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DEPARTMENT OF DEFENSE HANDBOOK

GUIDE FOR SELECTION OF LUBRICANTS AND HYDRAULIC FLUIDS FOR USE IN SHIPBOARD EQUIPMENT



**This handbook is for guidance only.
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FOREWORD

1. This handbook 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.

2. The purpose of this handbook is to provide basic and fundamental information on the selection and limitations of lubricants and hydraulic fluids for use in shipboard equipment. Every effort has been made to reflect the latest information on lubricants and hydraulic fluids in shipboard equipment.

3. 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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1. SCOPE

1.1 Scope. This handbook establishes design guides for the selection of lubricant fluids and compounds which conform to approved specifications and includes descriptive information relative to shipboard equipment applications and limitations of the lubricants. Materials used only during normal overhaul of shipboard equipment are not within the scope of this handbook. Materials used only for corrosion protection have been excluded from this handbook. Design and lubrication guidelines for military electronic equipment are provided in MIL-HDBK-454. Special precautions are to be used when selecting lubricants for use inside manned pressurized compartments (hyperbaric systems, diving systems, etc.). Selection of lubricants and compounds for these types of systems is outside the scope of this handbook. This handbook is for guidance only and cannot be cited as a requirement. Additional information regarding lubrication oils can be found in S9086-H7-STM-010/262. Additional information regarding hydraulic oils and hydraulic oil selection can be found in S9086-S4-STM-010/556 and SAE J1778. Supplementary Technical Requirement (STR) 4P22 defines lubricants and compounds approved for use in propulsion plants of nuclear-powered ships and applies to applications where forces afloat may have to maintain or assemble/disassemble equipment or piping systems on board the ship. STR 4P22 should be reviewed when selecting lubricants or compounds for those applications.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are those needed to understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

FEDERAL SPECIFICATIONS

VV-L-825 - Lubricating Oil, Refrigerant Compressor, Uninhibited

COMMERCIAL ITEM DESCRIPTIONS

A-A-50433 - Grease, Sea Water Wash Resistant

A-A-50493 - Oil, Penetrating (for Loosening Frozen Metallic Parts)

A-A-59004 - Anti-Galling Compound, Thread Lubricating, Seizing Resistant, and Calcium Hydroxide Containing

A-A-59313 - Thread Compound; Antiseize, Zinc Dust-Petrolatum

A-A-59691 - Silicone Compound NATO Code Number S-736

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-907 - Antiseize Thread Compound, High Temperature

MIL-PRF-2104 - Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service

MIL-DTL-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-PRF-9000 - Lubricating Oil, Shipboard Internal Combustion Engine, High-Output Diesel

MIL-L-15719 - Lubricating Grease (High-Temperature, Electric Motor, Ball and Roller Bearings)

MIL-DTL-16884 - Fuel, Naval Distillate

MIL-PRF-17331 - Lubricating Oil, Steam Turbine and Gear, Moderate Service

MIL-PRF-17672 - Hydraulic Fluid, Petroleum, Inhibited

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MIL-PRF-18458	- Grease, Wire Rope – Exposed Gear
MIL-H-22072	- Hydraulic Fluid, Catapult, NATO Code Number H-579
MIL-DTL-23549	- Grease, General Purpose
MIL-PRF-23699	- Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Numbers: O-152, O-154, O-156, and O-167
MIL-L-24131	- Lubricant, Colloidal Graphite in Isopropanol
MIL-PRF-24139	- Grease, Multipurpose, Water Resistant
MIL-L-24478	- Lubricant, Molybdenum Disulfide in Isopropanol
DOD-G-24508	- Grease, High Performance, Multipurpose (Metric)
MIL-PRF-24548	- Penetrating Fluid
DOD-PRF-24574	- Lubricating Fluid for Low and High Pressure Oxidizing Gas Mixtures
DOD-G-24650	- Grease, Food Grade, Food Processing Equipment (Metric)
DOD-L-24651	- Lubricating Oil, Food Grade, Food Processing Equipment (Metric)
MIL-PRF-27617	- Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant
MIL-DTL-32353	- Hydraulic and Lubricating Oil, Synthetic Hydrocarbon Base
MIL-PRF-83282	- Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537

(Copies of these documents are available online at <https://quicksearch.dla.mil/>.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

S9086-H7-STM-010/262	- Lubricating Oils, Greases, Specialty Lubricants, and Lubrication Systems
S9086-S4-STM-010/556	- Hydraulic Equipment (Power Transmission and Control)

(Copies of these documents 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. These documents are available for ordering (hard copy) via the Naval Logistics Library (NLL) 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.)

