INCH-POUND
MIL-H-19457D(SH)
12 April 1989
SUPERSEDING
MIL-H-19457C(SH)
28 April 1981
(See 6.6 and 6.8)

MILITARY SPECIFICATION

HYDRAULIC FLUID, FIRE-RESISTANT, NON-NEUROTOXIC

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements of fire-resistant hydraulic fluid for hydraulic systems which are accumulator loaded and operate above 600 pounds per square inch (lb/in^2) gauge.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document 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

O-M-232	- Methanol (Methyl Alcohol)
QQ-A-250	- Aluminum and Aluminum Alloy Plate and Sheet: General Specification for.
QQ-A-250/4	- Aluminum Alloy 2024, Plate and Sheet

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FEDERAL (Continued)

QQ-B-613 - Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet, and Strip).

QQ-C-576 - Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed, or Machined Edges, (Plate, Bar, Sheet and Strip).

TT-T-656 - Tricresyl Phosphate.

MILITARY

MIL-A-18001 - Anodes, Corrosion Preventive, Zinc; Slab Disc and Rod Shaped.

MIL-G-22050 - Gasket and Packing Material, Rubber, for Use with Polar Fluids, Steam, and Air at Moderately High Temperatures.

MIL-R-83248 - Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant.

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

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

MILITARY

MIL-STD-290 - Packaging of Petroleum and Related Products.

(Unless otherwise indicated, copies of federal and Military specifications and standards are available from the Naval Publications and Forms Center (ATTN NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099)

2.1.2 Other Government publication. The following other Government publication forms a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation

DEPARTMENT OF TRANSPORTATION (DOT)

Code of Federal Regulations, Title 29, Part 1910.1200 - Hazard Communication Standard.

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

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 OF TESTING AND MATERIALS (ASTM)

ASTM Manual of Engine Test Methods for Rating Fuels.

A 570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality. (DoD adopted)

A 611 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled Structural Quality. (DoD adopted)

D 91 - Standard Test Method for Precipitation Number of Lubricating Oils. (DoD adopted)

D 95 - Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation. (DoD adopted)

D 97 - Standard Test Method for Pour Point of Petroleum Oils (DoD adopted)

D 287 - Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method). (DoD adopted)

D 445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity). (DoD adopted)

D 892 - Standard Test Method for Foaming Characteristics of Lubricating Oils. (DoD adopted)

D 972 - Standard Test Method for Evaporation Loss of Lubricating Greases and Oils. (DoD adopted)

D 974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration. (DoD adopted)

D 1218 - Standard Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids.

D 1401 - Standard Test Method for Water Separability of Petroleum Oils and Synthetic Fluids. (DoD adopted)

D 2266 - Standard Test Method for Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method). (DoD adopted)

D 4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products. (DoD adopted)

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

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

2.3 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.3.

3.2 Material. The fluid shall be a stable, homogeneous formulation of tertiary butylated triphenyl phosphate and such other ingredients as are required for conformance to this specification. Additives to permit conformance to the viscosity requirements of the fluid are not permitted.

3.2.1 Put up The fluid shall be furnished in 1- and 5-gallon cans and 55-gallon drums as specified (see 6.2).

3.3 Fire resistance. The minimum compression ratio at which combustion occurs shall be 42:1, or statistically equivalent to the reference fluid specified in 4.5.1.1.6 within a 95 percent level of confidence using a Student's t-distribution (see 4.5.1).

3.4 Hydrolytic stability. The change in weight of a copper strip, when subjected to the products of the hydrolytic action of the test fluid as specified in 4.5.2 for 48 hours, shall be not greater than 0.3 milligram per square centimeter (mg/cm^2). There shall be no pitting, etching, or visible corrosion on the surface of the copper. While a brown discoloration of the surface of the copper is permitted, a gray or black discoloration shall be cause for rejection The acid number increase of the fluid shall be not greater than 0.2 mg of potassium hydroxide per gram of fluid. The acid content of the entire water layer shall not exceed the equivalent of 5 mg of potassium hydroxide. The amount of material insoluble in the fluid after the test (exclusive of water) shall be not greater than 0.5 percent by weight (see 4 5.2)

3.5 Corrosion. The fluid shall not produce visually evident pitting, etching, or a weight change in excess of 0.2 mg/cm^2 of brass, zinc, aluminum, or steel (see 4.5.3).

