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SUPERSEDING
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MILITARY SPECIFICATION

HYDRAULIC FLUID, RUST INHIBITED, FIRE RESISTANT

SYNTHETIC HYDROCARBON BASE

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

1. SCOPE

1.1 Scope. This specification covers the requirements for two types of synthetic hydrocarbon base hydraulic fluids. Type I is undyed and identified by Military symbol FRH and NATO code No. H-544 (see 6.7). Type II is dyed red for aero space use.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified (see 6.2), the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATION

FEDERAL

TT-T-656	- Tricresylphosphate.
PPP-C-96	- Cans, Metal, 28 Gage and Lighter.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Mobility Equipment Research and Development Command, ATTN: DRDME-DS, Fort Belvoir, VA 22060 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 9150

MILITARY

MIL-H-5606	- Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance.
MIL-H-6083	- Hydraulic Fluid, Petroleum Base for Preservation and Operation.
MIL-H-27601	- Hydraulic Fluid, Petroleum Base, High Temperature, Flight Vehicle.
MIL-H-83282	- Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft.

STANDARDS

FEDERAL

FED STD-313	- Material Safety Data Sheets, Preparation and Submission of.
FED-STD-791	- Lubricants, Liquid Fuels and Related Products; Methods of Testing.

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-290	- Packaging of Petroleum and Related Products.

PUBLICATION

BULLETIN

AF539	- Standard Elastomer Stocks.

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

D92	- Flash and Fire Points by Cleveland Open Cup.
D97	- Pour Point of Petroleum Oils.
D130	- Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test.
D270	- Sampling Petroleum and Petroleum Products.
D287	- API Gravity of Crude Petroleum and Petroleum Products. (Hydrometer Method).

D445 - Kinematic Viscosity of Transparent and Opaque Liquids and the Calculation of Dynamic Viscosity.
D892 - Foaming Characteristics of Lubricating Oils.
D972 - Evaporation Loss of Lubricating Greases and Oils.
D974 - Neutralization Number by Color-Indicator Titration.
D1193 - Reagent Water.
D1744 - Water in Liquid Petroleum Products by Karl Fischer Reagent.
D1748 - Rust Protection by Metal Preservatives in the Humidity Cabinet.
D1500 - ASTM Color of Petroleum Product (ASTM Color Scale).
D2266 - Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method).
D2273 - Trace Sediment in Lubricating Oils.
E1 - ASTM Thermometers.
E659 - Autoignition Temperature of Liquid Chemicals.
F313 - Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis.

(The ASTM standards listed above are included in Part 23, 24 or 25 of the Annual Book of ASTM Standards and are available separately. Application for copies should be addressd to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Specifications and standards of technical society are generally available for reference from libaries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. Hydraulic fluids furnished under this specification shall be products that are qualified for listing on the applicable Qualified Products List (QPL) at the time set for opening of bids (see 4.5.1 and 6.3).

3.1.1 Requalification. Requalification will be required if there is a change in the base stock source, synthesis process or additives. A minor change in the fluid formulation may be made without requalification, but only after notification to, and approval by, the qualifying activity (see 6.3). The qualifying activity may, at its discretion, waive complete requalification or may require only partial requalification testing in order to determine the significance and acceptability of the proposed formulation change.

3.2 Materials. The hydraulic fluid shall consist of a synthetic hydrocarbon base stock (alpha-olefin polymer) (see 3.3), and shall contain additives to meet the technical requirements of the finished product. The hydraulic fluid shall contain no resins, gums, fatty oils, oxidized hydrocarbons, chlorine or silica.

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

3.2.1.1 Corrosion inhibitors. Corrosion inhibiting materials shall be added to the blend in quantities necessary to comply with the requirements of this specification. When tested in accordance with 4.6.6 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 acid number shall not exceed 0.10 mg. KOH/gm.

3.2.1.2 Rubber swelling agent. The rubber swelling agent shall not exceed 30 percent by weight of the finished fluid.

3.2.1.3 Dye.

3.2.1.3.1 Type I. No dye shall be added.

3.2.1.3.2 Type II. The fluid shall contain red dye in a concentration not greater than one part of dye per 10,000 parts of oil by weight.

