

METRIC

MIL-PRF-17331L

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SUPERSEDING

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PERFORMANCE SPECIFICATION

LUBRICATING OIL, STEAM TURBINE AND GEAR, MODERATE SERVICE

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

1. SCOPE

1.1 Scope. This specification covers a single classification of moderate service steam turbine and gear lubricating oil for use in main and auxiliary turbines and gears, air compressors, and certain hydraulic equipment, as well as for general mechanical lubrication. The lubricating oil will be identified as follows:

<u>Military symbol</u>	<u>NATO symbol</u>
2190 TEP	O-250

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

2.2.1 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 of these documents are those cited in the solicitation or contract.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

S9510-AB-ATM-010 - Nuclear Powered Submarine Atmosphere Control Manual

(Copies of the chapter titled "Material Control Program" are available by email request to CommandStandards@navy.mil.)

T9070-AL-DPC-020/077-2 - NAVSEA Hazardous Material Avoidance Process

(Copies of this document are available online via Technical Data Management Information System [TDMIS] at <https://mercury.tdmis.navy.mil> by searching for the document number without the suffix. Refer questions, inquiries, or problems to: DSN 296-0669, Commercial (805) 228-0669. This document is available for ordering [hard copy] via the Naval Logistics Library at <https://nll.navsup.navy.mil>. For questions regarding the NLL, contact the NLL Customer Service at nllhelpdesk@navy.mil, (866) 817-3130, or (215) 697-2626/DSN 442-2626.)

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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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 these documents are those cited in the solicitation or contract.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Copies of this document are available from <http://webstore.ansi.org>.)

ASTM INTERNATIONAL

- ASTM D92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- ASTM D93 - Standard Test Methods for Flash Points by Pensky-Martens Closed Cup Tester
- ASTM D97 - Standard Test Method for Pour Point of Petroleum Products
- ASTM D129 - Standard Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)
- ASTM D130 - Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- ASTM D287 - Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
- ASTM D445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- ASTM D664 - Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- ASTM D665 - Standard Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water
- ASTM D892 - Standard Test Method for Foaming Characteristics of Lubricating Oils
- ASTM D943 - Standard Test Method for Oxidation Characteristics of Inhibited Mineral Oils
- ASTM D974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration
- ASTM D1298 - Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- ASTM D1401 - Standard Test Method for Water Separability of Petroleum Oils and Synthetic Fluids
- ASTM D1552 - Standard Test Method for Sulfur in Petroleum Products by High Temperature Combustion and Infrared (IR) Detection or Thermal Conductivity Detection (TCD)
- ASTM D2070 - Standard Test Method for Thermal Stability of Hydraulic Oils
- ASTM D2272 - Standard Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Pressure Vessel
- ASTM D2622 - Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry
- ASTM D3427 - Standard Test Method for Air Release Properties of Hydrocarbon Based Oils
- ASTM D4052 - Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- ASTM D4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products
- ASTM D4172 - Standard Test Method for Wear Preventive Characteristics of Lubricating Fluid (Four-Ball Method)

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- ASTM D4310 - Standard Test Method for Determination of Sludging and Corrosion Tendencies of Inhibited Mineral Oils
- ASTM D4898 - Standard Test Method for Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis
- ASTM D4927 - Standard Test Methods for Elemental Analysis of Lubricant and Additive Components-Barium, Calcium, Phosphorus, Sulfur, and Zinc by Wavelength-Dispersive X-Ray Fluorescence Spectroscopy
- ASTM D4951 - Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry
- ASTM D5182 - Standard Test Method for Evaluating the Scuffing Load Capacity of Oils (FZG Visual Method)
- ASTM D5949 - Standard Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
- ASTM D5950 - Standard Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)
- ASTM D6304 - Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- ASTM D6443 - Standard Test Method for Determination of Calcium, Chlorine, Copper, Magnesium, Phosphorus, Sulfur, and Zinc in Unused Lubricating Oils and Additives by Wavelength Dispersive X-ray Fluorescence Spectrometry (Mathematical Correction Procedure)
- ASTM D6481 - Standard Test Method for Determination of Phosphorus, Sulfur, Calcium, and Zinc in Lubrication Oils by Energy Dispersive X-ray Fluorescence Spectroscopy
- ASTM D7042 - Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- ASTM D7155 - Standard Practice for Evaluating Compatibility of Mixtures of Turbine Lubricating Oils
- ASTM D7546 - Standard Test Method for Determination of Moisture in New and In-Service Lubricating Oils and Additives by Relative Humidity Sensor
- ASTM D7751 - Standard Test Method for Determination of Additive Elements in Lubricating Oils by EDXRF Analysis
- ASTM E29 - Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

(Copies of these documents are available from www.astm.org.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 4406 - Hydraulic Fluid Power - Fluids - Method for Coding the Level of Contamination by Solid Particles

(Copies of this document are available from www.iso.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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.

