INCH-POUND
MIL-DTL-32617
23 October 2018
SUPERSEDING
(See 6.6)

DETAIL SPECIFICATION

PURIFIERS, CENTRIFUGAL, FUEL, AVIATION FUEL, AND LUBRICATING OIL

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

1. SCOPE

1.1 Scope. This specification covers fuel, aviation fuel, and lubricating oil centrifugal purifiers, in which water is separated continuously and solids are collected until cleaned, by manual or solids ejecting (self-cleaning) methods, for service onboard naval ships.

1.2 Classification. Centrifugal purifiers are of the types and uses as noted in 1.3. All purifiers have the capability to process the following fuels and oils, but normally will have a principal process fluid.

a. Turbine fuel, aviation grade JP-5, MIL-DTL-5624, at 60 °F (15 °C)

b. Naval distillate fuel F-76, MIL-DTL-16884, at 70 °F (21 °C)

c. Turbine lubricating oil 2190 TEP, MIL-PRF-17331, at 160 °F (71 °C)

d. Diesel lubricating oil 9250 (SAE 40), MIL-PRF-9000, at 175 °F (79 °C)

1.3 Part or identifying number (PIN). PINs are for general information only. The acquisition requirements herein take precedence. The PINs to be used for purifiers acquired to this specification are created as follows:

M	**32617**	**-**	**X**	**X**	**-**	**XXXXX**	**-**	**XXX**	**-**	**X**
Prefix for Military Specification	Specification Number	-	Bowl (see 1.3.1)	Control (see 1.3.2)	-	Capacity (see 1.3.3)	-	Principal Process Fluid (see 1.3.4)	-	Supplied As (see 1.3.5)
Examples:										
PIN M32617-1M-18000-JP5-L Designates a solid bowl, manually cleaned, manually operated 18,000 gallons per hour capacity JP-5 purifier, supplied as separate components (similar to the MIL-P-22088 JF-3 purifier)										
PIN M32617-2A-00700-F76-L Designates a self-cleaning, automatically operated, 700 gallons per hour capacity, F-76 fuel oil purifier, supplied as separate components (similar to the MIL-P-24710 SC-1 purifier)										
PIN M32617-2A-00098-TEP-L Designates a self-cleaning, automatically operated, 98 gallons per hour capacity, 2190 lubricating oil purifier, supplied as separate components (similar to the MIL-P-24710 SC-3 purifier)										

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.

AMSC N/A FSC 4330

1.3.1 Bowl type.

PIN Code	Description
1	Solid bowl (manual cleaning)
2	Self-cleaning bowl

1.3.2 Control.

PIN Code	Description
A	Automatic
S	Semi-Automatic
M	Manual

1.3.3 Capacity.

PIN Code	Description
xxxxx	Capacity stated in gallons per hour (examples: 20000 [large], 01000 [medium], 00500 [small]) as specified (see 6.2)

1.3.4 Process fluid.

PIN Code	Description
JP5	Turbine fuel, aviation grade JP-5, MIL-DTL-5624
F76	Naval distillate fuel F-76, MIL-DTL-16884
TEP	Turbine lube oil, 2190 TEP, MIL-PRF-17331
DLO	Diesel lube oil, 9250 (SAE 40), MIL-PRF-9000
OOF	Other oil or fuel process fluid

1.3.5 Supplied as.

PIN Code	Description
L	Purifier components supplied as separate items
S	Purifier supplied as skid-mounted unit

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 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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.

FEDERAL STANDARDS

FED-STD-H28	-	Screw-Thread Standards for Federal Services
FED-STD-H28/2	-	Screw-Thread Standards for Federal Services Section 2 Unified Inch Screw Threads - UN and UNR Thread Forms

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-901	-	Shock Tests, H.I (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
MIL-DTL-917	-	Electric Power Equipment, Basic Requirements for
MIL-DTL-1222	-	Studs, Bolts, Screws and Nuts for Applications where a High Degree of Reliability is Required; General Specification for
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-DTL-15024	-	Plates, Tags, and Bands for Identification of Equipment, General Specification for
MIL-P-15024/5	-	Plate, Identification
MIL-S-16032	-	Switches and Detectors, Shipboard Alarm Systems
MIL-DTL-16884	-	Fuel, Naval Distillate
MIL-DTL-17060	-	Motors, Alternating Current, Integral-Horsepower, Shipboard Use
MIL-I-17244	-	Indicators, Temperature, Direct–Reading, Bimetallic, (3 and 5 Inch Dial)
MIL-PRF-17331	-	Lubricating Oil, Steam Turbine and Gear, Moderate Service
MIL-DTL-17508	-	Mounts, Resilient: Types 6E100, 6E150, 7E450, 6E900, 6E2000, 5E3500, 6E100BB, 6E150BB, 7E450BB, and 6E900BB
MIL-B-17931	-	Bearings, Ball, Annular, for Quiet Operation
MIL-G-18997	-	Gauge, Pressure, Dial Indicating
MIL-S-24093		Steel Forgings, Carbon and Alloy Heat Treated
MIL-DTL-24299	-	Heaters, Lubricating Oil and Fuel, Electric, Naval Shipboard
MIL-DTL-24441	-	Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/20	-	Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III
MIL-DTL-24441/21	-	Paint, Epoxy-Polyamide, Haze Gray Formula 151, Type III
MIL-P-24691	-	Pipe and Tube, Carbon, Alloy and Stainless Steel, Seamless and Welded, General Specification for
MIL-P-24691/3	-	Pipe and Tube, Corrosion-Resistant, Stainless Steel, Seamless or Welded
MIL-C-24707	-	Castings, Ferrous, General Specification for
MIL-DTL-24707/1	-	Castings, Ferrous, for Machinery and Structural Applications
MIL-C-24707/3	-	Castings, Ferrous, Corrosion-Resistant, Austenitic, Chromium-Nickel

MIL-C-24707/5 - Castings, Ductile Iron and Austenitic Ductile Iron

MIL-DTL-32613 - Controller, Auxiliary-system, Naval Shipboard Use

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)

MIL-STD-438 - Schedule of Piping, Valves, Fittings and Associated Piping Components for Submarines Service

MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

MIL-STD-777 - Schedule of Piping, Valves, Fittings, and Associated Piping Components for Naval Surface Ships

MIL-STD-1472 - Human Engineering

MIL-STD-1474 - Noise Limits

MIL-STD-3045 - U.S. Navy Surface Ship Machinery Arrangements

MIL-STD-46855 - Human Engineering Requirements for Military Systems, Equipment, and Facilities

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

MIL-HDBK-470 - Designing and Developing Maintainable Products and Systems, Volume I

MIL-HDBK-781 - Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production

(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. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

GENERAL SERVICES ADMINISTRATION

GSA Global Supply Catalog

(Copies of this document are available online at https://www.gsaglobalsupply.gsa.gov.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) DRAWINGS

NAVSHIPS 803-1385850 - Piping Instrument Pressure for All Service

NAVSHIPS 810-1385917 - Temperature Indicator and Thermowell Selection

(Copies of these documents are available from the applicable repositories listed in S0005-AE-PRO-010/EDM, which can be obtained online via Technical Data Management Information System (TDMIS) at https://mercury.tdmis.navy.mil/. Copies of these documents may also be obtained from the Naval Ships Engineering Drawing Repository (NSEDR) online at https://199.208.213.105/webjedmics/index.jsp. To request an NSEDR account for drawing access, send an email to NNSY_JEDMICS_NSEDR_HELP_DESK@navy.mil.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

S9074-AR-GIB-010/278 - Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery

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

(Copies of these documents are available online via Technical Data Management Information System (TDMIS) at https://mercury.tdmis.navy.mil/. 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.)