3.2.1.4 Anti-wear agent. A maximum of 1 percent of anti-wear agents, such as tricresyl phosphate conforming to TT-T-656, shall be blended in sufficient quantity to permit the finished oil to meet the lubricity requirements specified in 3.3.9. When tricresyl phosphate is used, it shall contain not more than one percent of the ortho-isomer.

3.2.1.5 Other additives. Other additives may be added to meet the requirements of the specification.

3.3 Base stock requirements. The properties of the synthetic hydrocarbon base stock used in formulating the finished hydraulic fluid, before the addition of any other ingredients, shall be as specified in table I, when tested as specified in 4.6.

TABLE I. Properties of synthetic hydrocarbon base stock.

Property	Value
Viscosity in centistokes @ 40° C., (max)	18.5
Viscosity in centistokes @ 100° C., (min)	3.4
Viscosity in centistokes @ -40° C., (max)	2600
Flash point, ° C., (min)	204
Fire point, ° C., (min)	246
Evaporation loss, wt. percent, (max)	5.0
Acid or base number, mg. KOH/gm., (max)	0.10
Specific gravity at 15.6° C/15.6° C.	Report
Color, ASTM, (max)	1
Pour point, ° C., (max) 1/	-54

1/ No pour point depressant or viscosity index improver shall be used.

3.4 Finished fluid. The properties of the finished fluid shall be as specified in table II and 3.4.1 through 3.4.13.

TABLE II. Properties of finished fluid.

Property	Value
Viscosity in centistokes @ 40° C., (max)	19.5
Viscosity in centistokes @ 100° C., (min)	3.4
Viscosity in centistokes @ -40° C., (max)	2600
Viscosity in centistokes @ -54° C., (max)	Report
Trace sediment, ml, (max)	0.005
Evaporation loss, wt. percent, (max)	5.0
Flash point, ° C., (min) Type 1	218
Type II	204
Fire point, ° C., (min)	246
Pour point, ° C., (max) 1/	-54
Water, wt. percent, (max)	0.05
Acid or base number, mg. KOH/gm., (max)	0.20
Autoignition temperature, ° C., (min)	343
Bulk modulus (isothermal secant, 0 to 0.6.8 X 10^4 kPa (0 to 10,000 psi) at 40° C., kPa (psi), (min)	1.379X10^6 200,000
Water sensitivity, % transmittance, (min)	90%

1/ No pour point depressant or viscosity index improvers shall be used.

3.4.1 Specific gravity. The specific gravity shall be determined in accordance with 4.6 but shall not be limited. Samples of the hydraulic fluid submitted for acceptance tests shall not vary more than ± 0.008 at 15.6°C/15.6°C from the specific gravity of the sample originally approved.

3.4.2 Galvanic corrosion. When tested in accordance with 4.6, the hydraulic fluid shall prevent corrosion, etching, pitting or staining on the steel discs covered with a brass clip.

3.4.3 Corrosiveness and oxidation stability. The test shall be performed in accordance with 4.6.

3.4.3.1 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 at 121.1° C shall be no greater than ± 0.2 milligrams per square centimeter of surface. The change in weight of copper shall be no greater than ± 0.6 milligrams per square centimeter of surface. There shall be no etching, pitting 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. 2 of ASTM copper corrosion standards (ASTM D130). A slight discoloration of the cadmium shall also be permitted.

3.4.3.2 Oxidation stability. The hydraulic fluid shall not have changed more than 10 percent from the original viscosity in centistokes at 40° C after the corrosiveness and oxidation stability test. The viscosity shall be determined

in accordance with 4.6. The acid or base number after oxidation, as determined in accordance with 4.6 shall not have increased by more than 0.30 over the acid or base number before the oxidation test. There shall be no evidence of separation of insoluble materials nor gumming of the fluids.

3.4.4 Low temperature stability. When tested as specified in 4.6, for 72 hours at -40° C, the hydraulic fluid shall not gel, crystallize nor show separation.