3.6 Compatibility with packings The fluid shall be compatible with those packings which may be used with tricresyl phosphate. The volume increase or decrease of the rubber specimens in accordance with MIL-G-22050 and MIL-R-83248 (all types and classes) shall be within plus or minus 5 percent of that obtained when a specimen has been immersed in tricresyl phosphate in accordance with TT-T-656 (see 4.5.4).

3.7 Toxicity. The hydraulic fluid shall have no adverse effect on the health of personnel when used for its intended purpose. The fluid shall contain no components which produce noxious vapors or mists in such concentrations as to be a threat to the health of personnel during use under conditions of adequate ventilation while exercising caution to avoid prolonged contact with the skin Questions pertinent to this effect shall be referred by the contracting activity to the Naval Medical Command (NAVMEDCOM), who will act as an advisor to the contracting agency.

3.7.1 The fluid shall have a triorthocresyl phosphate (TOCP) content not greater than 0.2 percent (see appendix)

3.7.2 Material safety data sheet (MSDS) The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313 and 29 CFR 1910.1200, Hazard Communication Standard. When FED-STD-313 is at variance with

the CFR, 29 CFR 1910.1200 shall take precedence. FED-STD-313 shall be modified and supplemented accordingly. The MSDS shall be included with each shipment of the material covered by this specification (see 6.5).

3.8 Chemical and physical requirements. The fluid shall conform to the chemical and physical requirements specified in table I

TABLE I. Chemical and physical requirements.

Property	Limit	ASTM test method
Viscosity, centistokes at 40°C	38.5 - 45.5	D 445
Viscosity, centistokes at 100°C, minimum	4.8	D 445
Pour point, °C (°F), maximum	-18(0)	D 97
Evaporation loss at 100°C, percent (maximum)	0.3	D 972
Acid number (maximum)	0.1	D 974
Neutrality (qualitative)	Neutral	Method 5101 1/
Foaming tendency at 24°C (75°F), mL, maximum	65	D 892
Foam stability, mL after 10 minutes of foam collapse (maximum)	Complete collapse 2/	
Emulsion test (time to settle out (minutes) maximum) when stirred at 54°C (130°F) with distilled water 3/	30	D 1401
Specific gravity	1/	D 287
Refractive index, Nd at 20°C (68°F)	1/	D 1218
Precipitation	0.01	D 91
Fire resistance, CFR compression ratio (minimum)	42:1	(See 4 5.1)
Wear test scar diameter, mm (maximum)	0.6	D 2266 4/
Water, percent	None	D 95
Hydrolytic stability:		(See 4.5.2)
Copper specimen weight loss mg/cm^2 (maximum)	0.3	
Appearance	No visible corrosion	
Acid number increase of fluid mg KOH/grams fluid (maximum)	0.2	
Acidity of water layer mg KOH (maximum)	5.0	
Insolubles, percent (maximum)	0.5	

See footnotes at top of next page.

1/ In accordance with FED-STD-791.
2/ A ring of bubbles around the edge of the graduate shall be considered complete collapse.
3/ The presence of a 3-milliliter (mL) cuff at the fluid water interface after 30 minutes shall be acceptable.
4/ Pour the fluid to cover the lower three balls, approximately 8 mL.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein Except as otherwise specified in the contract or purchase order, 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. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4 1.1 Responsibility for compliance All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

(a) First article inspection (see 4.3).
(b) Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of the tests specified in table I, 4.5.1 through 4.5.4, and the appendix. Failure of the material to pass any test shall be cause for rejection of the first article (see 6.3).

4.3.1 Sampling. Two 5-gallon all-level samples shall be taken from the storage tank or from two containers selected at random The samples shall be placed in separate clean, dry, metal or glass containers, dyed as specified (see 6.2), and sealed, marked and forwarded to a laboratory satisfactory to the contracting activity for inspection.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the preliminary inspection specified in 4.4.4, the tests specified in table I, and the examination of filled containers specified in 4.4 6.

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

4.4.1.1 Packaged lot. A packaged lot is an indefinite number of 55-gallon drums, or smaller unit containers of identical size and type, offered for acceptance, and filled with a homogeneous mixture of material from one isolated container; or filled with a homogeneous mixture of material manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4.2 Sampling for inspection and test. Sampling shall conform to ASTM D 4057. Three separate samples of fluid shall be taken from each storage tank (upper, middle, and lower samples), or randomly from the number of drums equal to the cube root of the total in the lot.