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.

AEROSPACE INDUSTRIES ASSOCIATION (AIA)

NASM25027 - Nut, Self-Locking, 250 °F, 450 °F, and 800 °F

NASM17828 - Nut, Self-Locking, Hexagon Regular-Height, (Non-Metallic Insert) 250 °F or 450 °F, Nickel-Copper Alloy

NASM17829 - Nut, Self-Locking, Hexagon Regular-Height, (Non-Metallic Insert) 250 °F Non-CRES Steel

NASM17830 - Nut, Self-locking, Hexagon-Regular, 250 °F and 450 °F, Non-metallic Insert, 300 Series CRES

(Copies of these documents are available online at www.aia-aerospace.org.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

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

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

ASTM INTERNATIONAL

ASTM A36/A36M - Standard Specification for Carbon Structural Steel

ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A148/A148M - Standard Specification for Steel Castings, High Strength, for Structural Purposes

ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A252 - Standard Specification for Welded and Seamless Steel Pipe Piles

ASTM A322 - Standard Specification for Steel Bars, Alloy, Standard Grades

ASTM A473 - Standard Specification for Stainless Steel Forgings

ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A757/A757M - Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing and Other Applications, for Low-Temperature Service

ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings

ASTM B167 - Standard Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Seamless Pipe and Tube

ASTM B271/B271M - Standard Specification for Copper-Base Alloy Centrifugal Castings

ASTM F2045 - Standard Specification for Indicators, Sight, Liquid Level, Direct and Indirect Reading, Tubular Glass/Plastic

ASTM D2276 - Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling

ASTM D2709 - Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge

ASTM D3240 - Standard Test Method for Undissolved Water In Aviation Turbine Fuels

ASTM D4894 - Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials

ASTM D7619 - Standard Test Method for Sizing and Counting Particles in Light and Middle Distillate Fuels, by Automatic Particle Counter

ASTM F1510 - Standard Specification for Rotary Positive Displacement Pumps, Ships Use

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60072-1 - Dimensions and output series for rotating electrical machines - Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080

IEC 60072-2 - Dimensions and output series for rotating electrical machines - Part 2: Frame numbers 355 to 1000 and flange numbers 1180 to 2360

(Copies of these documents are available online at http://webstore.iec.ch.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 492 - Rolling bearings – Radial bearings – Geometrical product specifications (GPS) and tolerance values

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

SAE INTERNATIONAL

SAE AIR4127 - Steel: Chemical Composition and Hardenability

SAE AMS7259 - Rubber: Fluorocarbon (FKM), High Temperature/Fluid Resistant, Low Compression Set/ 85 to 95 Hardness, For Seals in Fuel Systems and Specific Engine Oil Systems

SAE AMSQQS763 - Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings

SAE J2360 - Lubricating Oil, Gear Multipurpose (Metric) Use

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

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC-SP10/NACE No.2 - Near-White Blast Cleaning

(Copies of this document are available online at www.sspc.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.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. This specification is not intended to be restrictive regarding materials; however, purifier materials shall be as specified in table I, unless alternate materials are equal to or better than the materials specified. Alternate materials shall be subject to review and acceptance by the contracting activity. Components for which specific materials are not specified shall be made of materials similar to those cited for the service intended. Components listed are not necessarily present in specific designs. Use of galvanically dissimilar materials shall be avoided.

TABLE I. Purifier materials.

Component	Material	Specifications
Frames	Corrosion resisting steel	ASTM A240/A240M (class 302 or 304)
	Steel	ASTMs A36/A36M, A108, A148/A148M, A252
Covers	Corrosion resisting steel	ASTMs B167, A240/A240M, SAE AMSQQS763 (class 316 or 304)
	Hydraulic bronze	ASTM B271/B271M (see 3.2.2.2.e)
	Steel	ASTMs A108 (grade 1018), A1011/A1011M, A36/A36M
Bowl assembly	Corrosion resisting steel	ASTM A240/A240M (class 304, 316, 317, 410)
	Corrosion resisting steel casting	MIL-C-24707, MIL-C-24707/3
Bowl casing	Steel	ASTMs A36/A36M, A53, A106/A106M (grade B), A108 (grade 1018), A473, A568/A568M, A1011/A1011M

TABLE I. Purifier materials - Continued.

Component	Material	Specifications
Spindle	Forged steel, free machining	MIL-S-24093 (class B or H)
	Cold rolled steel	ASTM A108
	Steel	ASTMs A322 (grade E43406), A276
Spindle housing	Nodular iron	MIL-C-24707/5
	Cast steel	MIL-DTL-24707/1, ASTMs A757/A757M (grade AlQ), A216/A216M (grade WCA)
Inlet and outlet piping	Corrosion resisting steel	MIL-P-24691, MIL-P-24691/3 (grade TP304)
O-rings	Fluorocarbon rubber	SAE AMS7259, ASTM D4894 (PTFE)

3.2.1 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.2.2 Toxicity and prohibited materials.

3.2.2.1 Toxicity. The purifier shall pose no serious or high risk to the health of personnel or the environment when used for its intended purpose.

3.2.2.2 Prohibited materials. The purifier shall not contain any chemicals categorized as "prohibited" in accordance with T9070-AL-DPC-020/077-2. Additionally, the following materials are prohibited for use in purifiers covered by this specification:

a. Magnesium and its alloys
b. Cast iron (except nodular iron)
c. Semi-steel
d. Cadmium plating
e. Copper alloys in contact with fuel or lubricating oil
f. Asbestos

3.2.3 Mercury. The purifier shall be free of mercury contamination. During the manufacturing process, tests, and examination, the product to be offered for acceptance shall not come in direct contact with mercury or any of its components, nor with any mercury-containing device employing a single boundary of containment.

3.3 Construction. Purifiers shall separate contaminants from F-76 (MIL-DTL-16884) and JP-5 (MIL-DTL-5624) fuels and turbine (MIL-PRF-17331) and diesel engine (MIL-PRF-9000) lubricating oils. These are referred to generally as process fluids, and normally a particular purifier will be used for a specific one. Purified process fluid shall be discharged under pressure through closed piping to the respective shipboard fuel or lube oil systems, as applicable. Water separated from the process fluid shall be continuously discharged to a designated drain tank or the shipboard oily water drain collection system. Separated solids shall collect within the bowl until they are removed by cleaning. Purifiers shall adhere to the following:

a. Manual cleaning purifiers shall be equipped with solid bowls.

b. Automatic and semi-automatic purifiers shall employ a shoot cycle that shall remove solids during normal operation to the designated drain tank or shipboard oily water drain collection system.

c. Purifiers shall utilize water supplied from the shipboard potable water system, dedicated head tank, or both, for priming seal water, cleaning, self-cleaning, and other purifier operating functions.

d. Purifiers shall operate in accordance with performance characteristics (see 3.4) under all shipboard conditions (see 3.5).

e. Operating capacity shall be as specified (see 6.2) based on a principal operating fluid in gallons per hour, under normal operating conditions (see 3.5).