3.4.5 Rust prevention. When tested in accordance with 4.6.1, the hydraulic fluid shall afford protection against corrosion of both sandblasted and polished steel panels.

3.4.6 Swelling of synthetic rubber. When tested in accordance with 4.6, swelling of the standard synthetic rubber NBR-L (as referenced in USAF Specification Bulletin 539) by the test fluid shall be within the range of 15.0 to 25.0 percent.

3.4.7 Solid particle contamination.

3.4.7.1 Particle size. When samples taken for particle count are tested in accordance with 4.6.7.1, in a clean dust free atmosphere, the number of solid contamination particles per 100 ml of the fluid shall not exceed the number specified in table III.

TABLE III. Particle size.

Particle size range (largest dimension) micrometers	Allowable number (max) each determination
5-25	10,000
26-50	250
51-100	50
over 100	10

3.4.7.2 Gravimetric method. The sample for solid particle contamination when tested in accordance with 4.6.7.2 shall not exceed 0.5 mg/100 ml.

3.4.7.3 Filtration time. The filtering time for each determination in 4.6.7.3 shall be 15 minutes maximum at 25 ± 5° C (77 ± 9° F).

3.4.8 Foaming characteristics. When tested in accordance with 4.6, the foaming characteristics of the hydraulic fluid shall be as specified in table IV.

TABLE IV. Foaming characteristics.

Test	Foaming tendency	Foam stability
	Foam volume, ml at end of 5 minutes blowing period.	Foam volume, ml at end 10 minutes settling period
at 24° C	65 (max)	Complete collapse 1/
at 93.5° C	65 (max)	Complete collapse 1/
at 24° C after test at 93.5° C	65 (max)	Complete collapse 1/

1/ A ring of bubbles around the edge of the graduate shall be considered complete collapse.

3.4.9 Lubricity. When tested in accordance with 4.6, wear values on a 10.0 ± 0.5 ml sample of the hydraulic fluid shall be as specified in table V.

TABLE V. Wear values.

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

3.4.10 Compatibility. When tested in accordance with 4.6.2, the hydraulic fluid shall be compatible in all concentrations with each of the fluids approved under this specification. Further, the hydraulic fluid shall also be compatible with MIL-H-5606, MIL-H-6083 and MIL-H-83282 fluids in all proportions.

3.4.11 Flammability.

3.4.11.1 High temperaure - high pressure spray ignition. If spray ignites when the test flame is applied in accordance with 4.6, the test fluid shall not continue to burn when the source of ignition is removed.

3.4.11.2 Flame propagation. When tested as specified in paragraph 4.6.4.1, the flame propagation rate shall be not more than 0.30 cm/sec.

3.4.12 Color of finished fluid (Type II only). There shall be no readily discernible difference in the color of the finished fluid and the standard color when tested as specified in 4.6.8.

3.4.13 Storage stability. After 12 months storage in accordance with method 3465 of FED-STD-791 (see 4.6), 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.

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

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government or the procuring agency. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot.

4.2.1 Bulk lot. An indefinite quantity of a homogeneous mixture of hyraulic fluid, 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 the ingredient materials.

4.2.2 Packaged lot. An indefinite number of unit containers of identical size and type, offered for acceptance, and filled with a homogeneous mixture of hydraulic fluid from a single, isolated container; or filled with a homogeneous mixture of hydraulic fluid, manufactured in a single plant run (not exceeding 24 hours), through the same processing equipment, with no change in ingredient materials.

4.3 Sampling.

4.3.1 Sampling for examination of filled containers. Take a random sample of filled containers from each packaged lot in accordance with MIL-STD-105 at inspection level II and acceptable quality level (AQL) 2.5 percent defective.

4.3.2 Sampling for tests (except particle size). Take samples for tests, except particulate contamination, in accordance with ASTM method D270.

4.3.3 Sampling for determination of particle size contamination. Take samples for determination of particle size contamination in accordance with MIL-STD-105 at inspection level S-3. The sample size and number of determinations per sample for the respective containers shall be as specified in table VI.