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3. REQUIREMENTS

3.1 **General.** For purposes of determining conformance with each requirement, an observed value or calculated value shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the limiting value in accordance with the rounding method in ASTM E29.

3.2 **Qualification.** The lubricating oil furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) before contract award (see 4.2 and 6.3).

3.3 **Material.** The lubricating oil shall be a stable, homogeneous blend of virgin petroleum lubricating oil stocks plus additive agents, if necessary, to meet the requirements of this specification. Additives in quantities up to 0.5 percent by weight may be used to meet the pour point requirement. Additive components as contained in the sample tested and granted qualification approval shall not be changed without approval of the qualifying activity. See 3.7.2.1 for information on prohibited materials.

3.4 **Oil compatibility.** The lubricating oil shall be compatible with reference oil furnished by the Government (see 4.4.7). For information on obtaining reference oil, see 6.3.

3.5 **Homogeneity.** Additive agents, when used, shall remain uniformly distributed throughout the oil at all temperatures above the pour point and up to 121 °C (250 °F). If the oil is cooled below its pour point, it shall regain its homogeneity at temperatures of 6 °C (10 °F) above its pour point and shall retain that homogeneity up to 121 °C (250 °F) (see 4.4.1).

3.6 **Chemical and physical.** The lubricating oil shall conform to the chemical and physical requirements as specified in [table I](#).

TABLE I. Chemical and physical requirements and test methods.

Characteristic	Requirement	Test Method ^{1/} (ASTM or other)
Sulfur, percent	^{2/}	ASTM D4927 (R), ASTM D129, ASTM D1552, ASTM D2622, ASTM D4951, ASTM D6443, ASTM D6481, ASTM D7751
Acid number, mg KOH/g oil, max.	0.3	ASTM D974 (R), ASTM D664
Corrosion (in presence of salt water)	None	ASTM D665, Procedure B ^{3/}
Corrosion test at 100 °C (212 °F), (copper strip) appearance, max.	Classification 1	ASTM D130
Oil compatibility	Pass	ASTM D7155 (see 4.4.7)
Water, percent by mass, max.	0.01	ASTM D6304 (R), ASTM D7546
Gravity, American Petroleum Institute (API)	^{2/}	ASTM D1298 (R), ASTM D287, ASTM D4052
Air release time, minutes at 50 °C (122°F), max.	20	ASTM D3427
Flash point, °C (°F), min.	204 (400) 234 (453)	ASTM D93 (R) ASTM D92
Pour point, °C (°F), max.	-6 (20)	ASTM D97 (R), ASTM 5949, ASTM D5950

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TABLE I. Chemical and physical requirements and test methods – Continued.