4.4.3 Sampling for filled containers examination. A sample of filled containers shall be randomly selected from the lot in accordance with ASTM D 4057.

4.4.4 Preliminary inspection. The fluid samples shall be tested separately for specific gravity and refractive index (see table I). If either the specific gravity or the refractive index of the three samples varies by more than plus or minus 0.004, the samples and the represented lot shall be rejected. One resampling and inspection shall be permissible. If the samples prove satisfactory, they may be combined for conducting of the tests specified in table I

4.4.5 Table I tests. The sample fluid, as specified in 4.4.4, shall be subjected to each of the tests specified in table I. Failure of the fluid to pass any two of the tests shall be cause for rejection of the represented lot One resampling and test will be permissible.

4.4.6 Examination of filled containers. The container sample shall be examined for defects of the container and closure, evidence of leakage, unsatisfactory markings, and for weight (see 6.2) Individual containers determined defective shall be rejected and, if the number of defective containers exceeds 4.0 percent, the representative lot shall be rejected.

4.5 Tests.

4.5.1 Fire resistance.

4.5.1.1 Apparatus.

4.5.1.1.1 Engine. The engine used for this test shall be the standard CFR cetane rating (method 5) engine specified in the ASTM Manual of Engine Test Methods for Rating Fuels, modified by:

(a) Attachment of a volume plug (see figure 1) to the variable compression plug, Waukesha Part No. 105100A, or equal, to extend the compression ratio range of the engine to 50:1

(b) Modification of cooling system to provide circulation of cooling water from an external source. A thermometer, Waukesha Part No 0105180A, or equal, shall be inserted into the cooling water outlet adapter attached to the cylinder head.

4.5.1.1.2 Combustion indicator. A 0 to 2000 lb/in^2 range strain gauge transducer shall be used as the pressure sensing element. A 0.062-inch open tip thermocouple (see figure 2) shall be used as the temperature sensing element The pressure signal and the temperature signal shall be amplified and recorded on a recording oscillograph.

4.5.1.1.3 Engine operating conditions.

Speed - 900 ± 9 revolutions per minute (r/min).
Injection advance - 13 degrees before top dead center.
Injection opening pressure - 1500 ± 50 lb/in^2.
Injection rate - 30 ± 0.5 mL per minute.
Air intake temperature - 60 ± 1 degrees Celsius (°C).
Water jacket temperature - 27 ± 1°C.
Other engine operating conditions as specified in supplement III on operation (cetane) in ASTM Manual of Engine Test Methods for Rating Fuels.

4.5 1.1.4 Test procedure. The engine shall be motored (with fuel bypass valve open) for 45 minutes or longer at a compression ratio of 50:1 until all engine operating conditions have been established During this warmup period, adjustments may be made to establish operating conditions and to purge fuel injection system.

4 5.1.1.4.1 With the compression ratio set at 50:1, the fuel bypass valve shall be closed The engine shall be run under this condition for 15 seconds continuous injection. At the end of the injection period, the fuel bypass valve shall be opened and the engine motored for 45 seconds The oscillograph shall be observed for indications of combustion.

4.5.1.1.4 2 To determine the lowest compression ratio for combustion, successive determinations shall be made by reducing the compression ratio two increments per determination until no evidence of combustion is observed This shall be followed with two additional injection 15-second runs, each preceded by a 45-second period of motoring with no injection. Indication of combustion in one or more of the three 1-minute runs shall be considered evidence that the fluid is combustible for that determination. The reported compression ratio value shall be the lowest compression ratio at which ignition is observed.

4.5.1.1.5 Evidence of combustion. Any increase in either pressure or temperature signal, or both, during the period of injection shall be considered evidence that the fluid is combustible at that compression ratio.

4.5.1.1.5 1 Indications of combustion which may occur immediately following the 15-second period of injection (fuel bypass valve open) shall not be considered as evidence that a fluid is combustible.

4.5.1.1.6 Reference fluid. Each unknown sample shall be bracketed with a reference fluid. The fluid used shall be an approved tertiary butyl phenyl triaryl phosphate ester fluid and shall be rated in the same way as the unknown sample. Fire resistance measurements obtained on an unknown sample shall e considered valid only when the compression ratios of the reference fluid determined during the bracketing runs exceeds the minimum compression ratio requirements of 42:1. When the fire resistance of the reference fluid does not meet the minimum requirements, engine condition shall be checked. Procedures detailed in the operating manual for cleaning and overhaul of engine shall be followed.