TABLE VI. Sample for particle size.

Container	Sample size (ml) 1/	Number of determinations per sample
1 quart	100	1
1 gallon	200	2
5 gallon	300	3
55 gallon	600	6

1/ Each determination shall be made on 100-ml portions of the sample.

4.3.3.1 Sample for determination of solid particle contamination (gravimetric method). One sample shall be taken from the orifice of the filler during the first day that packaging of a batch commences, for testing in accordance with 4.6.7.2.

4.3.4 Qualification samples. Qualification samples shall consist of three 1-gallon (3.785 liters) containers of hydraulic fluid, 1 gallon (3.785 liters) of the base stock before the blending-in of additives, 1 gallon (3.785 liters) of rubber swell fluid, 8 ounces avoirdupois (226.8 grams) of the anti-wear agent, 1 ounce (28.4 grams) of the oxidation-stability improver, and 1 ounce (28.4 grams) each of any other additives used in the finished fluid. If additives are supplied as concentrated solutions, an equivalent quantity of the solution shall be furnished. The samples shall be accompanied by a safety data sheet prepared in accordance with FED-STD-313 and a test report from the manufacturer or from a commercial laboratory containing complete information concerning the sources and types of the base stock and the additives used, the formulation and composition of the finished fluid, and the laboratory data showing quantitative results of all tests required in this specification except storage stability. Separate qualification inspection shall be required for each base stock used. The samples, reports, and safety data sheet shall be forwarded to the US Army Mobility Equipment Research and Development Command, Energy and Water Resources Laboratory, ATTN: DRDME-GL, Fort Belvoir, VA 22060. The samples shall be plainly identified by durable tags or labels, securely attached, and marked with the following information:

Sample for qualification inspection
HYDRAULIC FLUID, RUST INHIBITED, FIRE RESISTANT, SYNTHETIC HYDROCARBON BASE
Name of ingredient (for ingredient material)
Name of manufacturer
Product code number
Date of manufacturer

Submitted by (name) and (date) for qualification inspection in accordance with the requirements of MIL-H-46170 under authorization of (reference authorizing letter) (see 6.3).

4.3.4.1 Formulation sheet. The formulation sheet, indicating the percentage and identity of each ingredient, shall be of the following form:

Base stock (Composition)	percent
Rubber swell fluid	percent
Anti-wear additive (Mfr's name and No.)	percent
Oxidation inhibitor (Mfr's name and No.)	percent
Other additives	percent

4.4 Inspection. Perform inspection in accordance with Method 9601 of FED-STD-791.

4.4.1 Examination of filled containers. Examine samples taken in accordance with 4.3.1 for compliance with MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing and marking requirements. Reject any container having one or more defects or under the required fill. If the number of defective or underfilled containers exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, reject the lot represented by the sample.

4.5 Classification of tests.

(a) Qualification of tests.
(b) Quality conformance tests.

4.5.1 Qualification tests. Qualification tests shall consist of tests for all of the requirements specified in Section 3.

4.5.2 Quality conformance tests. Quality conformance tests shall consist of tests for all of the requirements specified in Section 3 except the following:

Bulk modulus (see 3.4).
Corrosiveness and oxidation stability (see 3.4.3).
High temperature-high pressure spray ignition (see 3.4.11.1).
Flame propagation (see 3.4.11.2).
Compatibility (see 3.4.10).
Storage stability (see 3.4.12).

4.6 Test methods. Perform tests in accordance with table VII and with 4.6.1 through 4.6.8 as applicable. Use reagent water conforming to the requirements for type III of ASTM method D1193 and reagent-grade chemicals in all tests, unless otherwise specified. Run blank determinations and apply corrections when necessary.

TABLE VII. Test methods.