3.3.1 General. Purifiers shall be manual, semi-automatic, or automatic operation as specified (see 6.2). Manual purifiers shall require operator control of all functions and cleaning. Semi-automatic purifiers shall operate with manual sequence initiations. Automatic purifiers shall operate without operator action once started. All purifiers shall have the following characteristics:

a. Manual pushbutton motor start on control panel.

b. Electric motor drive-through belts or gears.

c. Tachometer or counter for measurement of bowl speed.

3.3.1.1 Manual purifiers. In addition to requirements of 3.3.1, manual purifiers shall have manual control for flow of process fluid after prime.

3.3.1.2 Semi-automatic purifiers. In addition to requirements of 3.3.1, semi-automatic purifiers shall have the following characteristics:

a. Manual pushbutton or spring return selector switch control on control panel for priming water to bowl.

b. Manual pushbutton or spring return selector switch control on control panel for flow of process fluid after prime.

c. Manual pushbutton or spring return selector switch control on control panel for initiation of shoot cycle.

d. Manual pushbutton or spring return selector switch control on control panel for repositioning of bowl-operating controls and reprime of the bowl after shoot cycle.

e. Manual control of purified process fluid backpressure.

f. Provision for manual override of automatic features.

g. Full discharge bowl or partial discharge bowl as specified (see 6.2).

3.3.1.3 Automatic purifiers. In addition to requirements of 3.3.1, automatic purifiers shall have the following characteristics:

a. Automatic prime when unit has reached operating speed and after shoot cycle.

b. Automatic flow of process fluid after prime.

c. Automatic control for cyclic or other non-timed initiation of shoot cycle.

d. Automatic repositioning of bowl operating controls after shoot cycle.

e. Manual control of purified process fluid backpressure.

f. Provision for manual override of automatic features.

g. Full discharge bowl or partial discharge bowl as specified (see 6.2).

3.3.1.4 Dimensions. Dimensional requirements of the purifier and its maintenance envelope shall be as specified (see 6.2).

3.3.2 Mounts. Purifiers shall be vertical and hard-mounted on a base plate and furnished complete, ready for mounting directly to the deck of the ship without the use of a pedestal, unless the use of resilient mounts is cited in the specific acquisition (see 3.3.2.1).

3.3.2.1 Resilient mounts. When specified (see 6.2), resilient mounts shall be provided in accordance with MIL-DTL-17508.

3.3.3 Frames. Purifier frames shall be sufficiently rigid to permit lifting, handling, shipment, and installation of shipboard units without disturbing the alignment of the assembled units, so that the normal distortion, weaving, or vibration of the supporting structure aboard ships shall not cause misalignment of rotating elements.

3.3.3.1 Special handling provisions. Special tools or fittings shall be provided for lifting all items weighing more than 35 pounds (16 kilograms). Purifier installations aboard ship may be assumed to have bowl lifting provisions in accordance with MIL-STD-3045.

3.3.4 Brakes. Purifiers shall be equipped with bowl brakes, or other method of slowing and stopping the bowl.

3.3.5 Bearings. Purifier bowl spindle bearings shall be ball bearings. Other bearings may be of the sliding contact or rolling contact types. Self-aligning double row bearings and self-aligning bearing sets are permitted. In the selection of bearings, consideration shall be given to the fact that rolling and pitching of a ship at sea may introduce unusual radial and axial thrust loads.

3.3.5.1 Ball bearings. Ball bearing installation and lubrication shall be in accordance with ISO 492 for surface ships. For submarines and low-noise surface ship applications, bearings shall be in accordance with MIL-B-17931, except bearings operating at speeds greater than 3,600 revolutions per minute (r/min) need only meet the vibration requirements of MIL-B-17931. Bearing assemblies shall meet the vibration requirements of MIL-B-17931.

3.3.6 Lubricants. Lubricants used for purifier operation, assembly, and maintenance, except high speed (above 3,600 r/min) sealed bearings, should be selected from those standard lubricants listed in MIL-HDBK-267. Commercial lubricants may be used for sealed bearings operating above 3,600 r/min.

3.3.7 Piping and valves. Connections to ship's piping shall be flanged. Flange size, rating, specification, and surface finish for piping connections shall be as specified (see 6.2). Purifier valves, flanges, bolting, gaskets, fittings, and piping shall conform to MIL-STD-777 for surface ship applications and MIL-STD-438 for submarine applications (see 6.2).

3.3.8 Operating water connections. A water connection shall be provided for purifier operating requirements, including prime and shoot, as applicable. Water will be provided from the shipboard potable water system. The configuration shall minimize water quantity requirements. Water purification equipment, such as in-line filters required for proper operation, shall be included with the purifier. Hardness, chloride, and demineralization of water supply shall be considered when designing the in-line filters.

3.3.8.1 Fuel/water and oil/water interface control. Control of the interface between liquid seal (prime water) and fuel or oil shall be achieved by means of a backpressure regulating valve and gravity discs. Under all operating conditions, back pressure shall be sufficient to prevent aeration and foaming of purified fuel or oil.

3.3.8.2 Adjustment for specific gravity. The purifier shall include a set of gravity discs for specific gravity adjustment to ensure achieving the highest possible degree of purification. This adjustment range shall span the entire fuel and lubricating oil range, American Petroleum Institute (API) gravity 25 through 50 (779 through 903 kg/m^3), or be as specified (see 6.2).

3.3.9 Drain connections. Connections shall be provided for casing or funnel drains as applicable.

3.3.10 Flow adjustment. Purifiers shall be equipped with a means of adjusting the process fluid flow rate.

3.3.11 Low effluent switch. Purifiers shall be equipped with a low effluent switch assembly located in the purified process fluid discharge (effluent) line to actuate an alarm by means of a time delay relay. The flow switch shall be in accordance with MIL-S-16032.

3.3.12 Observation ports and sight glasses. Observation ports and sight glasses shall be provided in the clean process fluid discharge and the water drain line (heavy phase discharge), in accordance with ASTM F2045.

3.3.13 Sequence and valve control and actuators. Automatic and semi-automatic sequence control and valve actuators shall be electrically actuated; however, provision for manual operation shall be included. Other means of actuation may be permitted with approval of the contracting activity (see 6.2).

3.3.14 Overload relay. An overload relay shall be provided, which will be effective for all operating conditions, other than the initial starting period. The overload relay shall be the compensated thermal type. An embedded detector type shall not be used.

3.3.15 Vibration safety interlock. Purifiers shall be equipped with a vibration safety interlock to sense excessive vibration during operation, and to secure power to the purifier with a time-delayed automatic shutdown.