Characteristic	Requirement	Test Method (ASTM or other)
Viscosity: mm ² /s at 4.4 °C (40 °F), max. mm ² /s at 40 °C (104 °F) mm ² /s at 100 °C (212 °F), min.	870 77-97 8.0	ASTM D445 (R), ASTM D7042
Emulsion test, after 30 minutes settling time, oil layer/water layer/emulsion, max.	41/-/3	ASTM D1401 ^{4/}
Oxidation test, after 1500 hours: Acid number, mg KOH/g, max. Total sludge, mg, max. Total iron, mg, max. Total copper, mg, max.	2.0 100 100 100	ASTM D4310 ASTM D974 ASTM D4310 ASTM D4310 ^{5/} ASTM D4310
Oxidation by rotating pressure vessel, minutes to failure, min.	300 ^{2/}	ASTM D2272
Scuffing load capacity (FZG), failure load stage	Load Stage 9	ASTM D5182
Wear test, scar diameter, mm, max.	0.33	ASTM D4172 ^{6/}
Homogeneity, separation	None	See 4.4.1
Foam characteristics: After blowing/after 10 minutes Sequence I, mL, max. Sequence II, mL, max. Sequence III, mL, max.	65/0 65/0 65/0	ASTM D892 ^{7/}
Solid particle contamination, mg/100 mL, max.	2.5	ASTM D4898 ^{8/}
Thermal stability: Copper appearance, visual max. Steel appearance, visual max. Sludge, mg/100 mL, max.	Report Report 25	ASTM D2070
Coking tendency	Panel coker test	Appendix A
NOTES:		
^{1/} When applicable, the referee test method is listed first, followed by the notation “(R)”.		
^{2/} Report. In conformance testing, values are compared to qualification results (see 4.3.1).		
^{3/} Prior to the test, the oil shall be water-washed as follows: 300 grams of the oil to be tested shall be stirred with 50 grams of water for 30 minutes at 90 °C (194 °F) using the beaker and stirrer in accordance with ASTM D665. After 30 minutes stirring, the mixture shall be transferred to a separatory funnel and left to separate. Then the water layer shall be drawn off and the oil submitted to the salt-water corrosion test. The test shall be run for 24 hours.		

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TABLE I. Chemical and physical requirements and test methods – Continued.

<u>4/</u>	Distilled water and stirring temperature of 54 °C (130 °F) shall be used. Discrete water droplets entrained in the oil layer and clinging to the wall of the cylinder may be added to the water layer at a volume of 0.1 mL per droplet. The results shall be recorded using the format of oil layer/water layer/emulsion layer (time in minutes). There is no requirement for water layer. The emulsion limit applies to any of the three types of emulsions defined in the test method. If more than one emulsion type is present, the 3-mL maximum limit applies to the combined volume of the different emulsion types.
<u>5/</u>	The total iron content shall be determined using the procedure and calculations described in the Procedure for Determination of Sludge Weight and the Procedure for Determination of Copper in Oil, Water, and Sludge for Procedure A in accordance with ASTM D4310, except iron shall be substituted in place of copper where appropriate.
<u>6/</u>	Testing conditions shall be: (a) Load: 15 kilograms (b) Oil temperature: 80 °C (176 °F) (c) Speed: 600 revolutions per minute (rpm) (d) Duration of test: 120 minutes
<u>7/</u>	Option A is not allowed on freshly blended oils. If testing is done more than 1 week after blending, Option A is allowed. A ring of bubbles around the edge of the graduated cylinder shall be considered complete collapse or 0 mL.
<u>8/</u>	Sample shall be tested in accordance with ASTM D4898 using 0.8-micrometer pore diameter membrane filters.

3.7 Toxicity and prohibited materials.

3.7.1 Toxicity. When evaluated in accordance with 4.4.3, the lubricating oil shall pose no serious or high risk to the health of personnel or the environment when used for its intended purpose (see 4.4.3 and 6.6).

3.7.2 Prohibited materials. The lubricating oil shall not contain any chemicals categorized as “prohibited” in accordance with T9070-AL-DPC-020/077-2.

3.7.2.1 Additives. The use of additives to improve the viscosity-temperature characteristics of the base stocks is not permitted. Chlorine, zinc, or silicone-based materials/additives are not permitted.

3.8 Off-gassing. The lubricating oil shall be evaluated for off-gassing in accordance with the requirements of 4.4.2. Based on the circumstances of use and the chemical nature of the lubricating oil, the Navy will determine whether off-gas testing is required or if an administrative assessment is acceptable. In order to be considered acceptable for use in submarines, the lubricating oil shall be assigned to either the “Permitted” or “Limited” category (see 4.4.2 and 6.5).

3.9 Ozone depleting substances (ODSs). The use of ODSs in the composition of the lubricating oil under this specification directly or referenced in any federal test method is hereto prohibited. Environmentally safe and non-ODS alternative solvents shall be substituted in test methods for any previously specified ODS such as 1,1,1-trichloroethane, tri-chlorofluoroethane, perchloroethane, or other chlorofluorocarbons (CFC). A dehydrated mixture of primary alcohol, such as ethanol or isopropyl alcohol, and non-aromatic hydrocarbon solvent resulting in a minimum flash point of 60 °C (140 °F) plus effective solvent action shall be used as an alternative for any ODS.