4.5.2 Hydrolytic stability. A thermostatically controlled electric oven shall be maintained at a temperature of 93 $\pm$ 0.2°C and shall be fitted with a mechanism for rotating a 7-ounce carbonated beverage bottle, end over end, at 5 r/min. Place in the clean bottle 75 grams of the test fluid, 25 grams of distilled water, and one rectangular copper test specimen conforming to QQ-C-576 The copper test specimen (1.3 by 5.1 centimeters of 16 to 22 Brown and Sharpe gauge) shall be polished to a clean surface with emery paper number 00. The specimen shall be washed thoroughly in warm high-grade petroleum ether or chemically pure Toluene, followed by a hot 1:1 Toluene ethyl alcohol wash, dried, and weighed. Following this, the specimen shall be immediately immersed in the test fluid in the beverage bottle The bottle shall be tightly capped, an inert seal (1/16 inch teflon sheet may be used for this purpose) shall replace the cork liner of the bottle cap and the sample bottle, and placed in the revolving rig The bottle shall be rotated at 5 r/min being constantly maintained at the test temperature of 93°C for 48 hours. At the end of the test, the liquid contents shall be emptied into a weighed 100 mL cone-shaped centrifuge tube and centrifuged for 15 minutes at not less than 1500 r/min. The water layer, with the exception of fluids miscible with water, shall be separated from the fluid and the fluid layer washed with 25-mL portions of distilled water until the water is neutral to litmus. The wash water shall be combined with the water removed from the hydrolysis test and its acidity shall be determined by heating to the boiling point and titrating the hot solution with potassium hydroxide to a phenolphthalein end-point. The acidity shall be expressed as mg of potassium hydroxide required to neutralize the entire water layer. The fluid layer shall be dried over anhydrous phosphorus pentoxide in a vacuum desiccator and the neutralization number shall be determined. The precipitate, if any, remaining in the centrifuge tube shall be washed by adding 50 mL of the original fluid and centrifuging until the fluid layer is clear. The fluid layer shall be decanted, and the centrifuge tube containing the insoluble material placed in an oven until dry. The centrifuge tube shall be weighed, and the weight of the insoluble material calculated as a weight percent of the original fluid. The copper test specimen shall be washed successively in warm, chemically pure benzene and warm 95 percent ethyl alcohol. It shall be brushed with a short bristled paint or toothbrush while washing in the last two solvents. The specimen shall be dried and weighed, and the weight loss shall be recorded in mg/cm^2 of the total surface area.

4.5.3 Corrosion. Specimens of the following metals shall be used in this test:

Brass	- QQ-B-613 (leaded brass)
Zinc	- MIL-A-18001
Steel	- ASTM A 570 or ASTM A 611
Aluminum	- QQ-A-250 and QQ-A-250/4, any condition T

The suggested specimen size is 1/4 by 7/8 by 2 inches.

4.5.3.1 Test procedure. The four specimens shall be polished to remove pits, burrs, and irregularities from all faces and edges, finishing with a 240-grit polishing medium. The use of a slow speed horizontal metallurgical polishing wheel is convenient, with the final polishing being done with 240-grit aluminum oxide paper or cloth moistened with kerosene. The use of "wet or dry" cloths or "wet or dry" papers is prohibited. Specimens shall be cleaned by swabbing in hot naphtha with a final rinse in warm anhydrous methanol conforming to grade A of O-M-232 The specimens shall be held in a manner to avoid contact with the operator's hands. After weighing, the specimens shall be vertically arranged in the order as they are listed above and separated by glass separators around the inner perimeter of an ointment or wide-mouth jar. The jar shall be approximately 3 inches in diameter and fitted with a screw cap. The specimens shall be covered with 300 mL of the test compound The sealed jar shall then be placed in an oven at 55 $\pm$ 1°C for 7 days. Upon completion of the test, the compound and any loose corrosion products shall be removed from the specimens by swabbing with surgical gauze pads moistened with naphtha, then with methanol, and followed by clean solvent rinses. The specimens shall be reweighed and the weight loss or gain in mg/cm^2 shall be calculated.