Test	Test method No.	
	FED-STD-791	ASTM STANDARD
Pour Point		D97
Flash Point		D92
Fire Point		D92
Evaporation loss 1/		D972
Specific gravity		D287
Viscosity		D445
Foaming		D892
Color, ASTM (base stock)		D1500
Water		D1744
Acid and base number		D974
High temperature-high pressure spray ignition	6052	
Autoignition temperature		E659
Corrosiveness and oxidation stability 2/	5308	
Swelling of synthetic rubber 3/	3603	
Low temperature stability	3458	
Storage stability	3465	
Lubricity 4/		D2266
Galvanic corrosion	5322	
Rust prevention (see 4.6.1)		D1748
Trace sediment		D2273

1/ Test temperature 149° C. Test time: 22 hours.

2/ Bath, constant temperature, 121° ± 1° C. Test time: 168 hours. Thermometer ASTM E1-35C.

3/ Use standard rubber NBR-L (see 3.4.6 and 6.4) within 6 months of date of manufacture.

4/ A different 10 ± 0.5 ml sample shall be used for each test.

4.6.1 Rust prevention. Prepare six test panels, three polished and three sand-blasted, in accordance with ASTM method D1748. Perform the test in accordance with ASTM method D1748 for 100 ± 1 hours, at 49 ± 1° C and 95 to 100 percent relative humidity.

4.6.2 Compatibility. Samples of candidate hydraulic fluid in amounts of 25 ml, 50 ml and 75 ml shall be mixed with samples from each of the fluids previously approved under this specification. Total volume of each mixture shall be 150 ml. Mixtures shall be prepared in 250 ml stoppered flasks. The flasks shall be throughly agitated and then stored in an oven at 135° C for 3 hours. At the end of this time none of the mixtures shall show any signs of sediment, turbidity or crystallization. The sample shall then be stored at -40° C

for a period of 3 hours at which time slight turbidity that later disappears will be permitted. Compatibility tests described herein shall also be conducted with a representative fluid qualified to MIL-H-5606, MIL-H-6083 and MIL-H-83282.

4.6.3 Bulk modulus.

4.6.3.1 Apparatus. The bulk modulus of the hydraulic fluid shall be determined using test equipment referenced in MIL-H-27601.

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

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

where V is the original volume of the fluid.
ΔV is the observed volume change due to ΔP increase in pressure,
ΔP is the pressure change between the two measurements in psig, and
ΔVg is the correction factor.

The correct factor (ΔVg) 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 (4.77×10^6 psig.)

$$\text{Therefore: } \Delta Vg = \frac{V\Delta P}{4.77 \times 10^6}$$

4.6.4 Flammability.

4.6.4.1 Flame propagation test. The flame propagation test shall be conducted according to 4.5.5 of MIL-H-83282B.

4.6.5 Water sensitivity test. The following procedure shall be used to determine water sensitivity.

a. Clean two 1-pint (475 ml) glass bottles with caps by washing with a detergent (Alconox or equivalent), rinsing with tap water, then reagent-grade water 1/, then anhydrous isopropyl alcohol and finally filtered petroleum ether. After the petroleum ether rinse, allow the bottles to drain upside down in the dust-free clean room where they are to be used.

b. Clean a 250-ml volumetric flask, a funnel, a punch and the top of the can by the same method used to clean the 1-pint (475-ml) bottles above. In the clean room, shake the can to be tested (clean and hermetically sealed) to distribute uniformly any settled material. Punch the top of the can and transfer a 250-ml sample of oil into each of the cleaned bottles using the volumetric flask and the funnel mentioned above.

c. To one of the samples add 0.50 ml of reagent-grade water 1/ (0.20 percent by volume), using a clean, 1.0-ml graduated pipette. Place the cap on the bottle and shake it throughly for 60 seconds. Allow it to stand for 24 hours at a temperature of 24 + 3° C.

d. At the end of the 24-hour period, conduct a light transmittance test using a spectrophotometer capable of being adjusted to 100-percent light transmittance at approximately 540 nm on the untreated oil sample, as follows: Place the untreated oil sample in a single beam spectrophotometer, using a cell with a path length of one centimeter. Adjust the light transmittance at 540 nm to 100 percent transmittance. Remove the untreated sample and replace it with the water-treated sample, again using a cell with a path length of one centimeter. Record the transmittance reading. If the light transmittance reading is less than 90 percent, the fluid is unacceptable.