3.3.16 Pressure gauges, gauge piping, and connections. Pressure gauges shall be 3.5 inches (9 centimeters) in diameter and flush/surface mounted in accordance with MIL-G-18997. Gauge piping and connections shall be in accordance with 803-1385850 and shall be installed so as to resist breakage and disconnection caused by damaging vibration.

3.3.17 Thermometers and thermometer well and bulbs. Thermometers shall be 3 inches (7.6 centimeters) in diameter, in accordance with MIL-I-17244. Use of mercury thermometers is prohibited. Thermometer wells and bulbs, when supplied, shall be in accordance with 810-1385917.

3.3.18 Gear-driven purifier dipstick, sight glass, and oil. Gear-driven purifiers shall be provided with an oil dipstick or sight glass to determine the lubricating oil level within the drive mechanism case. Drive mechanism case oil shall be in accordance with SAE J2360.

3.3.19 Thread fit. Screw threads shall be in accordance with FED-STD-H28 and FED-STD-H28/2.

3.3.19.1 Alignment critical fit. Where alignment must be maintained, fitted bolting or positive interference methods shall be used. Fit shall be:

Nominal size	Maximum clearance (and interference)
1.27 to 2.86 centimeters	plus 0.0013 (minus 0.0005) centimeters
½ to 1⅛ inches	plus 0.0025 (minus 0.0010) inches

3.3.20 Fastener application. Except where torque-controlled, pre-stressed bolts and nuts are used, not less than one thread, but not greater than four threads, shall protrude beyond the crown of the nut. With plastic insert self-locking nuts, the end of the thread runout shall be not less than one thread above the top of the plastic insert. Washers shall not be used under the nut for the purpose of reducing thread protrusion. Thread engagement for the setting end of a stud shall be such that the shear load strength of the engaged threads shall be greater than the tensile load strength of the stud.

3.3.20.1 Thread engagement for materials of similar and dissimilar tensile strengths. For materials having similar mechanical properties, the full thread engagement shall be not less than one major diameter (1D). For materials having differing tensile strength, the minimum engagement of stud setting threads shall be computed in accordance with FED-STD-H28/2, using the maximum expected tensile strength of the stud material and minimum specified (or expected, if no minimum is specified) tensile strength of the body material, plus one thread, but in no case less than 1D.

3.3.20.2 Through tapping and bolting. Through tapping is permissible only if metal thickness is sufficient for 1D full thread engagement, plus thread run-out and end bevel, and shall be used only where necessary to maintain watertight or structural integrity. Bottom-tapped holes shall have full threads for the entire depth. Through bolting shall be used wherever possible. If use of such bolting is not possible, studs, tap bolts, or machine screws shall be used. Thread engagement in blind holes shall be not less than 1D.

3.3.20.3 Foundation bolts. Foundation bolts or studs shall be not less than ½ inch in diameter.

3.3.20.4 Self-locking nuts. When required to prevent loosening due to shock or vibration, self-locking nuts in accordance with NASM25027 shall be used. Self-locking nuts having plastic inserts or self-locking nuts of the all-metal, distorted-top type shall be used at temperatures which shall be not greater than 259 degrees Fahrenheit (°F) (121 degrees Celsius [°C]). The following documents apply to nuts of the indicated material:

a. Nickel-copper alloy (NASM17828)

b. Carbon steel (NASM17829); modified to specify MIL-DTL-1222, grade 2H for use with alloy steel bolts, or grade 2 for use with carbon steel bolts

c. Corrosion resisting steel (NASM17830); modified to specify 15303 of SAE AIR4127

3.3.21 Pipe plugs. Purifier pipe plugs shall not have tapered threads. Pipe plugs shall be straight machine threaded. Tight sealing shall be ensured by use of O-rings.

3.3.22 Doweling. Each component part of an assembled unit supported directly by a frame or bedplate shall be doweled to facilitate reassembly and maintenance of alignment. Dowels shall be unequally spaced, or be of different diameters, to avoid incorrect assembly.

3.3.23 Machined surfaces. Bearing and seating surfaces of frames or bedplates shall be finish machined.

3.3.24 Welding. Welding shall be in accordance with S9074-AR-GIB-010/278. Loose welding beads, slag, and spatter shall be removed.

3.3.25 Painting. Non-working surfaces, normally painted, shall be finished as follows:

a. Surface preparation prior to painting in accordance with SSPC-SP 10/NACE No.2.

b. Two coats epoxy paint formula 151 and one coat of formula 150, in accordance with MIL-DTL-24441, MIL-DTL-24441/20, and MIL-DTL-24441/21 (average 3 mils dry film thickness per coat).

3.3.26 Purifier pumps. When required (see 6.2), pumps shall be supplied.

a. Unless otherwise specified (see 6.2), purifier pumps shall be class CD, DD, or DH, in accordance with ASTM F1510. The capacity of each discharge pump shall be approximately 110 percent of the rated capacity of the corresponding feed pump. Pumps shall be furnished with built-in spring loaded bypass valves. A pressure gauge and thermometer shall be installed between the discharge of the feed pump and the inlet to the purifier bowl. The suction lift of the pumps, referred to the horizontal centerline of pump rotors, shall be 15 inches of mercury (51 kPa). The discharge pressure of pumps shall be 25 pounds per square inch (lb/in^2) (172 kPa) gauge when operating under the specified conditions of service.

b. When specified (see 6.2), the pumps and the purifier shall be driven by a common motor.

3.3.27 Heaters. When specified (see 6.2), heaters in accordance with MIL-DTL-24299 shall be supplied with the purifiers. Heaters shall heat process fluid from the ambient temperatures specified to the purification temperatures specified in table II, with the process fluid flowing through the heater at the rated capacity of the feed pump.

TABLE II. Temperature.

	Turbine fuel, aviation grade JP-5, MIL-DTL-5624 at 60 °F (15 °C) [1/]	**Naval distillate fuel F-76, MIL-DTL-16884 at 70 °F (21 °C)**	**Turbine lube oil 2190 TEP, MIL-PRF-17331, at 160 °F (71 °C)**	**Diesel lube oil 9250 (SAE 40), MIL-PRF-9000 at 175 °F (79 °C)**
Influent temperature range, °F (°C)	60–90 (15–32)	60–80 (16–27)	150–170 (66–77)	165–185 (74–85)
Ambient temperature range, °F (°C)	40–100 (4–38)	40–122 (4–50)	40–122 (4–50)	40–122 (4–50)

NOTE:

[1/] JP-5 is not required to be heated for purification at any time.

3.3.28 Motors. Motors shall conform to MIL-DTL-17060 for alternating current (AC) motors, and shall have the following characteristics:

Horsepower (hp)	See 3.3.28.2
Service	A
Speed classification	Constant
Duty	Continuous
Enclosure	Totally enclosed or dripproof
Bearings	In accordance with ISO 492 (MIL-B-17931 if low noise application)
Ambient temperature	122 °F (50 °C)
Insulation	B or F with sealed insulation system
Type	Squirrel cage induction
Voltage rating	440 volts AC, 3-phase, unless otherwise specified (see 6.2)
Design	As required (see 3.3.31)
Low noise application	As specified (see 6.2)
Mechanical balance	Precision (superprecision if low noise application)

3.3.28.1 Direct current (DC) motors. When specified (see 6.2), DC motors shall be provided in accordance with IEC 60072-1 or IEC 60072-2.