STR 4P22	- List of Approved Lubricants and Compounds for Shipboard Use in Propulsion Plant Equipment and Piping Systems
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(Copies of this document are available by email request to CommandStandards@navy.mil.)

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein.

AMERICAN NATIONAL STANDARDS INSTITUTE/AMERICAN GEAR MANUFACTURERS ASSOCIATION (ANSI/AGMA)

ANSI/AGMA 9005 - Industrial Gear Lubrication

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

ASTM INTERNATIONAL

ASTM D4485 - Standard Specification for Performance of Active API Service Category Engine Oils

(Copies of this document are available online at www.astm.org/.)

SAE INTERNATIONAL

SAE AMSG6032 - Grease, Plug Valve, Gasoline and Oil Resistant, NATO Code Number G-363, Metric

SAE J1703 - Motor Vehicle Brake Fluid

SAE J1778 - Ship Systems and Equipment – Recommended Practice for Hydraulic Fluid Selection

SAE J2360 - Automotive Gear Lubricants for Commercial and Military Use

(Copies of these documents are available online at www.sae.org/.)

2.4 Order of precedence. In the event of a conflict between the text of this handbook and the references cited herein, the references cited take precedence.

3. DEFINITIONS

This section is not applicable to the handbook.

4. GENERAL GUIDANCE

4.1 Lubricating greases, general applications and limitations.

4.1.1 SAE AMSG6032, types I and II – Grease, Plug Valve, Gasoline and Oil Resistant, NATO Code Number G-363, Metric.

a. Uses: These greases are intended for use in tapered plug valves, as a gasket or seal lubricant, for scuppers in freshwater, saltwater, and sewage systems, and for any general plug valve service in systems where gasoline, oil, alcohol, or water resistance is required. The two types provide for the use of high-pressure lubrication equipment (type I) or for servicing those valves which require a stick type lubricant (type II). The type I grease is identified by North Atlantic Treaty Organization (NATO) Code G-363.

b. Limitations: These greases are not suitable for use with strong acids, alkali, or hydrogen peroxide. They should not be used in nonspecified applications without prior performance evaluation.

4.1.2 MIL-L-15719 – Lubricating Grease (High-Temperature, Electric Motor, Ball and Roller Bearings).

a. Uses: This is a high-temperature grease composed of a polymethyl silicone fluid and thickened with lithium soap. This grease is intended for lubricating ball and roller bearings in class H insulated electric motors with heat-stabilized ball bearings operating in a range from -17.8 to 149 °C (0 to 300 °F). In accordance with S9086-H7-STM-010/262, “MIL-L-15719 shall be used for boiler sliding feet,” unless otherwise specified by the equipment technical manual.

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b. Limitations: This grease should not be applied to bearings in which the main action involves the sliding of metal on metal, as in journal bearings, spiral gears, gear trains, and similar applications, with the exception of the application to boiler sliding feet. It should not be used in nonspecified applications without prior performance evaluation.

4.1.3 MIL-PRF-18458 – Grease, Wire Rope – Exposed Gear.

a. Uses: This grease is intended for external application to wire running ropes and exposed gears of hoists, winches, cranes, shovels, dredges, and other similar equipment. In accordance with S9086-H7-STM-010/262, “Wire rope grease must adequately lubricate individual wires and strands to prevent frictional wear of these components,” and “must penetrate to the fiber rope core to prevent it from drying out.” The grease also forms an effective barrier against corrosion. Two types of grease are specified: type I is for general application; type II is an environmentally preferable composition where potential discharge to the environment is greater. Naval Sea Systems Command (NAVSEA) approved commercial equivalents can also be used.

b. Limitations: This grease should not be used for other than the recommended application without prior performance evaluation.