4.5.4 Compatibility with packings. Test method 3603 of FED-STD-791 shall be followed, using the rubber specimens in accordance with 3.6. Only one reference fluid, tricresyl phosphate in accordance with TT-T-656 (see 3.6), shall be used, and rubber shrinkage as well as swell shall be measured.

4.6 Toxicological formulations. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.7 Packaging inspection. Sample packages and packs and the inspection of the packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of 4.4 6, section 5, and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisitions.)

5.1 Packaging. Hydraulic fluids in the quantity and containers specified (see 3.2.1) shall be packaged and packed in the level specified (see 6 2), and marked in accordance with MIL-STD-290 and 5.2.

5.2 Special marking. Each interior and exterior container shall be marked or labeled as follows:

"WARNING: TOXIC. CONTAINS TERTIARY BUTYLATED TRIPHENYL PHOSPHATE, A TYPE OF TRIARYL PHOSPHATE. USE PRESCRIBED PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT INHALING VAPORS, SWALLOWING, OR CONTACTING SKIN WITH MATERIAL. IN CASE OF ACCIDENTAL CONTACT, REMOVE SOILED ARTICLE(S) IMMEDIATELY AND WASH CONTAMINATED SKIN WITH LARGE VOLUME OF WATER. CONSULT A PHYSICIAN. THOROUGHLY LAUNDER SOILED CLOTHING PRIOR TO REUSE."

6. NOTES

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

6.1 Intended use. The material covered by this specification is intended for use as a fire-resistant power transmission fluid for accumulator loaded shipboard hydraulic systems which operate at pressures exceeding 600 lb/in^2 gauge. This fluid may soften and deteriorate most commonly used paints, elastomers and electrical insulating materials, and therefore requires the use of compatible materials as necessary. Special handling procedures are required for use with this fluid (see 5.2). This material is not satisfactory for use on board submarines.

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 2.1 1 and 2.2).
(c) When first article inspection is required (see 3.1).
(d) Quantity and container required (see 3.2.1).
(e) That hydraulic fluid scheduled for Navy use shall be dyed with 9 parts per million by weight of Sudan Blue II dye (see 4 3.1). (This dye is available from BASF Wyandotte Corporation, Pigments Division, 491 Colombia Avenue, Holland, MI 49423.)
(f) Weight of filled container (see 4.4.6).
(g) Levels of packaging and packing required (see 5.1).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/ provided and that the DIDs are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference paragraph	DID number	DID title	Suggested tailoring
4.3	DI-E-4901	First article inspection procedure	--------
4.3	DI-T-4902	First article inspection report	--------

The above DIDs were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the items should be a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4 3 1 The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Material safety data sheets. Contracting officers will 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 of data are listed in FED-STD-313.

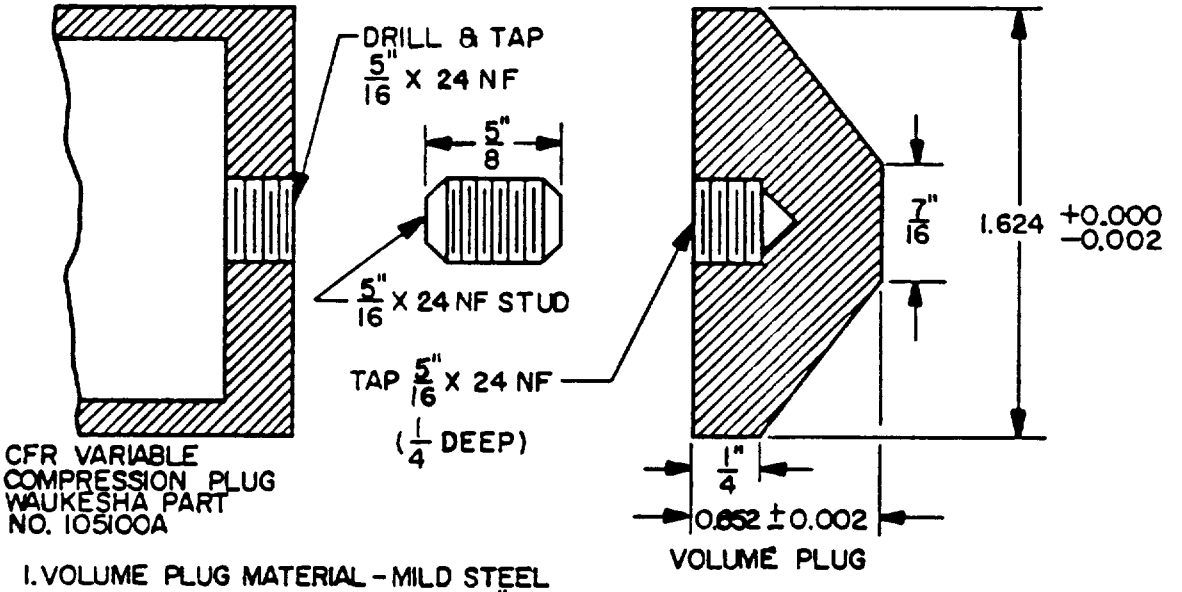
6.6 The fire resistant hydraulic fluid covered by this specification replaces type I and type II of MIL-H-19457B(SH).