3.10 Tri-cresyl phosphate (TCP). If TCP is used as an antiwear additive, not more than 1.0 percent of the additive shall be the ortho isomer (see 6.7.2).

3.11 2,6-Di-tert-butylphenol (DTBP). The addition of DTBP (Chemical Abstract Service Number 128-39-2) in any lubricating oil produced under the military symbol 2190 TEP and NATO symbol O-250 is prohibited; this applies to both surface ships and submarine use. DTBP shall not be intentionally added to the oil. The level of DTBP, if detected, shall not exceed 10 parts per million (ppm) by mass (see 4.4.6).

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3.12 Appearance. The lubricating oil shall be free of haze or cloudiness (see 4.4.8).

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 inspection. Qualification tests shall be conducted at a laboratory acceptable to NAVSEA. Qualification inspection shall consist of all of the tests specified herein to satisfy the requirements in section 3 and [table I](#). A minimum sample size of 30 gallons taken from a single lot, as defined in 4.3.2.1.1 is required for qualification testing.

4.2.1 Change approval. A change in product composition, formulation, or ingredients used in the manufacture of lubricating oil, which has been qualified, shall require written approval of NAVSEA. Incorporation of any changes, which have not been so approved, shall require requalification of item in question.

4.2.1.1 Requalification. Unless otherwise approved by NAVSEA, requalification shall consist of the tests specified in [table I](#) and 4.4.

4.3 Conformance inspection. Each sample selected as specified in 4.3.2 shall be tested as specified in [table I](#) and 4.4.8 except that the scuffing load capacity (FZG), oxidation test (ASTM D943), wear test, compatibility, air release, homogeneity, thermal stability (ASTM D2070), and coking tendency tests will not be required. The tests are performed on the finished product. Where more than one test method is allowed for a specific requirement, [TABLE II](#) identifies the referee test method first, followed by the notation "(R)".

4.3.1 Lot conformance requirements. The results from each sample selected as specified in 4.3.2, when tested as specified in [table I](#), shall not vary from the analysis of the sample given qualification approval by more than the tolerances listed below:

- a. Gravity, degrees API: ± 1.0
- b. Sulfur, percent: ± 20 percent of value for qualified product ⁽¹⁾
- c. Viscosity:
 - (1) mm²/s kinematic at 4.4 °C (40 °F): maximum 870
 - (2) mm²/s kinematic at 40 °C (104 °F): ± 8 ⁽²⁾
 - (3) mm²/s kinematic at 100 °C (212 °F): ± 1 ⁽²⁾
- d. Pour point, °C: ± 3 ⁽²⁾
- e. Oxidation by rotating pressure vessel: -15 percent maximum
 - (1) For oils qualified below 0.15 percent sulfur, no minimum restriction; +0.08 percent allowable.
 - (2) Shall meet requirements of this specification (see [table I](#)).

4.3.2 Sampling for conformance.

4.3.2.1 Inspection lot.

4.3.2.1.1 At place of manufacture. For the purpose of sampling, one lot of lubricating oil shall consist of a manufacturer's batch. When material cannot be identified by batch, a lot shall consist of not more than 38 m³ (10,000 gallons).

4.3.2.1.2 At place of delivery. For the purpose of sampling, one lot of lubricating oil shall consist of all oil in a single shipment.

4.3.2.2 Sampling a storage tank. A representative sample of 5 gallons of lubricating oil shall be taken from each lot in accordance with ASTM D4057.

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4.3.2.3 Sampling during loading. Samples shall be drawn at the discharge pipe where it enters the bulk carriers (tank cars, tank trucks, and so forth). At least four samples shall be taken at regular intervals during the entire period of loading or filling, each sample being 1 pint. Only one sample for one continuous drum filling operation is required and shall be taken after approximately 10 percent of the volume of product has been drummed.

4.3.2.4 Sampling of filled containers. Where the lubricating oil is contained in drums or cans, quart samples shall be drawn from four randomly selected drums in the lot and composited, unless the lot consists of less than five containers, in which case a 1-gallon sample shall be drawn from one drum. The contents of each container to be sampled shall be shaken, rolled, or stirred to mix the contents thoroughly. Equal portions shall be withdrawn from approximately the center of each drum by means of a thief or other sampling device.