4.1.4 MIL-DTL-23549 – Grease, General Purpose.

a. Uses: This grease is intended primarily for use on steam catapults. It is intended for use under conditions of high temperatures, high load, salt water, and contact with live steam. This is a general-purpose mineral grease with a molybdenum disulfide additive.

b. Limitations: This grease should not be used at temperatures below -18 °C (0 °F) or in other nonspecified applications without prior performance evaluation and cannot be satisfactorily used in grease guns at temperatures below 4 °C (40 °F). In accordance with S9086-H7-STM-010/262, “Grease containing molybdenum disulfide shall not be used in areas where the metallic component will be immersed in water or regularly wetted by splashing or periodic flooding of the bilges. Bacteria in the water, especially seawater, cause the molybdenum disulfide to break down. The by-products of the breakdown (especially the sulfur) form compounds that attack metallic components.”

4.1.5 MIL-PRF-24139 – Grease, Multipurpose, Water Resistant.

a. Uses: This multipurpose grease is intended for use in water-resistant applications, particularly where dispensing through long lengths of tubing is required. This is a soft National Lubricating Grease Institute (NLGI) number 2 mineral oil and soap type grease. This grease can be used at temperatures ranging from -18 to 110 °C (0 to 230 °F) in applications requiring dispensing through long lengths of tubing. The temperature range for use in ball and roller bearing applications is -29 to 121 °C (-20 to 250 °F). This grease is identified by NATO Code G-450.

b. Limitations: This grease is not preferred for submarine applications as it is not water-wash resistant. A-A-50433 grease is water-wash resistant and, therefore, is preferred for submarine applications. It should not be used in nonspecified applications without prior performance evaluation.

4.1.6 A-A-50433 – Grease, Sea Water Wash Resistant.

a. Uses: This aluminum-complex grease is a water-wash resistant grease to replace MIL-PRF-24139 grease on board submarines; however, its use is not limited to only submarines. This grease can be used at temperatures ranging from -9 to 177 °C (15 to 350 °F).

b. Limitations: This grease should not be used in nonspecified applications without prior performance evaluation.

4.1.7 DOD-G-24508 – Grease, High Performance, Multipurpose (Metric).

a. Uses: This is the most widely used general-purpose grease. DOD-G-24508 grease consists of a synthetic base stock and clay thickening agent. It is also used in grease lubricated ball and roller (rolling element) bearings operating continuously at temperatures up to 149 °C (300 °F) and intermittently up to 177 °C (350 °F) for periods up to 4 hours in any 24-hour period. The temperature range for use in ball and roller bearing applications is -29 to 121 °C (-20 to 250 °F).

b. Limitations: Use of this grease in nonspecified applications should be done only after evaluating its compatibility with all involved materials. It should not be used as a water-resistant grease. The compatibility of DOD-G-24508 grease with other greases is extremely limited due to its clay-based thickener.

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4.1.8 MIL-PRF-27617 – Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant.

a. Uses: These greases are intended for use in lubrication of taper plug valves, gaskets, and bearings in fuel and oil systems, high-pressure air systems at 10,342 kilopascals (kPa) (1,500 pounds per square inch [psi]) or above, oxygen systems, or oil-free nitrogen systems. These greases are also suitable for use in the presence of liquid oxygen as a lubricant and antiseize for threads. There are five types that are categorized based on operating temperature range. Type II and type III are currently utilized shipboard. Type II is used over an operating range of -40 to 204 °C (-40 to 400 °F). Type III is used over an operating temperature range of -34 to 260 °C (-30 to 500 °F). This is a fluorinated hydrocarbon grease. This grease is identified by NATO Code G-1350.

b. Limitations: These greases are not recommended for antifriction bearing lubrication and may not be suitable for aluminum or magnesium dynamic bearing lubrication because of possible ignition hazards. They are not for use in nonspecified applications without prior performance evaluation.

4.2 Lubricating oils, general applications and limitations.4.2.1 VV-L-825 – Lubricating Oil, Refrigerant Compressor, Uninhibited.

a. Uses: These lubricating oils are intended for the lubrication of the compression unit of refrigeration equipment. Type II is intended for use in equipment where refrigerants 11, 12, and 114 are used. Type IV is intended for use in equipment where refrigerant 22 is used. The type II oil is identified by NATO Code O-283. These are general guidelines, and the Original Equipment Manufacturer (OEM) requirements should be reviewed when selecting the lubricant.

b. Limitations: These oils should not be used for other than the recommended applications without prior performance evaluation. These oils should not be used in equipment where new hydrofluorocarbon (HFC) refrigerants are being used.