6.7 Subject term (key word) listing.

Acid number
Tertiary butylated triphenyl phosphate
Tricresyl phosphate

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

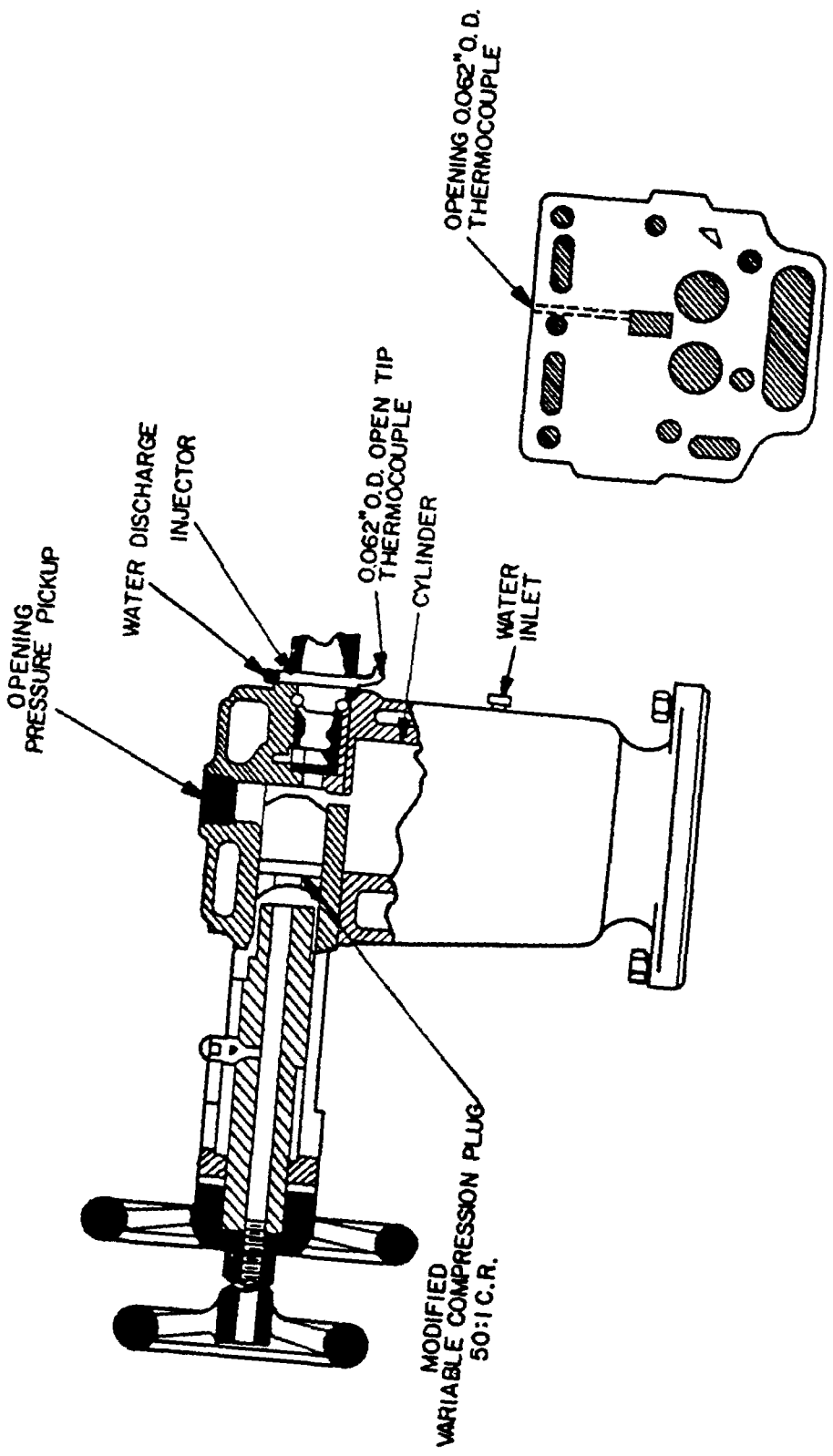
Preparing activity:
Navy - SH
(Project 9150-N812)