3.3.28.2 Horsepower (hp) rating. The hp rating of each motor shall be not less than the sum of the maximum brake hp of the driven components under any condition of service. The actual motor rating shall be in accordance with Navy standard hp sizes in accordance with MIL-DTL-17060, or IEC 60072-1 or IEC 60072-2 for other sizes, as required. If the maximum brake horsepower (BHP) of the equipment is less than 2, and if there is a possibility of an unpredictably high frictional load due to improper adjustment of glands or to some other cause, then the maximum brake hp shall be multiplied by a safety factor of [1.5 - (Max. BHP)/4] before selecting the next larger Navy standard rating.

3.3.28.3 Thermal protection. Thermal protection shall be provided for the purifier motor stator and motor bearings in accordance with MIL-DTL-17060, with the provision for de-energizing the motor control. Thermal protection for motor bearings and motor stator shall be in parallel electrically. Thermal protection shall include motor-mounted monitor control, with a plug-in relay having not less than one pair of normally open and one pair of normally closed contacts. The temperature sensing system shall include not less than three thermal sensors imbedded in the stator windings, and one thermal sensor for each motor bearing. Positive temperature coefficient (ptc) thermal sensors shall be used and shall have a temperature coefficient of resistance at the switch point of not less than 15 percent per degree Celsius.

3.3.29 Controllers. When specified (see 6.2), motor controllers shall be provided. Motor controllers shall conform to MIL-DTL-32613 and shall be of the following characteristics.

Enclosure	Dripproof
Operation	Magnetic
Type	Across line for AC; resistor for DC
Function	Motor starting and purifier control
Duty	Continuous
Protection	Overload – under voltage (LVP)
Ambient temperature	122 °F (50 °C)
Voltage	440 volts AC, 3-phase, unless otherwise specified (see 6.2) (DC voltage requirements, if applicable, shall be as specified [see 6.2])
Performance	Manual or automatic as specified (see 6.2)

Master switches	Local, manual
Low noise application	When specified (see 6.2), AC controllers for low noise applications shall meet the structureborne noise requirements for type III equipment of MIL-STD-740-2, and airborne noise requirements for grades A3 and A12 equipment of MIL-STD-1474.

3.3.30 Cybersecurity. Cybersecurity measures of MIL-DTL-32613 shall be implemented.

3.3.31 Acceleration allowance. Motor and controller shall permit acceleration of the unloaded purifier to full operating speed in minimal time (less than 12 minutes) without exceeding permissible temperature rise in any components or causing wear due to slippage of drive.

3.3.32 Accessibility. The construction shall provide the maximum accessibility (within space limitations if applicable, see 3.3.1.4 and 6.2) to parts that require scheduled maintenance and to effect repairs. Construction of manual purifiers shall be such that the purifier can be opened for cleaning and maintenance without breaking any piping connections. Removal of major operational parts shall not be necessary to permit accessibility for maintenance, inspection, and repair. The human engineering considerations specified in MIL-STD-1472 and MIL-STD-46855 shall not be degraded during detail design and construction.

3.3.33 Interchangeability. Identically identified components shall be functionally and physically interchangeable, without degradation of performance, reliability, or operating characteristics, and without selective assembly or modification except for calibration and adjustment. Repair parts shall be interchangeable with, and identified identically to, the part they replace. Notwithstanding the above, parts balanced as complete assemblies shall not be exchanged without rebalancing the complete assembly.

3.3.34 Skid mounted purifiers. When specified (see 6.2), purifiers shall be provided as a skid-mounted unit. When skid mounting is specified, the skid shall include all components required for immediate operation when installed aboard ship and require only connection to the serviced fuel or lubricating oil system, fresh water, and electric power. Pumps, heaters, and controllers (if so specified) shall be included on the skid.

3.4 Performance.

3.4.1 Rated capacity. The capacity of a purifier shall be as specified (see 6.2) and maintained for a period of 1 hour, during which time the purified fluid shall purify in accordance with table III. Additionally, purifiers shall have surplus capacity of at least 15 percent of their rated capacity, to accommodate transfer pump flow rates that exceed their rated capacity and provide flexibility when sizing transfer pumps.

TABLE III. Allowable process fluid contaminants.

Fluid	**Contaminants**	
	Water	Solids
Lubricating Oils MIL-PRF-9000 MIL-PRF-17331	0.05 percent by volume	0.02 percent by volume
Propulsion Fuel F-76 MIL-DTL-16884	30 parts per million (ppm)	4 mg/L
		10% of influent solids
Aviation Fuel JP-5 MIL-DTL-5624	10 parts per million (ppm)	Average no greater than 0.70 mg/L with no single sample exceeding 3.0 mg/L
		Removal efficiency not less than 99.5%

3.4.2 Emergency surge capacity. The purifier shall efficiently remove the water from a mixture that is half oil or fuel and half water, for brief intermittent periods. During emergency surge loads, the purifier may operate at 50 percent of rated capacity. The purified fluid shall contain not more than 0.30 percent water by volume at 50 percent rated capacity. When JP-5 is the purified fluid, no water shall be present in the purified effluent.

3.4.3 Solids retention. In all instances, solids within the influent process fluid shall be based upon the influent test conditions of 4.5.7.1. The solids retention volume of the purifier shall be such that automatic and semi-automatic purifiers shall not require more than one shoot cycle per operating hour with the specified principal operating fluid. Manual purifiers shall have solid retention capacity sufficient to not require more than one cleaning in 24 hours of normal operation with their specified principal operating fluid.

3.4.4 Shock. The purifier shall meet the requirements for grade A, type A, class I or II (see 6.2) high-impact shock in accordance with MIL-DTL-901. The purifier shall restart and resume normal operation if it shuts down when subjected to the test requirements of MIL-DTL-901. Equipment shall be hard-mounted to a rigid base plate for test purposes. The determination of stresses resulting from the shock test shall be accomplished by the application of analytical mechanics. The allowable stress in components due to shock shall be the yield strength (0.2 percent offset of the material). Normal stresses in parts, such as the tensile stress in a bolt due to initial pull-up, shall not be added to the shock stresses. The maximum accelerations possible under the shock tests shall be withstood by hold-down bolts, supporting feet or lugs, and main structural member of the equipment. No failure or permanent deformation may occur as a result of shock. Components of an assembly mounted on a common rigid base need not be designed for higher accelerations than the values for which the whole assembly is designed, unless there is reason to believe that higher accelerations will be experienced by the components.

3.4.5 Mechanical vibration. The equipment shall conform to the requirements of MIL-STD-167-1, type II, and shall be free of self-induced destructive vibration under all operating conditions.

3.4.5.1 Environmental vibration. The equipment shall withstand the environmental vibration requirements of MIL-STD-167-1, type I.

3.4.6 Noise. The equipment shall be in accordance with the acceptance criteria for shipboard equipment as specified in MIL-STD-1474 when tested (see 4.5.11).