4.3.2.5 Examination of filled containers. A random sample of filled containers shall be selected from each lot in accordance with ANSI/ASQ Z1.4 at inspection level II to verify compliance regarding fill, closure, marking, and other requirements not involving tests. Samples shall be examined for defects of the container and the closure, for evidence of leakage, and for unsatisfactory markings. Each container shall also be weighed to determine quantity. Any container in the sample having one or more defects or under required fill shall be cause for rejection of the container.

4.3.3 Rejection of lots. When the sample of lubricating oil fails any of the tests, this shall be cause for rejection of the lot represented by the sample.

4.4 Test methods.

4.4.1 Homogeneity. After determining the pour point of the oil, the test jar and oil shall be returned to a cooling bath. The test jar and oil shall be cooled to 6 °C (10 °F) below the pour point and held at that temperature for 3 hours. The jar of oil shall be removed from the cooling bath and allowed to warm to room temperature. Next, the jar and oil shall be placed in an oil bath, the bath shall be brought to a temperature of 121±2.8 °C (250±5 °F) and held at test temperature for 1 hour. The jar of oil shall be removed from the oil bath and allowed to cool in air to room temperature. The test oil shall be examined visually for sediment or separation of insoluble material at temperatures from 6 °C (10 °F) above the pour point and up to 121 °C (250 °F) (see 3.5).

4.4.2 Off-gassing. The lubricating oil shall be evaluated for off-gassing in accordance with S9510-AB-ATM-010 chapter titled "Material Control Program" (see 3.8 and 6.5). If the Navy determines that off-gas testing is required, testing shall be conducted at a NAVSEA-approved test facility (see 3.8). The Navy will review the off-gas test results and assign a usage category. Additionally, the Navy will assign a usage category if an administrative re view is conducted in lieu of off-gas testing (see 3.8).

4.4.3 Toxicity and prohibited materials. A Health Hazard Assessment (HHA) will be conducted to ensure conformance to 3.7.1 and 3.7.2, as required by the qualifying activity. The Navy and Marine Corps Public Health Center (NMCPHC) will evaluate the lubricating oil using data provided by the manufacturer/distributor to the NMCPHC (see 3.7.1 and 6.6).

4.4.4 ODSs. Verification that an ODS is not used in the formulation of the lubricating oil or testing thereof shall be as specified (see 6.2).

4.4.5 TCP. The use of TCP as an antiwear additive shall be verified as specified (see 6.2).

4.4.6 2,6-DTBP. Analytical data with the method documented from a NAVSEA-approved laboratory shall be as specified (see 6.2) to document relative absence of DTBP, and, if detected, shall not exceed 10 ppm by mass (see 3.11).

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4.4.7 Oil compatibility. Oil compatibility shall be determined using Option 2 of ASTM D7155 (i.e., 10: 90, 50: 50, and 90: 10 mixture of new candidate oil [Oil A] and new reference oil [Oil B]). The oil mixtures, along with separate samples of Oil A and Oil B, shall be subjected to Tier 1 testing in an oven at 65 ± 3 °C (149 ± 5.4 °F) for 168 hours. After cooling to room temperature, inspect the beakers in accordance with the Appearance Rating Appendix of ASTM D7155. If the visual inspection results are satisfactory, proceed to subject the previously heated mixtures to Tier 2 testing. The candidate oil shall be considered compatible with the reference oil furnished by the Government if the three mixtures of the test oil with the reference oil gives passing values on the oxidation (ASTM D943), corrosion (salt water), foam, and emulsion tests (see 3.4). A reference oil is an oil listed on the QPL for MIL-PRF-17331. For information on obtaining a reference oil, see 6.3.

4.4.8 Appearance. The appearance of the lubricating oil shall be assessed by filling a clear quart-sized bottle with the lubricating oil and holding the sample in front of a strong light source. The lubricating oil shall be inspected for any cloudiness or haziness (see 3.12).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The lubricant is intended for use in main and auxiliary turbines and gears, air compressors, and certain hydraulic equipment, as well as for general mechanical lubrication onboard naval vessels. Current stock of lubricants may be used until depleted; future requisitions for lubricants should refer to the current version of this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Quantity required.
- c. Requirement for a certificate of conformance for ODSs (see 4.4.4) and TCP (see 4.4.5).
- d. Requirement for analytical data documenting relative absence of DTBP (see 4.4.6).
- e. Packaging requirements (see 5.1).
- f. Activities requiring copies of completed safety data sheets (SDSs) (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. 17331 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to CommandStandards@navy.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.3.1 Provisions governing qualification. Copies of SD-6, "Provisions Governing Qualification," are available online at <http://quicksearch.dla.mil/> or <https://assist.dla.mil>.

