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An American National Standard

Standard Specification for Shipboard Oil Pollution Abatement System[1]

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1. Scope

1.1 This specification covers a shipboard oil pollution abatement system (OPAS) that processes oily waste and allows selective suction from all oily waste holding tanks, waste oil, dirty oil, and drain tanks and the bilges of all oily water generating spaces for operation within the U.S. Contiguous Zone as excepted by local regulatory authorities.

1.1.1 This specification covers the system from the point of entering the system until the oil-water mixture is treated and discharged overboard.

1.1.2 This includes minimizing oily waste generation, the oily waste holding tank, the oil-water separation device, the control system, feed and recirculation pump(s), a secondary treatment device, and an automatic stopping device capable of detecting 15 ppm oil in the waste stream.

1.1.3 Fig. 1 provides a general system schematic to utilize for system configuration.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A307 Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A312/A312M Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A530/A530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe
A563 Specification for Carbon and Alloy Steel Nuts
A999/A999M Specification for General Requirements for Alloy and Stainless Steel Pipe
B165 Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube
F467 Specification for Nonferrous Nuts for General Use
F468 Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
F708 Practice for Design and Installation of Rigid Pipe Hangers
F992 Specification for Valve Label Plates
F993 Specification for Valve Locking Devices
F998 Specification for Centrifugal Pump, Shipboard Use
F1030 Practice for Selection of Valve Operators
F1098 Specification for Envelope Dimensions for Butterfly Valves—NPS 2 to 24
F1122 Specification for Quick Disconnect Couplings (6 in. NPS and Smaller)
F1155 Practice for Selection and Application of Piping System Materials
F1166 Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities
F1298 Specification for Flexible, Expansion-Type Ball Joints for Marine Applications
F1323 Specification for Shipboard Incinerators
F1337 Practice for Human Systems Integration Program Requirements for Ships and Marine Systems, Equipment, and Facilities
F1510 Specification for Rotary Positive Displacement Pumps, Ships Use
F1511 Specification for Mechanical Seals for Shipboard Pump Applications
F2044 Specification for Liquid Level Indicating Equipment, Electrical

2.2 *ANSI Standards:*[3]

B16.1 Cast Iron Pipe Flanges and Flange Fittings
B16.5 Steel Pipe Flanges, Flanged Valves and Fittings 150, 300, 400, 600, 900, 1500 and 2500 lb
B16.11 Forged Steel Fittings, Socket Welding and Threaded
B16.24 Bronze Flanges and Flanged Fittings 150, 300 lb

2.3 *Code of Federal Regulations:*[4]

33 CFR Part 155 Department of Homeland Security, U.S. Coast Guard (USCG), Oil or Hazardous Material Pollution Prevention Regulations for Vessels
40 CFR Part 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants

[1] This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.06 on Marine Environmental Protection.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

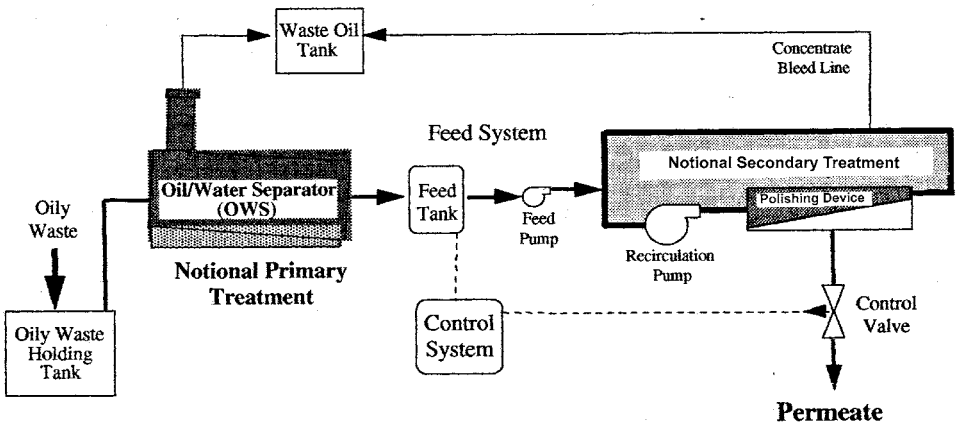

FIG. 1 Notional Shipboard Oil Pollution Abatement

46 CFR Part 162 Department of Homeland Security, U.S. Coast Guard (USCG), Engineering Equipment

46 CFR Part 147 Department of Homeland Security, U.S. Coast Guard (USCG), Hazardous Ships' Stores

40 CFR Part 171 Department of Transportation (DoT), Research and Special Programs Administration (RSPA), General Information, Regulations and Definitions