3.4.7 Electromagnetic interference. The equipment shall be in accordance with electromagnetic emission suppression requirements of MIL-STD-461.

3.5 Environmental conditions. Equipment shall operate continuously at rated capacity under any combination of the range of environmental conditions specified herein.

3.5.1 Temperatures. Table II establishes the applicable temperature ranges.

3.5.2 Humidity. Purifiers shall operate and meet all specified requirements when subjected to relative humidity of 0 to 100 percent, non-condensing.

3.5.3 Pitch and inclined operation. The equipment shall suffer no damage and shall operate to the requirements of the specification when subjected to the motions stated in table IV.

TABLE IV. Motions. 1/ 2/

Motion attitude	Surface ships (radians [degrees])	Submarines (radians [degrees])
Pitch (from normal either direction) 3/	0.17 (10)	0.175 (10)
Trimmed down (from normal horizontal)	0.087 (05)	0.524 (30)
Roll (from vertical) 4/	0.785 (45) 5/	1.047 (60) surfaced 0.524 (30) submerged
Permanently listed (either side of vertical)	0.262 (15)	0.262 (15)

NOTES:

1/ Trim and list conditions shall be considered to occur simultaneously.

2/ Roll and pitch conditions shall be considered to occur simultaneously.

3/ Time of cycle: 10 seconds.

4/ Time of cycle: 15 seconds.

5/ The purifier shall maintain lubrication without loss of oil to the drive assembly. The purifier shall continue to operate without the need for re-priming after recovering from the subject motion attitude.

3.6 Reliability and maintainability. Guidance for reliability and maintainability may be found in MIL-HDBK-470 and MIL-HDBK-781.

3.6.1 Reliability. Mean time between failure for the purifier shall be not less than 8,000 hours.

3.6.1.1 Failure. For purposes of reliability calculation, the purifier is in a failed state if it cannot be started, or if a malfunction occurs that forces the purifier to be shut down prior to the completion of its scheduled test time or operating time. In addition, the purifier shall be considered to fail if the capacity (see 3.4.1) or the quality of purification (see 4.5.7) is not in accordance with the requirements specified, even if the unit has not experienced a forced shutdown. Failures shall be classified as either relevant or nonrelevant. Only relevant failures shall be chargeable for verifying reliability requirements.

a. Relevant failures are caused by:

(1) Equipment design defects

(2) Equipment manufacturing defects

(3) Parts defects

(4) Unknown

(5) All other causes not specifically listed as non-relevant

b. Non-relevant failures are caused by:

(1) Accident, mishandling, or improper storage

(2) Operator or procedural error

(3) External test equipment or facility failures

(4) Drawing, maintenance manual or other documentation errors, provided prompt correction is shown to eliminate future similar failures (this shall not be construed to include design errors)

(5) Failures of multiple, simultaneous, or immediately sequential nature (only the initial failure shall be counted in such cases)

(6) Direct result of relevant or non-relevant failures of another item of equipment (secondary failures)

(7) Improper maintenance-induced failures

(8) Foreign object damage, unless caused by failure of protective device built into equipment

3.6.1.2 Failure mode, effects, and criticality analysis (FMECA). A FMECA should be performed for first article purifiers (see 6.2 and 6.4).

3.6.2 Maintainability. Mean time to repair for the purifier shall not exceed 2 hours.

3.7 Identification plates. Identification plates shall be furnished on each purifier and shall be type A or B, in accordance with MIL-DTL-15024 and MIL-P-15024/5, except that plastic identification plates shall not be used. Identification plates shall be secured to equipment with corrosion-resistant metallic screws.

3.7.1 Identification information. Purifier identification plates shall contain the following information:

a. Manufacturer's name

b. "Centrifugal Purifier" (followed by flow rate)

c. Manufacturer's model

d. Navy size designation

e. Date of manufacture (month and year)

f. Manufacturer's serial number

g. Contract number (and item number for multiple unit orders)

h. National stock number

i. Nominal bowl speed

3.7.2 Other identification plates. Each motor and each accessory unit shall have an identification plate in accordance with the applicable equipment specification.

3.8 Safety criteria. Equipment shall be constructed to ensure safety to operating and maintenance personnel. Purifiers shall have their bowls enclosed to prevent free vapor from escaping. External moving parts, which are a potential hazard to personnel, shall be avoided wherever practicable. When their use is unavoidable, positive protection in the form of a guard shall be provided. Sharp corners and projections, which may cause injury to personnel or on which clothing may catch, shall be avoided. The following are some of the known safety criteria that apply to auxiliary machinery; others are contained in MIL-DTL-917.

a. Exposed rotating or reciprocating components, such as couplings, linkages, belts, chains, and flywheels, shall be enclosed with a safety guard to prevent accidental personnel contact with the moving part.

b. When an equipment specification requires the presence of a hazardous material as a component of shipboard equipment, conspicuous indication on the equipment of the presence of such material, together with necessary warnings and instructions, is required.

3.9 Special tools. Special tools shall be furnished in the quantity specified (see 6.2 and 6.6). Special tools are defined as those items required for shipboard maintenance, servicing, and repair not listed in the GSA Global Supply Catalog.

3.10 Workmanship. All parts of the purifier, before and after painting, shall be clean and free of sand, rust, dirt, pits, sprues, scale, and other harmful extraneous material that might detract from the intended operation, function, or appearance of the equipment. Fasteners shall be fully engaged, and bolt heads and nuts shall be flat on washers or mating surface.

4. VERIFICATION

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

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall be performed on a sample purifier unit of each new design, produced with the equipment and procedures used in normal production when a first article sample is required (see 3.1). The sample purifier shall be submitted for first article tests with required pumps and motors. This inspection shall include the examinations and tests noted in table V. Critical or major defects (see table VI) shall be cause for inspection failure.

4.2.1 Sampling plan for driver test. For the test specified in 4.5.2, a sample of purifiers shall be selected from each lot in accordance with ANSI/ASQ Z1.4, at inspection level II, and the Acceptance Quality Limit (AQL) specified (see 6.2). For lot sizes of three or fewer, all units shall be tested.

4.3 Conformance inspection. Conformance inspection shall include the examinations and tests noted in table V. Critical or major defects (see table VI) shall be cause for inspection failure.

TABLE V. Examination and tests.

Characteristics	Requirement	First Article	Conformance
Materials	3.2 through 3.2.3	4.4	4.4
Construction	3.3 through 3.3.33	4.4	4.4
Cybersecurity	3.3.30	4.6	
Performance: rated capacity	3.4.1	4.5.1 through 4.5.3	4.5.3
Performance: surplus capacity	3.4.1	4.5.3.1	
Performance: emergency surge capacity	3.4.2	4.5.8	
Performance: solids retention	3.4.3	4.5.7, 4.5.9	
Performance: shock	3.4.4	4.5.1	
Performance: vibration	3.4.5	4.5.10	
Performance: noise	3.4.6	4.5.11	
Performance: electromagnetic interference	3.4.7	4.5.1	
Environmental	3.5	4.5.4, 4.5.6	
Reliability and maintainability	3.6	4.5.4, 4.5.6	
Identification plates	3.7	4.4	
Safety	3.8	4.4	
Special tools	3.9	4.4	
Workmanship	3.10	4.4	

TABLE VI. Classification of defects.

