether.
c. Add 25 mL of the 3-7 HCl-bromine water reagent, shake for 1 minute, venting frequently, allow the layers to settle, and draw the lower (aqueous) layer into another 250 mL separatory funnel.
d. Extract the ethyl layer with one additional 25 mL and one 20 mL portion of the reagent, combine the three extracts, and wash with a 50 mL portion of ethyl ether in the second separatory funnel.
e. Transfer the combined acid extracts to a 250 mL beaker.
f. Rinse the 50 mL portion of ethyl ether with 5 mL of the reagent, let settle and combine the acid with the extracts in the 250 mL beaker.
g. Neutralize, using methyl orange as indicator, with ammonium hydroxide, and boil until the dissolved ether has been removed (approximately 20 minutes).
h. Make just acid with dilute HCl and add 20 mL of the barium chloride solution.
i. Bring to boiling and place beaker on a steam bath for one-half hour.
j. Filter through a number 42 Whatman filter paper, wash free of excess barium chloride by using three hot ammonium chloride washes.
k. Place the filter paper containing the precipitate into a weighed crucible, ignite until free from carbonaceous matter, cool and reweigh.

$$\text{Calcium sulfate, percent} = \frac{\text{Grams of } BaSO_4 \text{ x } 58.3}{\text{Grams of sample}}$$

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 of materiel 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 within 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.

6. NOTES

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

6.1 Intended use. The hydraulic fluid is intended for use as an operational fluid from -54°C to 135°C where corrosion protection is required and a determination has been made that MIL-PRF-46170 (FRH) hydraulic fluid cannot be used. This includes use in recoil mechanisms and hydraulic systems for rotating weapons or aiming devices of tactical and support ordnance equipment, except combat armored vehicles/equipment which require FRH. The hydraulic fluid is also used as a preservative fluid for aircraft hydraulic systems and components where MIL-H-5606 (OHA) or MIL-PRF-87257 is used as an operational fluid.

6.1.1 Cleaning agents.

6.1.1.1 Isopropyl alcohol. Isopropyl alcohol should not be used as a cleaning agent on components containing any parts which may have come in contact with hydraulic fluid. A sticky acrylic resin is formed which may be detrimental to the proper operation of hydraulic components. If isopropyl alcohol must be used as part of a cleaning sequence, it is essential that the components be thoroughly dried to remove all traces of the alcohol.

6.1.1.2 Chlorinated solvents. Chlorinated solvents should not be used for cleaning hydraulic components. Residual solvent contaminates the hydraulic fluid and may cause corrosion damage.

6.1.1.3 Recommended solvents. The recommended solvents are P-D-680, type II, or other petroleum distillate type solvents.

6.1.2 Storage condition. 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.

6.2 Acquisition requirements. Acquisition documents must 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 2.3).

c. If sample for conformance inspection should be tested other than as specified (see 4.3).
d. If water and/or chemicals used are other than specified (see 4.5).
e. Method of determining particle size (see 4.5.6.1).
f. Packaging requirements (see 5.1).
g. Type, PIN, and quantity of oil required (see 6.4).

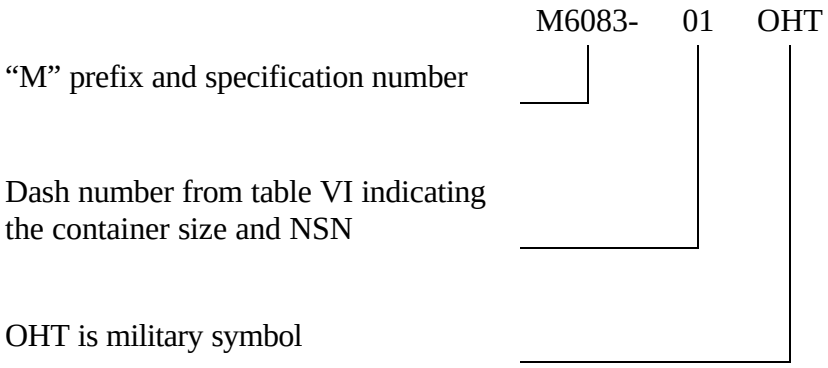
6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 6083 whether or not such products have actually been so listed by that date. The attention 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 may be obtained from US Army Mobility Technology Center-Belvoir, ATTN: AMSTA-RBF, 10115 Gridley Rd., STE 128, Ft. Belvoir VA 22060-5843.