NOTE: The comparison described in d. (above) may be performed in a differential mode, as an alternative.

4.6.6 Corrosion inhibitors. Determine chloride and sulfate content of corrosion inhibitors in accordance with 4.6.6.1 and 4.6.6.2 of specification MIL-H-6083. Determine the acid number by ASTM method D974.

4.6.7 Solid particle contamination.

4.6.7.1 Particle size. Particle size shall be measured by the use of automatic particle counters in lieu of the optical procedure detailed in method 3009 of FED-STD-791. HlAc counter, models PC-202, PC-203, PC-305, PC-320 or equivalent, counting to the limits specified in table III may be used. Directions in the manual for the respsective instruments shall be followed.

4.6.7.2 Gravimetric method. A gravimetric determination shall also be made, by ASTM method F313, using two 0.45 micrometer filter membranes.

1/ Conforming to type III of ASTM D1193.

4.6.7.3 Filtration time. Filtration time will be measured in accordance with method 3009 FED-STD-791 using a single 0.45 micrometer filter.

4.6.8 Color of Type II finished hydraulic fluid. Compare the color of the hydraulic fluid with a standard sample prepared by adding one part dye, Passaic Color and Chemical Company's "Oil Red 235" to 10,000 parts of an oil not darker than 5 ASTM color. Make the color comparison using the sample containers and procedures described in ASTM D1500.

4.7 Inspection of packaging.

4.7.1 Examination. The examination of the packaging and packing of the hydraulic fluid shall be done in accordance with the inspection requirements of MIL-STD-290. The container shall be inspected for all the characteristics stated in paragraph 5.1. Any container that is not as specified shall be cause for rejection.

4.7.2 Marking. The marking of the hydraulic fluid containers shall be inspected for the characteristics listed in paragraph 5.2. Any marking not as shown in paragraph 5.2 shall be cause for rejection of the whole lot.

5. PACKAGING

5.1 Packaging and packing. The packaging and packing of the hydraulic fluid shall be in accordance with MIL-STD-290. For Army procurement, the fluid shall be furnished only in 1-quart or 1-gallon metal cans conforming to type I of PPP-C-96, as specified (see 6.2). For Navy, Air Force and industrial procurement, larger containers of other types may be used if so specified in the procurement documents (see 6.2 and 6.5). All materials used in the construction of the containers shall be such as will not affect or be affected by the contained hydraulic fluid. Just prior to filling, all containers shall be thoroughly cleaned, rinsed wih 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 cause for rejection. If 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.

5.2 Marking. The marking of the hydraulic fluid containers shall be in accordance with MIL-STD-290. In addition to any special marking required in the contract or order, the unit containers for type I shall also be marked with the following:

MILITARY SYMBOL FRH
NATO CODE NUMBER H-544

NOT TO BE USED FOR AIR APPLICATIONS

Type I and II shall also be marked with the following:

INSTRUCTIONS: THIS FLUID IS NOT INTERCHANGEABLE WITH ANY OTHER TYPE OR GRADE OF HYDRAULIC FLUID. IT IS COMPATIBLE WITH MIL-H-5606, MIL-H-6083, and MIL-H-83282.

WARNING: THIS FLUID MAY CONTAIN TRICRESYL PHOSPHATE WHICH MAY BE ABSORBED THROUGH THE SKIN AND PRODUCES PARALYSIS IF TAKEN INTERNALLY. APPROPRIATE PROTECTIVE MEASURES SHOULD BE TAKEN TO AVOID SUCH EXPOSURES. DECONTAMINATE CONTAINERS BEFORE REUSE.

Type II shall also be marked "NOT FOR GROUND EQUIPMENT USE".

6. NOTES

6.1 Intended use. The hydraulic fluid covered by Type I of this specification is intended for use in the tank recoil mechanism and hydraulic systems. If used in any other ground equipment mechanisms or systems, a study should be made to determine its applicability in such mechanism or systems, particularly in the area of elastomer compatiblity and operation at high and low temperatures. The fluid is rust inhibited and may be used as a preservative medium for hydraulic systems and components. The hydraulic fluid covered by type II of this specification is intended for use in aerospace test stands.