4.2.2 Polyol ester (POE) refrigeration oils.

a. Uses: These lubricating oils are intended for the lubrication in refrigeration and air-conditioning (AC) compressors using HFC refrigerants. Oils are selected based on the refrigerant used and OEM requirements. The Navy primarily uses POE oils with ISO viscosity grade (VG) 32, 46, and 68. ISO 32 POE oil is used in AC plants with centrifugal compressors where R-134a refrigerant is used. ISO 46 POE oil is used in equipment where R-236fa refrigerant is used. ISO 68 POE oil is used in equipment where R-134a refrigerant is used. These are general guidelines, and the OEM requirements should be reviewed when selecting the lubricant.

b. Limitations: These oils should not be used for other than the recommended applications without prior performance evaluation.

4.2.3 MIL-PRF-2104 – Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service.

a. Uses: These lubricating oils are military standard lubricants. The combination of engine and heavy-duty transmission requirements are not covered by commercial diesel engine oils. These oils are intended for use in combat and tactical equipment including the crankcase lubrication of reciprocating compression-ignition engines, heavy-duty automatic and power shift transmissions, hydraulic systems, and non-hypoid gear units of engineer/construction and material handling equipment. MIL-PRF-2104 includes five SAE VGs: 15W-40, 40, 30, 10W, and Single Common Powertrain Lubricants (SCPL). The most common grade in U.S. Navy ships is 15W-40, but all grades are used. Select based on OEM viscosity requirements. When equipment specifies commercial off the shelf (COTS) lubricants, note that the monograde lubricants meet America Petroleum Institute (API) CH-4 at a minimum and the multigrade lubricants meet API CI-4 at a minimum. The 15W-40, 10W, and 30 grades are identified by the following NATO Codes, respectively, O-1236, O-237, and O-238.

b. Limitations: SCPL grade oil should not be used in legacy Detroit Diesel Corporation (DDC) high-output two-cycle heavy-duty diesel engines if ambient temperatures exceed 32 °C (90 °F). Although these lubricants have been tested in accordance with selected Allison Transmission Inc. and Caterpillar Inc. transmission lubricant requirements, without further testing and certification, they cannot be recognized as compliant with either company's lubricant specifications. These lubricating oils should not be used in engines containing silver bearings or in other nonspecified applications without prior performance evaluation.

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4.2.4 ASTM D4485 – API CK-4 SAE 15W-40 diesel engine oil.

a. Uses: This lubricating oil is intended for use in shipboard diesel engines as designated by the OEM and for use in shipboard diesel engines operating at ambient temperatures less than 0 °C (32 °F).

b. Limitations: This oil should not be used in gear applications due to instantaneous shearing of multigrade oils. This oil should not be used for applications other than the recommended application without prior performance evaluation.

4.2.5 MIL-PRF-9000 – Lubricating Oil, Shipboard Internal Combustion Engine, High-Output Diesel.

a. Uses: This SAE 40 diesel engine lubricating oil is intended for use in advanced design high-output shipboard main propulsion and auxiliary diesel engines, using fuel conforming to MIL-DTL-16884 and MIL-DTL-5624. This is also used in select reduction gear and hydraulic applications in which the system was designed to use the oil. This oil is identified by NATO Code O-278.

b. Limitations: This oil is not suitable for crankcase lubrication of gasoline engines, nor for use in diesel engines, in ambient temperatures below 0 °C (32 °F). For use at ambient temperatures below 0 °C (32 °F), see 4.2.3.

4.2.6 ASTM D4485 – API CK-4 and CF SAE 40 diesel engine oil.

a. Uses: These SAE 40 diesel engine oils are intended for use in advanced design high-output shipboard main propulsion and auxiliary diesel engines and are selected when MIL-PRF-9000 oil does not meet the OEM requirements of the engines. These oils are also used in select reduction-type gear applications in which the system was designed to use the oil.

b. Limitations: These oils should not be used for other than the recommended application without prior performance evaluation.