1. VOLUME PLUG MATERIAL - MILD STEEL
2. STUD MADE BY CUTTING OFF 5/16" X 24 NF BOLT.
3. HOLE IN VARIABLE COMPRESSION PLUG MUST BE CENTERED SO VOLUME PLUG IS CONCENTRIC WITH VARIABLE COMPRESSION PLUG ON ASSEMBLY.
4. ASSEMBLE PARTS IN FOLLOWING ORDER
   A. STUD TO VOLUME PLUG UNTIL BOTTOMS.
   B STUD AND VOLUME PLUG TO VARIABLE COMPRESSION PLUG.

SH 7698

FIGURE 1. CFR engine, volume plug details.



SH 7699

FIGURE 2. CFR engine - details of combustion head.

APPENDIX

HYDRAULIC FLUID, FIRE RESISTANT

10. SCOPE

10.1 Scope. This appendix outlines the procedure to determine ortho-cresyl substitution in phosphate esters at concentrations down to 0.1 weight percent or less. Ortho-cresyl groups are converted to ortho-cresol and measured as such Unreacted ortho-cresol present in the sample will also be included in the total ortho-cresyl substitution determined. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

10.2 Summary of the method. A sample of phosphate ester is saponified overnight in a Parr bomb containing aqueous caustic solution After neutralization, the phenolic fraction is extracted with diethyl ether. The ether solution is chromatographed and o-cresol is determined by external standardization using known mixtures of o-cresol in diethyl ether.

20. MATERIALS AND APPARATUS

20.1 Materials. The materials used shall be as follows.

(a) Sodium hydroxide, American Chemical Society (ACS) reagent grade, pellets.
(b) Diethyl ether, ACS reagent grade.
(c) Sodium sulfate, ACS reagent grade, anhydrous.
(d) Hydrochloric acid, "Baker Analyzed" reagent, J.T. Baker Company, or equal.
(e) Reference o-cresol: Aldrich Chemical, Milwaukee, Wisconsin, or Eastman Chemicals.

30. PROCEDURE

30.1 Procedure The test procedure shall be as specified in 30 1 1 through 30.1.12.

30 1.1 Tare the Parr Bomb, add 5-gram sample, and reweigh. Add 5 grams NaOH 10 mL distilled H_2O

30 1.2 Seal the bomb and place in oven at 140 to 150°C for 16 hours. Note that much longer saponification times could result in lowered results

30.1.3 Cool to room temperature and transfer contents to a 150-mL beaker Rinse bomb with distilled water, adding rinsings to beaker

30 1 4 Cool beaker in ice bath and slowly add, while stirring, 1:1 HCl to pH less than 5

30 1.5 Transfer contents to a separatory funnel with a distilled-water washing and an ether washing.

30.1.6 Extract twice with 20-mL portions of diethyl ether. Combine ether extracts in a dry 150-mL beaker. Add 1 gram anhydrous sodium sulfate and stir thoroughly to remove traces of water.

30.1.7 Decant the ether solution into a 50-mL volumetric flask Rinse the sodium sulfate with small portions of diethyl ether and transfer rinsings to the volumetric flask. Adjust final volume of 50 mL.

30.1.8 Set the chromatograph for the following conditions.

Column temperature program:	Initial T - 160°C for 1 minute
	Rate - 30°C per minute
	Final T - 220°C for 15 minutes
TC detector temperature:	270°C
Injection port temperature:	250°C
Helium carrier flow rate:	20 mL per minute

Figure 3 shows retention times for phenolic isomers. This chromatogram may be used as a guide for peak identification using the above conditions.

30.1.9 Chromatograph 1 microliter (μL) solution and obtain area for o-cresol.

30.1.10 To obtain weight percent o-cresol, prepare a weighed standard in 50 mL diethyl ether. Select a weight corresponding to the expected concentration based on a preliminary run.