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 -57° C to 71° C.

6.2 Ordering data. Procurement documents should specify:

(a) Title, number and date of this specification.
(b) Type of fluid required (see 1.1)
(c) Type and size of container (see 5.1 and 6.2.1).
(d) Quantity.
(e) Applicable levels of packaging and packing (see 5.1).

6.2.1 Unit of purchase. The material should be purchased by volume, unit being of a US gallon of 231 cubic inches at 15.6° C.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening bids, qualified for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of contractor is called to this requirement, and manufacturers are urged to arrange

to have the products that they proposed 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 qualified products list is the US Army Mobility Equipment Research and Development Command, Energy & Water Resources Laboratory, ATTN: DRDME-GL, Fort Belvoir, VA 22060, and information pertaining to qualification of products may be obtained from that activity.

6.4 Standard elastomer. Samples of the standard synthetic rubber NBR-L for the test for swelling of synthetic rubber specified in table VII may be obtained from the qualification activity (see 6.3).

6.5 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 1-quart and 1-gallon 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.

6.6 Recommended corrosion inhibitor. It has been found that 1.75 percent ± .25 percent barium dinonylnaphthalene sulfonate provides the required degree of rust protection. The diluent of the rust inhibitor should be the synthetic hydrocarbon base stock.

6.7 International standardization. Certain provisions of this specification are the subject of international standardization agreement (NATO STANAG 1135). When amendment, revision, or cancellation of this specification is proposed which would affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization offices, if required.

6.8 Interchangeability and compatibility. MIL-H-46170 fluids are not interchangeable with any other fluids. MIL-H-46170 fluids should not be regarded as compatible with any other fluids except those conforming to MIL-H-5606, MIL-H-6083, and MIL-H-83282. Dilution with MIL-H-5606, or MIL-H-6083 severely lowers the flash point.

6.9 Disposal actions.

6.9.1 Background. The product may contain 1.0 percent tricresyl phosphate which may be absorbed through the skin and produces paralysis if taken internally. The corrosion inhibitor contains barium. Accumulated waste liquids shall have the exterior of the outer pack marked as containing barium and tricresyl phosphate to assist disposal facilities to manage the product according to regulations promulgated by the US Environmental Protection Agency under Public Law 94-580, Resource Conservation and Recovery Act of 1976.

6.9.2 Handling and safety precautions. Personnel handling the product shall 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 shall promptly wash with soap or mild detergent and water. Respirators are not required unless there is an inhalation exposure to mists. Personnel shall 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 absorbents shall be used to absorb the liquid. Contaminated soil shall be removed and placed in a box with absorbents or towels. This box with spill clean-up wastes shall either be buried along with ordinary refuse at a rate not to exceed 10 pounds of clean-up waste per spill event or be incinerated in a permitted municipal waste incinerator. Bulk wastes and contaminated liquids shall not be landfilled. Partially full containers of contaminated product shall be collected centrally and stored for later recycle or heat recovery use. State requirements may vary regarding recycle alternatives. Liquids for recycle or heat recovery shall be accumulated by repouring in appropriately sized and labeled larger containers. See paragraph 6.9.3.3 below.

6.9.3.2 Depot-type operations. The same as 6.9.3.1. Additionally, used product that has been drained from hydraulic systems shall be combined with unused but contaminated fluid from partially full containers and then recycled.

6.9.3.3 Container disposal. Tops from one-time-use containers shall be discarded with ordinary refuse. Containers shall be made as empty as possible using gravity draining, after which they shall 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.

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Navy - AS
Air Force - 68

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Navy - SA, SH, MC
DSA - PS, GS

User activity:
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DOCUMENT IDENTIFIER *(Number)* AND TITLE MIL-H-46170B Hydraulic Fluid, Rust Inhibited, Fire Resistant Synthetic Hydrocarbon Base

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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