4.2.7 SAE J2360 – Automotive Gear Lubricants for Commercial and Military Use, types 75W, 80W-90, and 85W-140.

a. Uses: These oils are intended for hypoid automotive gear units, heavy duty industrial-type enclosed gear units, automotive type steering gears, and fluid-lubricated universal joints of automotive equipment. These lubricants may be appropriate for other gear applications where the position of the shafts relative to each other and the type of gear flank contact involve a large percentage of sliding contact. Such applications typically require extreme pressure (EP) additives to prevent the adhesion and subsequent tearing away of material from the loaded gear flanks. The most common gear oil under this specification is the 80W-90, which is used in many heavier gear applications such as winches. Grade 80W-90 is intended for an operating temperature range from -18 to 135 °C (0 to 275 °F). For special operations below -18 °C (0 °F), ambient grade 75W should be substituted. This oil is identified by NATO Code O-226.

b. Limitations: These oils are not appropriate for the lubrication of worm gears. Since oil conforming to SAE J2360 has poor water-separating ability, it should not be used in force-fed lubrication systems or in systems where water contamination is likely. These oils should not be used for other than the recommended application without prior performance evaluation.

4.2.8 ANSI/AGMA 9005 – ISO VG 460 Compounded Lubricant.

a. Uses: This oil contains a fatty oil additive that enhances its surface wetting ability under high moisture conditions and is recommended in gear oil applications where water contamination is likely.

b. Limitations: This oil should not be used in engines containing silver bearings or in other nonspecified applications without prior performance evaluation.

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4.2.9 MIL-PRF-17331 – Lubricating Oil, Steam Turbine and Gear, Moderate Service.

a. Uses: This mineral oil lubricant was originally designed for use in main and auxiliary steam turbines; however, it has since been adopted for use in many other applications to minimize the total number of lubricants used onboard. This steam turbine oil is used to lubricate: main reduction gears (MRG); low, medium, and high-pressure air compressors; line shaft or spring bearings; controllable pitch propellers; generators on steam turbine engines; generators on some gas turbine engines; and other machinery. In addition to submarines using this oil as their primary lubricating oil, they also use it as a hydraulic fluid. This oil is comprised of high-viscosity index paraffinic base stocks with anti-wear, antioxidant, antifoaming, and anticorrosion additives. This oil is identified by NATO Code O-250.

b. Limitations: This oil should not be used for other than the recommended applications without prior performance evaluation.

4.2.10 MIL-DTL-32353 – Hydraulic and Lubricating Oil, Synthetic Hydrocarbon Base.

a. Uses: This synthetic fluid is a stable, homogeneous blend of polyalphaolefin (PAO) synthetic hydrocarbon base stocks and additive agents. This fluid has similar properties to MIL-PRF-17331 oil and is intended to be a drop-in replacement for MIL-PRF-17331 oil. Submarines are transitioning to MIL-DTL-32353 oils, but no surface ships use this oil at the time of this revision. MIL-DTL-32353 and MIL-PRF-17331 oils are compatible.

b. Limitations: This synthetic fluid is not for use in nonspecified applications without prior performance evaluation and NAVSEA approval.

4.2.11 MIL-PRF-23699 – Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Numbers: O-152, O-154, O-156, and O-167.

a. Uses: These lubricating oils, typically made with neopentyl polyol ester base stocks, are intended for use in gas turbine engines and gear boxes for air, sea, and ground mobility equipment. There are four types that vary based on the additives included in the oils. The standard (STD) class oil is intended for use in normal performance turbo equipment where concerns about ferrous material (gears and bearings) corrosion induced from extended periods of downtime in a moist environment is not a concern. The Navy does not use the STD class in any shipboard applications. The corrosion inhibitor (C/I) class oil is intended for applications where corrosion inhibition is desired. The majority of shipboard applications utilize the C/I class. The Navy uses the C/I class to minimize corrosion that was occurring in ship applications and during storage of spare turbines. The high thermal stability (HTS) class is for use in hot running engine designs where evidence of oil coking, oil degradation, or both are noted. The HTS class is generally for high-temperature aircraft applications and some newer ship applications. The enhanced ester (EE) class is intended for applications needing improved fluorocarbon compatibility as well as better load carrying capability. The C/I, HTS, STD, and EE class are identified by the following NATO Codes, respectively, O-152, O-154, O-156, O-167.

b. Limitations: Certain types of silicone materials may not be compatible (oil foaming, material softening) with this oil at temperatures varying with the type of silicone material used. The four classes are compatible and can be mixed. However, the advantage of the C/I, HTS, or EE will be lost and revert to the STD level of performance if classes are mixed. It should not be used in nonspecified applications without prior performance evaluation.