Categories	Critical Defects
001	Capacity not as specified (see 3.3.e and 6.2).
002	Materials not as specified or allowed (see 3.2).
003	Performance not as specified (see 3.4).
Major Defects	
101	Reliability not as specified (see 3.6).
102	Maintainability not as specified (see 3.6.2).
103	Safety not as specified (see 3.8).
Minor Defects	
201	Identification plates not as specified (see 3.7).
202	Special tools not as specified (see 3.9).
203	Workmanship not as specified (see 3.10).

4.4 Visual, dimensional and material examination. Every sample purifier shall be examined to ascertain that the equipment is in accordance with all the requirements cited in table V.

4.5 Tests.

4.5.1 Operational test. Every completely assembled purifier shall be operated for a period of not less than 10 minutes at rated speed to validate smoothness of running, satisfactory operation of controls, and proper assembly.

4.5.2 Driver test. The purifier shall be operated at full capacity, as specified (see 6.2), for a period of not less than 1 hour. Quantitative measurements of purification are not required for this test. If the purifier is supplied with a motor controller (see 3.3.29), the motor controller supplied with the purifier shall be used during this test. During this test, the brake horsepower input to the assembled purifier shall be determined. The type of fluid circulated through the purifier during the test shall be the fluid specified for the particular size and capacity (see 3.4.1).

4.5.3 Rated capacity test. The sample unit shall be tested for capacity to ensure conformance with 3.4.1. Unless otherwise specified (see 6.2), the purifier shall be operated using turbine lube oil 2190 TEP, MIL-PRF-17331; diesel lube oil 9250 (SAE 40), MIL-PRF-9000; naval distillate fuel F-76, MIL-DTL-16884; and aviation fuel JP-5, MIL-DTL-5624, each for 1 hour, as specified (see 6.2), to determine the purifier capacity. For each fluid, an effluent quality test shall be performed as specified in 4.5.7. A five-minute emergency surge load test shall be performed on the sample unit and for each fluid tested, as specified in 4.5.8.

4.5.3.1 Surplus capacity test. The purifier shall be operated using its principal operating fluid (see 6.2) at a feed rate of at least 15 percent in excess of the rated capacity (that is, 345 gpm for size JFL purifier) for a period of not less than 1 hour. Test conditions, acceptable performance, and test methods shall be as specified in 4.5.7.

4.5.4 Reliability test. The sample unit shall be operationally tested for a total of not less than 1,800 hours. Each operational period shall be not less than 7 hours. The motor controller used during this test shall be identical to the one to be supplied with the purifier. The operating fluid during the test shall be the principal process fluid the purifier is to be used for, or as specified (see 6.2). The reliability test may be conducted concurrently with the tests specified in 4.5.6 through 4.5.9. An effluent quality test shall be performed on the sample unit at 10, 600, 1,200, and 1,800 hours of operation (see 4.5.7). One 5-minute surge load test shall be performed on the sample unit at every 300 hours of operation for 1,800 hours (see 4.5.8). Validation verification of the reliability requirements of 3.6 may be demonstrated by continuing the testing to 8,000 hours, or by use of the procedures of MIL-HDBK-217.

4.5.5 Maintainability demonstration examination. The quantitative requirements for the equipment shall be as specified in 3.6.2. As part of the maintenance undertaken over the course of the reliability test (see 4.5.4), a maintainability demonstration shall be conducted. The procedures of MIL-HDBK-470 may be used.

4.5.6 Inclination test. The purifier shall be at an inclination of 0.262 radians (15 degrees) for 24 hours of the reliability test.

4.5.7 Effluent quality test. Test conditions, acceptable performance, and methods of determining acceptable performance shall be as specified in 4.5.7.1 through 4.5.7.3.

4.5.7.1 Test conditions. Test conditions shall be as follows:

a. Flow. At capacity as specified (see 6.2), ±5 percent.

b. Water in influent. The amount of water shall be varied from 0.5 to 4.0 percent by volume.

c. Solids. The amount of solids shall be varied from 0.1 to 0.15 percent by mass.

d. Temperature. Temperatures shall be in the ranges specified in table II for the fluid under test.

4.5.7.2 Acceptable performance. Acceptable performance shall be in accordance with table III.

4.5.7.3 Test methods. The influent and effluent samples shall be taken simultaneously. Alternate or modified test procedures (for example, sampling and analysis) shall be subject to review and acceptance.

4.5.7.3.1 Influent test methods. Influent quality test methods shall be performed to verify conformance to 4.5.7.1.b and 4.5.7.1.c as follows:

a. Sampling procedures. The sample cock shall be fully opened and 200 milliliters shall be drawn. The 200 milliliters shall be discarded. Samples shall then be obtained as follows:

(1) Undissolved (free) water. At least six influent samples shall be drawn directly into a 100-millilter graduated centrifuge tube for free water determination by way of a bottom, sediment and water (BS&W) test for lubricating oils, and by ASTM D3540 for fuel oils.

(2) Solids content. At least six influent samples shall be drawn into a 1-liter bottle for solids content test by way of gravimetric analysis.

b. Undissolved (free) water. The water in the process fluid sample shall be as specified in 4.5.7.1.b. Free water shall be determined, by way of a bottom, sediment and water (BS&W) test, in accordance with ASTM D2709 (for example, centrifuge, 100-milliliter capillary tip test tubes) for lubricating oils. Undissolved water in fuel shall be determined to the nearest 10 parts per million (ppm) in accordance with ASTM D3240.

c. Solids content. Gravimetric analysis for solid contaminant shall be in accordance with ASTM D5452. Analysis shall be performed on entire sample. The solids contaminate injection shall be as specified in 4.5.7.1.c.

4.5.7.3.2 JP-5 effluent test methods. When JP-5 is the principle process fluid, calibrated particle counts in accordance with ASTM D7619 shall be conducted at the ≥ 4, 6, 14, 21, 25, and 30 micrometer (μm) channels.

4.5.8 Emergency surge load test. A 5-minute surge test shall be performed on the sample unit at every 300 hours of operation for 1,800 hours. The surge load shall be influent with water concentration of 50 percent. During surge load, the purifier may operate at 50 percent of rated capacity.

a. Lubricating oil purified effluent shall show not more than 0.3 percent water by volume.

b. When F-46 orJP-5 is the purified fluid, all water shall be discharged to the heavy phase discharge. No water shall discharge in the clean fuel outlet.

4.5.9 Solids retention test. The ability of the unit to remove solids and water shall not decline as the solids retention capacity is approached. A solids retention test shall be performed during which effluent samples are taken at regular intervals as the purifier is run from a clean bowl condition to the point when the calculated solids retention capacity is approached. These samples shall be analyzed as specified in 4.5.7.3. The analyses shall verify that all the samples comply with the performance specified in 4.5.7.2.