6.4 National Stock Numbers (NSNs). The following is a list NSNs which correspond to the hydraulic fluid container sizes:

TABLE VI. NSN and corresponding minimum container size.

Size designation	National Stock Numbers - NSN	Size containers
01	9150-00-935-9807	1 qt
02	9150-00-159-4472	16 ounces aerosol
03	9150-00-935-9808	1 gal
04	9150-00-935-9809	5 gal
05	9150-00-935-9810	55 gal drum

6.5 Part identifying number (PIN). The PIN to be used for hydraulic oil acquired to this specification are created as follow:



6.6 Fluid handling. Owing to the difficulty of preventing contamination after the opening of a container, it is recommended that the hydraulic fluid be purchased in 16-ounce (oz), 1-qt, and 1 gal containers by all users. If the fluid is dispensed from larger containers, strict procedures must be employed to exclude and remove moisture, solid particles or other contaminants from the fluid.

6.7 International standardization. Certain provisions of this specification are the subject of international standardization agreements (NATO STANAG 1135, STANAG 3149, STANAG 3713). 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 standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.8 Interchangeability and compatibility. MIL-PRF-6083 fluids are not substitutable for (interchangeable with) any other fluids. MIL-PRF-6083 fluids should not be mixed (regarded as compatible) with any other fluids except those conforming to MIL-PRF-87257, MIL-PRF-46170, and MIL-H-83282.

6.9 Disposal actions.

6.9.1 Background. The product may contain 0.5 percent tricresyl phosphate, where not more than 0.01 percent may be present as the ortho isomer. If this ortho isomer of tricresyl phosphate is absorbed through the skin or taken internally it may cause paralysis. Accumulated waste liquids should have the exterior of the outer pack marked as containing tricresyl phosphate to assist disposal facilities to manage the product according to regulations promulgated by the US Environmental Protection Agency under Public Law 94580, Resource Conservation and Recovery Act of 1976.

6.9.2 Handling and safety precautions. Personnel handling the product should wear appropriate impervious clothing to prevent repeated or prolonged skin contact. Local appraisal is required for exact health and safety implications and compliance with OSHA regulations. Product

labeling and Material Safety Data Sheets (MSDS) information should be used by safety and health office of using activity to prescribe precise application of protective measures. If skin or clothing becomes moistened with the product, personnel should promptly wash with soap or mild detergent and water. Respirators are not required unless there is an inhalation exposure to mists. Personnel should wear protective clothing when using the product and when cleaning up spills.

6.9.3 Disposal.

6.9.3.1 Field operations. Depending on the size of spills, paper towels or absorbent should be used to absorb the liquid. Contaminated soil should be removed and placed in a box with absorbent or towels. This box with spill clean-up wastes should either be buried along with ordinary refuse at a rate not to exceed 10 lbs of clean-up waste per spill event or be incinerated in a permitted municipal waste incinerator. Bulk wastes and contaminated liquids should not be landfilled. Partially full containers or contaminated product should be collected centrally for commercial recycling by a commercial reprocessing firm. Recycling by DoD military field activities, including depot-type operations, are not authorized at this time. Liquid products used for heat recovery are regulated by the Environmental Protection Agency under Public Law 94580, Resource Conservation and Recovery Act of 1976. Heat recovery is required to meet the Standard in 40 CFR 266, subpart E, Used Oil, burned energy recovery.