4.2.12 DOD-PRF-24574 – Lubricating Fluid for Low and High Pressure Oxidizing Gas Mixtures.

a. Uses: This lubricating fluid is for use in oxidizing gas systems, including oxygen and compressed air. It is intended for use with oxygen systems at all pressures and high-pressure (>10,342 kPa [1,500 psi]) air and oil-free nitrogen systems. The operating parameters in high-pressure (>10,342 kPa [1,500 psi]) air, oxygen, and oil-free nitrogen systems require a lubricant that will resist auto-ignition. There are three types, depending on temperature ranges of the application. Type I lubricating fluid is intended for use at operating temperatures from -46 °C (-50 to 32 °F), for example, as a crankcase lubricant in compressors for low-temperature liquid air distillation plants. Type II is intended for use at operating temperatures from -20 to 40 °C (-4 to 104 °F), for example, as a compressor lubricant in liquid oxygen transfer pumps. Type III is intended for use at operating temperatures from 20 to 70 °C (68 to 158 °F), for example, as a crankcase lubricant in oxidizing gas systems, including oxygen and compressed air at all pressures including oil-free nitrogen at pressures above 10,342 kPa (1,500 psi). This is a hydrocarbon lubricating fluid.

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b. Limitations: This fluid is not recommended for lubrication of aluminum or magnesium materials because of possible ignition problems. It is not for use in other nonspecified applications without prior performance evaluation.

4.2.13 National Marine Manufacturers Association – Lubricating Oil, Type TC-W.

a. Uses: This oil is intended for use in two-cycle gasoline engines where the fuel and lubricant are premixed.

b. Limitations: This oil is not for use in nonspecified applications without prior performance evaluation.

4.3 Hydraulic fluids, general applications and limitations.

4.3.1 SAE J1703 – Motor Vehicle Brake Fluid.

a. Uses: This motor vehicle brake fluid is of the nonpetroleum type, based upon glycols, glycolethers, and appropriate inhibitors, for use in braking systems of any motor vehicle. This fluid is designed for use in braking systems fitted with rubber cups and seals made from styrene-butadiene rubber (SBR), or a terpolymer of ethylene, propylene, and a diene (EPDM). This brake fluid is intended for use only as an operating fluid in automotive type hydraulic brake systems at ambient temperatures ranging from -35 to 55 °C (-31 to 131 °F) and fluid temperatures ranging from -35 to 206 °C (-31 to 403 °F). This hydraulic fluid is identified by NATO Code H-549.

b. Limitations: This fluid is not to be used in preserving brake parts and components in warehouse storage, nor is it to be used in the brake system of vehicles that will be subjected to prolonged periods of standby storage. This fluid is not intended for use under arctic conditions. It should not be used in nonspecified applications without prior performance evaluation.

4.3.2 MIL-PRF-17672 – Hydraulic Fluid, Petroleum, Inhibited.

a. Uses: This petroleum base hydraulic fluid is available in three VGs: Military Symbols 2075-T-H, 2110-T-H, and 2135-T-H. Military Symbols 2110-T-H and 2135-T-H are intended for use in surface ship deck equipment and gun hydraulic equipment. Military Symbol 2135-T-H is intended also for use in hydraulic steering gears. Military Symbol 2075-T-H is intended for use in submarine external hydraulic systems and other selected applications operating in an ambient temperature range as low as -29 °C (-20 °F). These fluids are ISO VG 32, 46, and 68, respectively, with rust and oxidation inhibitors. This hydraulic fluid is not an EP or anti-wear (AW) fluid. The ISO 46 grade is identified by NATO Code H-573.

b. Limitations: This fluid is not fire resistant and limitations apply to its use in accumulator-loaded hydraulic systems. For a fire-resistant fluid, see 4.3.4. This fluid is not for use in nonspecified applications without prior performance evaluation.

4.3.3 MIL-H-22072 – Hydraulic Fluid, Catapult, NATO Code Number H-579.

a. Uses: This hydraulic fluid is a water and glycol mixture intended for use as a fire-resistant power transmission fluid for hydraulically actuated systems in naval aircraft launching catapults and in hydraulic-type weapon elevators. This hydraulic fluid is identified by NATO Code H-579.

b. Limitations: To minimize water loss, fluid temperature should be maintained below 60 °C (140 °F). If the fluid temperature exceeds 80 °C (176 °F), the possibility exists that fluid dumping through a relief valve at high pressure could convert to steam. This fluid may soften and remove most commonly used paints. It is not interchangeable with any other type of hydraulic fluid and should not be used in nonspecified applications without prior performance evaluation.