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6.4 SDSs. Contracting officers will identify those activities requiring copies of completed SDSs prepared in accordance with FED-STD-313. In order to obtain the SDS, FAR clause 52.223-3 must be in the contract.

6.5 Material certification. Materials to be installed in submarines are to be controlled to prevent off-gassing, which contaminates the submarine's atmosphere and can result in health hazards to personnel or deleterious effects on machinery. These controls are administered through the Submarine Material Control Program, which is described in the Nuclear Powered Submarine Atmosphere Control Manual, S9510-AB-ATM-010 chapter titled "Material Control Program." Under the Submarine Material Control Program, all materials considered for use on submarines require certification and assignment of a usage category. Under the certification process, candidate materials are selected by Navy activities or contractors, and a request for certification is submitted to Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to CommandStandards@navy.mil. The certification request is accompanied by detailed information, including descriptions of the material, method of application, usage, and storage. A chemical analysis is conducted, which can be accomplished through off-gas testing. If off-gas testing is required, it must be conducted in a Government approved laboratory. Information pertaining to this test requirement may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to CommandStandards@navy.mil. Based on the chemical analysis results, a usage category is assigned to the material defining whether, and to what extent, the material may be used on submarines.

6.6 Toxicity evaluation. The NMCPHC requires sufficient information to permit an HHA of the product. Upon completion of the HHA, a copy will be provided by the NMCPHC to the Government for evaluation. The HHA process is described on the NMCPHC's website, <http://www.med.navy.mil/sites/nmcphc/industrial-hygiene/Pages/health-hazard-assessment.aspx>.

6.7 Definitions.

6.7.1 Bulk lot. A bulk lot consists of a quantity of a homogeneous mixture of fluid offered for acceptance in a single, isolated container or manufactured in a single plant run through the same processing equipment with no change in the ingredient materials.

6.7.2 Ortho isomer. Isomers are compounds with the same molecular formula but different structures. The ortho isomer is one where adjacent sites on a benzene ring are substituted.

6.7.3 Packaged lot. A packaged lot consists of an indefinite number of 55-gallon drums or smaller unit packages of identical size and shape, offered for acceptance, and filled with a homogeneous mixture of fluid from a single, isolated container, or filled with a homogeneous mixture of fluid.

6.8 Shelf-life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings IAW MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government. These and other requirements, if necessary, are in DoDM 4140.27, Volume 1, *DoD Shelf-Life Management Program: Program Administration*; and Volume 2, *DoD Shelf-Life Management Program: Materiel Quality Control Storage Standards*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoDM 4140.27, Volumes 1 and 2, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: <https://www.shelflife.dla.mil/>.

6.9 Subject term (key word) listing.

2190 TEP

Air compressor

Gas turbine auxiliaries

Line shaft bearings

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6.10 International standardization agreement implementation. This specification implements international standardization agreement NATO STANAG 1135/AFLP 1135, *Interchangeability of Fuels, Lubricants, and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations*, and AFIC AIR STD FG 4024, *Interchangeability Chart of Standardised Aviation Fuels, Lubricants, and Associated Products*. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at <https://assist.dla.mil>.

6.11 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.

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APPENDIX APANEL COKER TEST METHOD FOR DETERMINING
COKING TENDENCY OF MIL-PRF-17331 LUBRICATING OIL

A.1. SCOPE

A.1.1 Scope. The panel coker test method, which is based on a modification of method 3462 of Federal Test Method Standard No. 791, is used for determining the tendency of finished oils to form coke (solid decomposition products) when in contact with surfaces at elevated temperatures for relatively short periods. It consists of mechanically splashing the oil for 4 hours against an aluminum test panel heated to 330 °C (626 °F) and determining the weight of coke deposited on the surface of the plate. 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 this appendix. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in this appendix, 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 these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

(Copies of this document are available from www.astm.org.)