30.1.11 Chromatograph 1 μL standard solution to obtain area for o-cresol isomer.

30.1.12 Calculation.

$$\text{Weight percent o-cresol} = \frac{\text{weight (wt) standard x area sample x 100}}{\text{area standard x wt sample}}$$

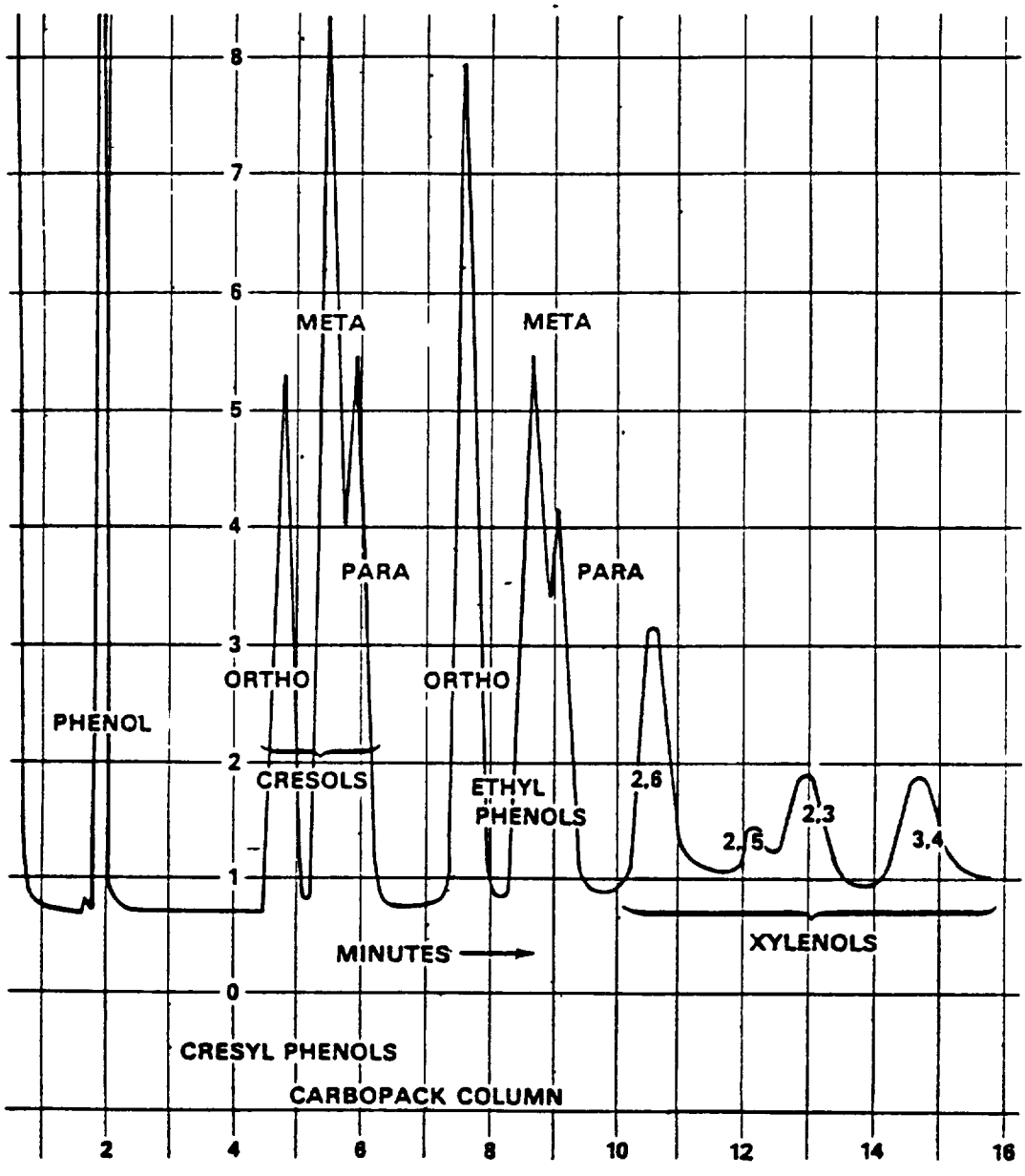


FIGURE 3. Gas chromatogram of cresols, xylenols, and ethyl phenols.

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