4.3.4 MIL-PRF-83282 – Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537.

a. Uses: This fluid is intended for use from -40 to 205 °C (-40 to 401 °F) in automatic pilots, shock absorbers, air compressor gear boxes, brakes, flap-control mechanisms, missile hydraulic servo-controlled systems, and other hydraulic systems using synthetic sealing material. This aircraft hydraulic fluid is sometimes used in weight critical advanced surface craft such as hydrofoils and surface effect ships. This is a polyalphaolefin synthetic hydrocarbon material with limited corrosion protection and low-temperature operability. This fluid may be stored in areas ranging in temperature from -40 to 50 °C (-40 to 122 °F). This hydraulic fluid is identified by NATO Code H-537.

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b. Limitations: This fluid is not recommended for applications subject to water contamination and high temperatures because of acid forming tendencies under these conditions. While the fluid has a higher flash point than fluids conforming to MIL-PRF-17672, it is not truly a fire-resistant fluid. This fluid should only be considered for applications in which MIL-PRF-17672 fluids are too viscous. This fluid is not for use in nonspecified applications without prior performance evaluation.

4.4 Miscellaneous lubricants, general applications and limitations.

4.4.1 A-A-50493 – Oil, Penetrating (for Loosening Frozen Metallic Parts).

a. Uses: This penetrating oil is intended for use in the freeing of corroded and frozen metallic parts resisting movement, without causing damage to such parts. The penetrating oil is applied to metal surfaces to break down rust and corrosion, reduce friction, and retard corrosion. It is available in two classes which are each also available in two types. The two classes are bio-based and non-bio-based. The two types are liquid application (brush, dip, or spray) and aerosol.

b. Limitations: Aerosol cans containing this oil should not be exposed to direct sunlight, radiators, fires, hot water, or other sources of heat. This oil may be used on board submarines only while in port while ventilating outboard. This oil is not for use in nonspecified applications without prior performance evaluation.

4.4.2 MIL-PRF-907 – Antiseize Thread Compound, High Temperature.

a. Uses: This antiseize compound is intended for use on carbon steel materials. Specifically, it is to be used on threads of nuts, studs, bolts, and other mating surfaces at temperatures up to 566 °C (1,050 °F). There are three types of this antiseize compound: type I is a copper/graphite formulation; type II is a graphite/aluminum formulation; and type III is a marine grade water-resistant formulation. Type III (marine grade water-resistant formulation) antiseize compound is intended for use in applications where superior water washout resistance is required.

b. Limitations: This compound is not intended for use in other nonspecified applications.

4.4.3 A-A-59691 – Silicone Compound, NATO Code Number S-736.

a. Uses: This non-melting, heat-stable silicone compound is used in high-tension electrical connections, ignition systems, and electronics equipment; for application to unpainted mating threaded or non-threaded surfaces; and as a lubricant for components fabricated from rubber. This compound is effective in the temperature range from -54 to 204 °C (-65 to 400 °F) for extended periods and to 260 °C (500 °F) for short periods. Additionally, this can be used as a sealant to prevent galvanic corrosion due to moisture penetration in areas of dissimilar metal contact, sealing and insulating electronic equipment where material is to remain in soft state to allow disassembly, or as a lubricant and sealant for rubber O-rings and gaskets. This compound is identified by NATO Code S-736.

b. Limitations: This silicone compound is not intended for use as a heat sink. Materials having more suitable properties are available commercially. This compound is not to be used on electrical connectors having natural rubber inserts, as noted in applicable technical orders or specifications for connectors on electric motors or generators that use carbon brushes, or in other nonspecified applications. This is not recommended as a thread lubricant for threads on recompression chambers and systems using air oxygen and other gases.

4.4.4 A-A-59313 – Thread Compound; Antiseize, Zinc Dust-Petrolatum.

a. Uses: This compound is intended to prevent seizing during assembly or disassembly of threaded or unthreaded components fabricated from aluminum or its alloys, engaged with components fabricated from similar or dissimilar metals. It is also intended to provide corrosion protection to metal surfaces.

b. Limitations: Application of an excessive amount of this compound may prevent proper seating of the components. Under low-temperature conditions, this compound hardens and is difficult to apply. This compound is not suitable for use on the threaded or unthreaded components of such equipment as optical instruments.