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

6.10 Recommended maximum blending temperature. At no time during compounding process or any operations subsequent thereto, should the temperature of any of the ingredients of the liquid, or the fluid itself, be greater than 149°C.

6.11 Sonic shear test equipment. A 250 W, 10 KC magnetostrictive oscillator model DF-101 supplied by the Raytheon Corporation, or its equivalent, may be used in the shear stability test (see 3.4.6). Directions in the manual for respective instruments should be followed.

6.12 Material safety data sheets. Contracting officers should identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission are listed in appendix B of FED-STD-313.

6.13 Subject term (key word) listing.

C-635
OHT
Tricresyl phosphate

6.14 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.

APPENDIX A

TEST PROCEDURE FOR DETERMINING CORROSIVITY

A.1 SCOPE

A.1.1 Scope. This Appendix gives the procedure for determining the corrosiveness of an oil on a bimetallic couple. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 APPLICABLE DOCUMENTS

A.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 requirement documents cited in section 3 and 4 of this specification, whether or not they are listed.

A.2.2 Non-Government publications. The following documents form a part of this document 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 cited 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).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B121 - Standard Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar (DoD Adopted).

(Applications for copies should be address to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

A.3 PROCEDURE

A.3.1 Specimen preparation.

A.3.1.1 Steel disks. Three steel disks (composition in accordance with Unified Number System designation G52986, dimensions of 2.54 cm diameter by 1.25 to 2.54 cm thick, and heat treated to Rockwell C-62 hardness) shall be prepared as follows:

a. Grind one side to 0.508 micrometer roughness prior to hand-polishing.
b. Slush the disks in methyl alcohol, absolute [1,3,0] to remove traces of coolant used in grinding.

c. Polish the ground side using 150, 240, 400, and 600 grit silicon carbide or aluminum oxide paper in succession. Perform each polishing operation at right angles to the previous one, and continue until all cross scratches from the previous operation are removed.
d. Clean the disks by wiping with a clean, lint-free, dry cloth, being careful not to touch the polished surface with bare hands.
e. Examine with 10-power magnifier for discoloration, etching, pitting, or other signs of corrosion. Discard disks with any sign of corrosion.
f. Store the disks in a desiccator until use.

A.3.1.2 Brass clips. Three brass clips (composition in accordance with ASTM B121, H08 temper, fabricated to dimensions shown in figure A.1.) shall be prepared as follows:

a. Immerse the brass clips in an etching solution for 20 seconds. The etching solution shall consist of

450 mL distilled water
225 mL concentrated nitric acid [2,0,0]
300 mL concentrated sulfuric acid [3,0,2]
8 mL concentrated hydrochloric acid [3,0,0].

b. Immediately wash successively in cold running water, distilled water, and technical grade acetone [1,3,0]. Allow to air dry, and store in the desiccator until ready for use. Be careful not to touch (with bare hands) the surface that will be in contact with the steel disks.