4.5.9.1 Automatic purifier shoot cycle solids rejection test. The first article sample unit of automatic purifiers shall operate for 2,000 hours under the conditions specified in 4.5.4 without requiring manual cleaning.

4.5.10 Vibration test. The sample unit shall be subjected to the type I and II environmental and mechanical vibration requirements of MIL-STD-167-1. The frequency range for type I vibration shall be as specified (see 6.2).

4.5.11 Noise test. The purifier shall be noise tested as follows.

4.5.11.1 Airborne noise test. The sample purifier shall be tested in accordance with MIL-STD-1474 and shall meet the performance requirements specified in 3.4.6.

4.5.11.2 Structureborne noise test. When specified (see 6.2), every completely assembled purifier shall be tested in accordance with MIL-STD-1474 and shall meet the performance requirements specified in 3.4.6.

4.5.12 Shock tests. The sample unit shall be subjected to the high-impact, grade A, type A shock test specified in MIL-DTL-901. The test shall be class I or class II in accordance with MIL-DTL-901 as specified (see 6.2 and 3.4.4).

4.5.12.2 Shock testing with drivers. Unless otherwise specified (see 6.2), the test purifiers shall be shock tested with drivers. Purifiers shock tested with one driver will not be required to be shock tested again when supplied with a different shock qualified driver. Drivers are subject to shock tests in accordance with the applicable equipment specifications.

4.5.12.3 Failure criteria.

a. Breakage of any part, including mounting bolts.

b. Appreciable distortion or dislocation of any part, such as a shaft, mounting feet, bearing (except for anti-friction bearing brinelling), or other part that would render the unit unusable in an emergency.

c. A mechanical imbalance of more than two times the amplitude of balance measured prior to test at rated speed.

d. The purifier cannot be restarted or does not exhibit acceptable performance as specified in 4.5.4.

4.5.13 Electromagnetic interference. The purifier shall be tested as specified in MIL-STD-461 to determine conformance to 3.4.7.

4.6 Cybersecurity. Any cybersecurity measures required herein (see 3.3.30) shall be verified as required by MIL-DTL-32613. Additional cybersecurity verifications may be specified (see 6.2).

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. Purifiers covered by this specification are intended for use onboard Naval ships for the removal of water and solids from fuel and lube oil.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. When first article is required (see 3.1).

c. Purifier capacity and principal operating fluid (see 3.3 and 3.4.1).

d. Whether automatic, semi-automatic, or manual purifier (see 3.3.1).

e. Full discharge bowl or partial discharge bowl (see 3.3.1.2.g and 3.3.1.3.g)

f. Dimensional requirements of the purifier and its maintenance envelope, if required (see 3.3.1.4).

g. When resilient mounts are required (see 3.3.2.1).

h. Flange size, rating, specification, and surface finish for piping connections (see 3.3.7).

i. Ship applicability (surface ship or submarine) (see 3.3.7).

j. API gravity requirements (see 3.3.8.2).

k. Sequence and valve control actuation, if not electrical (see 3.3.13).

l. Purifier pump requirement and type (see 3.3.26).

m. When common pump drive is required (see 3.3.26).

n. When oil heaters are required (see 3.3.27).

o. Motors (see 3.3.28).

(1) Voltage.

(2) Low noise application.

(3) Type (AC, DC) (see 3.3.28.1).

p. Controllers (see 3.3.29).

(1) Voltage.

(2) Low noise application.

q. When the procedures to restore the controller and its associated sensors are to be documented and provided to NAVSEA (see 3.3.30).

r. Skid mounting requirements (see 3.3.34).

s. Shock requirements (see 3.4.4, 4.5.1, and 4.5.12.2).

t. FMECA requirements (see 3.6.1.2).

u. Special tools (see 3.9).

v. AQL of 1.0 (see 4.2.1).

w. Capacity test fluid (see 4.5.4).

x. Surplus capacity test fluid (see 4.5.3.1).

y. Reliability test fluid (see 4.5.4).

z. Frequency range for vibration testing (see 4.5.10).

aa. Noise requirements (see 4.5.11.2).

bb. Shock tests (see 4.5.1 and 4.5.12.2).

cc. Additional cybersecurity verifications, if required (see 4.6).

dd. Packaging requirements (see 5.1).

6.3 Recommended documentation. The following list of documentation is recommended to be requested as part of the acquisition of any pump unit(s) under this specification:

a. Engineering drawings.

b. Materials listing.

c. Pump curves.

d. Installation drawings.

e. Technical manual.

f. Test reports.

g. Certifications.

h. Onboard repair parts list.

i. Alignment procedures.

j. Technical repair standard (TRS).

6.4 Failure mode effects and criticality analysis (FMECA). The analysis should include analyses of possible failure modes, their frequency, causes and effects, and precautionary measures to eliminate or minimize the failure modes. The depth of the FMECA should include all equipment, assemblies, subassemblies, and components whose failure would cause the purifier to fail to meet the requirements herein.

6.5 Special tools. One set of special tools as defined in 3.9 should be acquired for each ship's compartment in which purifiers are installed. The number of sets required should be established by the acquisition activity.

6.6 Supersession data. For new design, this specification supersedes MIL-P-20632B, dated 20 April 1992; MIL-P-22088B, dated 15 April 1993; and MIL-P-24710A, dated 17 June 1993. Existing purifier models in use, which are those that comply with the inactive-for-new design specifications MIL-P-22088 (model JF-3), MIL-P-20632 (models B and C), or MIL-P-24710 (models SC-1 and SC-3) may be replaced in kind with the same model, citing the relevant inactive specification. Current stock of these purifiers may be used until depleted; future requisitions for purifiers should refer to the current version of this specification. Table VII summarizes the capacities of those existing purifiers.

TABLE VII. Existing purifiers.

Purifier standard designation	**Turbine fuel, aviation grade JP-5, MIL-DTL-5624 at 60 °F (15 °C)**	**Naval distillate fuel F-76, MIL-DTL-16884 at 70 °F (21 °C)**	**Turbine lube oil 2190 TEP, MIL-PRF-17331, at 160 °F (71 °C)**	**Diesel lube oil 9250 (SAE 40), MIL-PRF-9000 at 175 °F (79 °C)**
B	1/	250 (946)	225 (852)	75 (284)
C	2/	425 (1,608)	350 (1,324)	125 (473)
SC-1	2/	700 (2,650)	500 (1,892)	166 (628)
SC-3	2/	6,600 (24,960)	5,880 (22,260)	1,920 (7,260)
JF-3	18,000 (68,160)	2/	2/	2/

NOTES:
1/ Capacity in gallons per hour (liters per hour) of principal operating fluid as specified (see 6.2)
2/ No capacity specified, but possesses capability of purifying all oils in this table.

6.7 Subject term (key word) listing.

Bearings
Brakes
Frames
Mounts
Ports, observation
Process fluid
Sight glass
Spindle

CONCLUDING MATERIAL

Custodians:
Army – AV
Navy – SH

Review activities:
Army – MI
Navy – AS
DLA – CC

Civil agency:
GSA – FAS

Preparing activity:
Navy – SH
(Project 4330-2018-005)

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.