4.4.5 MIL-L-24131 – Lubricant, Colloidal Graphite in Isopropanol.

a. Uses: This lubricant is intended for use with metal parts having limited clearances in applications where control of impurities is required. It is used on sliding surfaces and threaded fasteners to reduce friction and the likelihood of galling where lead or sulfur contamination cannot be tolerated.

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b. Limitations: The range within which the coefficient of friction of this lubricant lies is wide compared to that of molybdenum disulfide in isopropanol conforming to MIL-L-24478 and graphite in mineral oil conforming to A-A-59004. Therefore, in threaded fastener applications where pre-load is established by torque on the bolt or nut, these other compounds may be preferable to graphite in isopropanol. MIL-L-24131 lubricant should not be used on nickel-chrome-iron alloys (such as Inconel or similar) above 649 °C (1,200 °F); stainless steels, low-alloy, and carbon steels above 538 °C (1,000 °F); and nickel-copper alloys (such as Monel or K-Monel or similar) and chrome-nickel alloy 17-4 PH above 354 °C (670 °F).

4.4.6 MIL-L-24478 – Lubricant, Molybdenum Disulfide in Isopropanol.

a. Uses: This lubricant is used to reduce friction and galling in applications having limited clearances and where control of impurities is required. It is intended for use on thread fasteners and other antiseize applications of closely fitted parts.

b. Limitations: This lubricant should not be used in contact with austenitic stainless steels or chrome-nickel alloy 17-4 PH since cracking of these alloys may result. Of particular concern are applications where this lubricant may be applied on surfaces near areas yet to be welded, on surfaces to be heat treated above 649 °C (1,200 °F), or on surfaces that will experience long term operational temperatures above 343 °C (650 °F). Unless otherwise approved by NAVSEA, it is not authorized to use this lubricant due to it containing molybdenum disulfide.

4.4.7 A-A-59004 – Anti-Galling Compound, Thread Lubricating, Seizing Resistant, and Calcium Hydroxide Containing.

a. Uses: This compound is used on threaded fasteners to reduce friction and the likelihood of galling at room temperature and seizing at elevated temperatures due to it having a low coefficient of friction range. It is recommended for use in areas where the fastener will be immersed in water or subject to regular wetting or splashing.

b. Limitations: Do not use this compound above 538 °C (1,000 °F) on low-alloy and carbon steels or above 354 °C (670 °F) in all other applications.

4.4.8 MIL-PRF-24548 – Penetrating Fluid.

a. Use: This fluid is used to aid in freeing corroded and frozen metallic parts. This is a water-based material. For propulsion plant equipment in nuclear powered ships, only this penetrating fluid can be used. Refer to STR 4P22 for current applicability.

b. Limitations: This fluid should not be used below a temperature of -1 °C (30 °F).

4.4.9 DOD-G-24650 – Grease, Food Grade, Food Processing Equipment (Metric).

a. Uses: This grease is intended for use in food processing applications where there may be incidental contact with food. This grease must be approved by the U.S. Department of Agriculture for use in food processing equipment. This is an NLGI number 2 type grease.

b. Limitations: The use of this grease in other than food processing equipment is not recommended without prior performance evaluation.

4.4.10 DOD-L-24651 – Lubricating Oil, Food Grade, Food Processing Equipment (Metric).

a. Uses: These oils (type I for general-purpose lubricating and type II for gear lubrication) are intended for use in food processing applications where there may be incidental contact with food. In accordance with S9086-H7-STM-010/262, “The finished oil shall meet FDA Regulation No. 21 CFR 175.300 or NSF Registered Proprietary Substances and Nonfood Compounds requirements for incidental food contact and ingestion (H1 designation).”

b. Limitations: The use of these oils in other than food processing equipment is not recommended without prior performance evaluation.

5. DETAILED GUIDANCE

5.1 Detailed requirements. Detailed requirements for the lubricants, hydraulic fluids, and compounds described in this handbook may be found in the applicable documents contained in section 2 of this handbook.

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6. NOTES

6.1 Intended use. This handbook is intended for use in selecting lubricants and hydraulic fluids for shipboard equipment applications.

6.2 Subject term (key word) listing.

Graphite

Grease

Oil

Silicone

6.3 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.

CONCLUDING MATERIAL

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