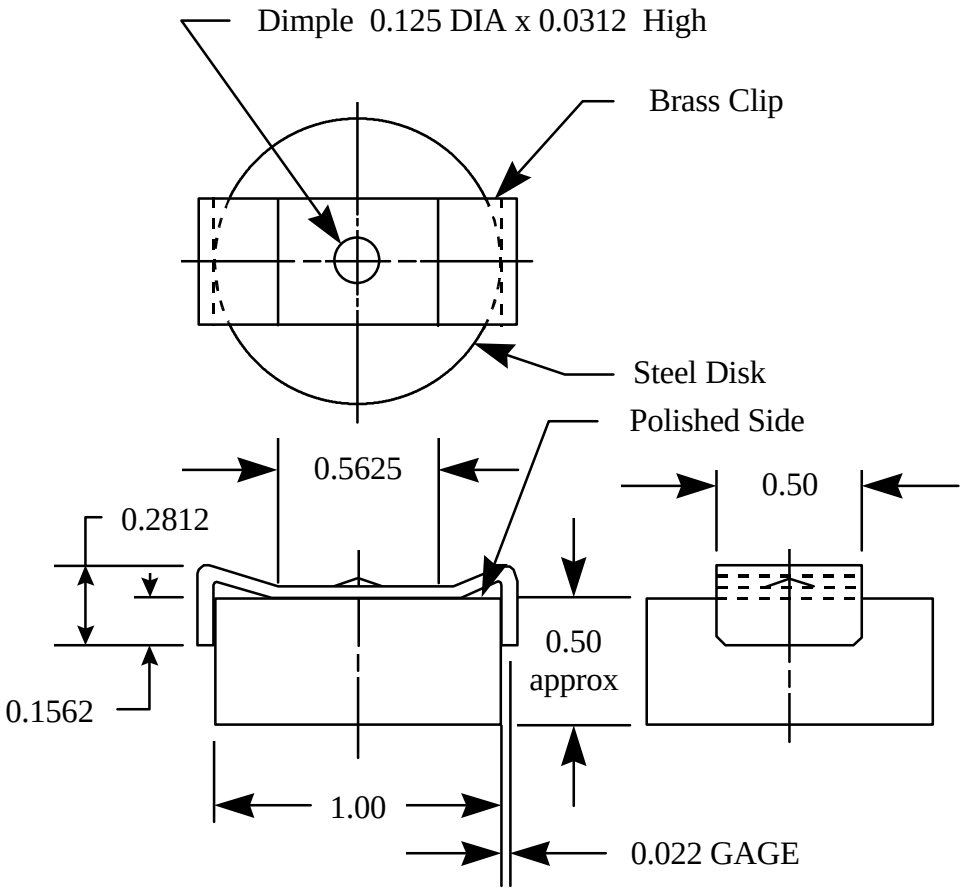
A.3.2 Test procedure. The following test procedure shall be performed.

a. Remove the disks from the desiccator (being careful not to touch the finished surface), and using a stirring rod, drip the test sample over the entire polished surface of each disk.
b. Remove the brass clips from the desiccator (being careful not to touch the area to be in contact with the polished surface of the disks), and place on the disks as indicated in figure A.1 so that the center of the clip is in full contact with the disk.
c. Place the assemblies in a humidity cabinet for 10 days at 27°C and 50 percent relative humidity.
d. Remove the assemblies from the cabinet after 10 days, and using a sharp pencil, mark an outline of the clips where they were in contact with the polished surface of the disks. Remove the clips, and wipe the disks clean with lint free cloth.
e. Using a 10-power magnifier, examine the marked off area of the disks for discoloration, etching, pitting, or other signs of corrosion.

f. If the test results are questionable, repeat the test using new disks and extending the exposure time in the humidity cabinet to 20 days. Examine the disks and indicate that the test was repeated.

A.4 ACCEPTANCE LEVELS

A.4.1 Failure. Oil shall be considered to have failed this test if the test areas of more than one disk show signs of corrosion, pitting, or other attack. The oil shall also have failed if two are free of corrosion, but the third shows more than three affected spots.



NOTES:
1. Dimensions in inches.
2. Tolerance ± 0.0312

FIGURE A.1. Corrosivity test setup.

Custodians:
Army - AT
Navy - AS
Air Force - 68

Preparing Activity:
Army-AT

(Project 9150-1163)

Review Activities:
Army - AL, AV, MD, MI
Navy - OS, MC, SA, SH,
DLA - GS, PS

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, 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 of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive 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-6083F	970917

3. DOCUMENT TITLE

HYDRAULIC FLUID, PETROLEUM BASE, FOR PRESERVATION AND OPERATION

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, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE *(Include Area Code)*	
	(1) Commercial (810) 574-8745	(2) AUTOVON 786-8745
c. ADDRESS *(Include Zip Code)* Commander U.S. Army Tank-automotive and Armaments Command ATTN: AMSTA-TR-E/BLUE Warren, MI 48397-5000	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	