FEDERAL TEST METHOD (FTM) STANDARD

FTM-791-3462 - Coking Tendencies of Lubricating Oils

(Copies of this document are available from <http://www.falexint.com>.)

A.3 TEST METHOD

A.3.1 Summary. A test panel of aluminum conforming to ASTM B209 is polished to a dull luster finish, washed in Mineral Spirits, and weighed to the nearest milligram. The test panel is then mounted, polished side down, onto the coker panel test apparatus, preheated to 330 °C (626 °F), and the test apparatus splasher is started at 1,000±50 rpm for 4 hours. At the end of the 4-hour test period, the test panel is washed with Mineral Spirits, dried, and reweighed. The weight of coke deposited on the test panel is then recorded as the oil's coking tendency.

A.3.2 Purpose. In-service MIL-PRF-17331 lubricating oil may be exposed to localized elevated temperatures when used in systems containing electric lube oil heaters. Historical experience has demonstrated a propensity for coking and thermal cracking to occur under certain conditions. This test method will be used to assess the tendency of a qualifying formulation towards the formation of coking deposits.

A.4 TEST APPARATUS

A.4.1 Guidelines. The general guidelines for the design of a satisfactory panel coker test apparatus are provided in the following figures. Customization of these requirements is permitted provided that the material and dimensional test setup requirements depicted on [figures A-1](#) through [A-3](#) are met.

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APPENDIX A

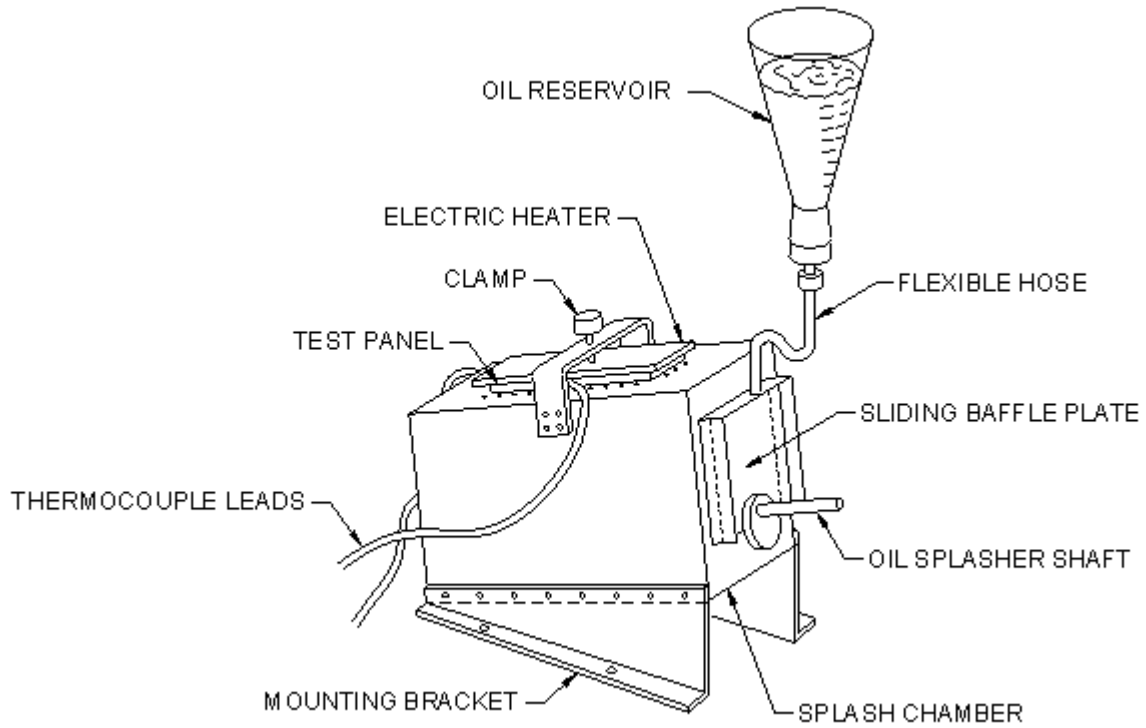
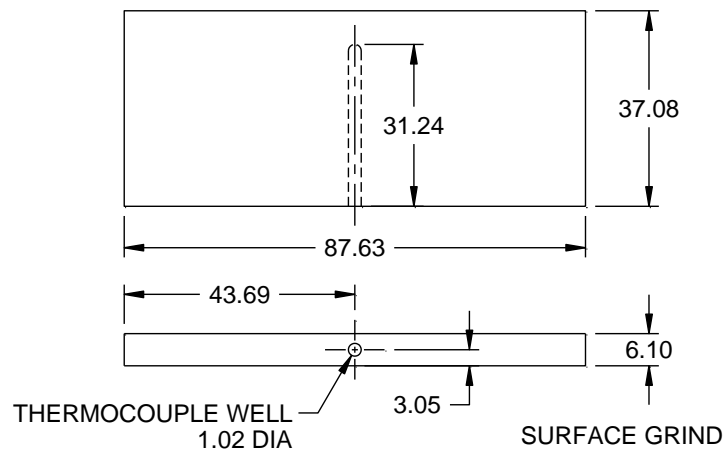


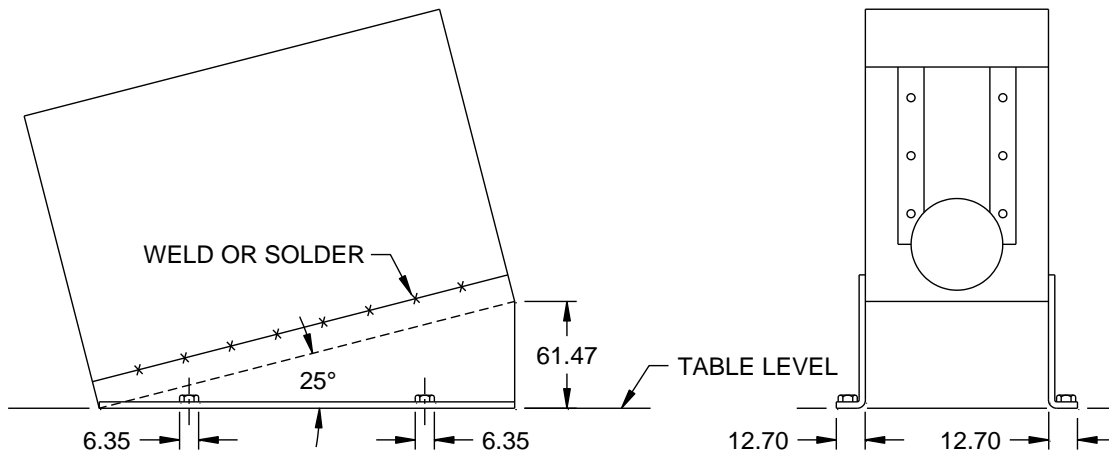
FIGURE A-1. Test setup.



DIMENSIONS IN MILLIMETERS
TOLERANCE: ± 0.25
MATERIAL: ALUMINUM ALLOY (ASTM B209)

FIGURE A-2. Test panel.

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DIMENSIONS IN MILLIMETERS

TOLERANCE: ± 0.25

MATERIAL: STAINLESS STEEL. 1.57 STOCK THICKNESS

FIGURE A-3. Splash chamber.

A.5 TEST PROCEDURE

A.5.1 Preparation of test panel. The test panel shall be prepared as follows:

- Polish the ground surface of the test panel (figure A-2) to a dull luster finish using No.1 metallurgical emery paper. Wash the test panel in Mineral Spirits, dry, and weigh to the nearest milligram.
- Mount the test panel onto the panel coker test apparatus and preheat the test panel to 330 ± 2 °C (626 ± 5 °F). Fill the oil reservoir with 350 milliliters of test oil. Start the oil splasher at $1,000 \pm 50$ rpm and run the test apparatus for 4 hours.
- At the end of 4 hours, secure the oil splasher and remove the test panel from the test apparatus, being careful that none of the deposits are accidentally removed from the test panel. Photograph the test panel. Carefully remove any coke deposits from the edges of the panel and then rinse with several portions of Mineral Spirits. Air dry the panel and then reweigh to the nearest milligram.
- Record the coking tendency as the difference in weight, in milligrams, between the new and used test panel.

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CONCLUDING MATERIAL

Custodian(s):

Navy – SH

DLA – GS3

Preparing activity:

Navy – SH

(Project 9150-2018-011)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.