2.4 *Other Documents:*

64 Federal Register Number 173, 8 September 1999 Contiguous Zone Proclamation ANSI/NFPA No. 70 National Electrical Code[5]

IEEE 45-2002 Recommended Practice for Electric Installations on Shipboard International Convention for the Preventing of Pollution from Ships (1973), as modified by the Protocols of 1978 (MARPOL 73/78) and 1997 and associated Annexes, including Annex I and Annex VI[6]

Resolution MEPC.107(49) Revised Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships[7]

Public Law 92-500 Federal Water Pollution Control Act, October 18, 1972, as amended by Public Law 95-217, Clean Water Act, December 27, 1977, as amended Underwriters Laboratories Standard 913 (as revised April 8, 1976)[5]

UL Standard 913 Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations[8]

ISO 9377–2:2000 Water Quality—Determination of Hydrocarbon Oil Index—Part 2: Method Using Solvent Extraction and Gas Chromatography[9]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *15 ppm separation device*—a separation device that is designed to remove enough oil from an oil-water mixture to provide a resulting mixture that has an oil concentration of 15 ppm or less.

3.1.2 *automatic stopping device*—a device that automatically stops any discharge overboard of oily mixture when the oil content of the effluent exceeds 15 ppm.

3.1.3 *bilge alarm*—an instrument that is designed to measure the oil content of oily mixtures from machinery space bilges and fuel oil tanks that carry ballast and activate an alarm at a set concentration limit.

3.1.4 *bilge monitor*—an instrument that is designed to measure and record the oil content of oily mixtures from machinery space bilges and fuel oil tanks that carry ballast.

3.1.5 *cargo monitor*—an instrument that is designed to measure and record the oil content of cargo residues from cargo tanks and oily mixtures combined with these residues.

3.1.6 *contiguous zone*—the entire zone established by the United States under Contiguous Zone Proclamation.

64 Fed. Reg 173

3.1.7 *discharge*—includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping.

3.1.8 *hazardous materials*—any material or combination of material that poses a substantial danger to human beings, plants, animals and the marine environment. A material is hazardous if it possesses one or more of the following characteristics: ignitability, corrosivity, reactivity, toxicity, and radioactivity.

3.1.9 *independent laboratory*—a laboratory that is not owned or controlled by a manufacturer, supplier, or vendor of separators, monitors, or bilge alarms.

3.1.10 *oil*—oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged soil.

3.1.11 *oil content monitor*—instruments that are designed to measure the oil content of the oil-water separator effluent

[5] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

[6] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331

[7] Available from International Maritime Organization (IMO), Marine Environmental Protection Committee (MEPC), 4 Albert Embankment, London, SE1 7SR, U.K.

[8] Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

[9] Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland.

discharge and that automatically diverts any discharge of oily mixture when the oil content of the effluent exceeds 15 ppm.

3.1.12 *oil-water separation device*—may include any combination of a separator, filter, coalescer or other means, and also a single unit designed to produce an effluent with oil content not exceeding 15 ppm.

3.1.13 *ppm*—parts of oil per million parts of water by volume.

3.1.14 *public vessel*—a vessel owned or bareboat chartered and operated by the United States, or by a State or political subdivision thereof, or by a foreign nation, except when the vessel is engaged in commerce.

3.1.15 *remove or removal*—refers to containment and removal of the oil from the water and shorelines or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches.

3.1.16 *synthetic oil*—oils that are not petroleum based, but chemical based, do not rise to the surface of water and are as heavy or heavier than water.

3.1.17 *United States*—the States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands.

3.1.18 *vessel*—every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel.

4. Ordering Information

4.1 Orders shall include the following information:

4.1.1 Sizing requirements.

4.1.2 Processing rate requirements.

4.1.3 Additional control requirements.

4.1.4 Any additional requirements required by the purchaser to meet special needs.

5. Materials and Manufacture

5.1 *Bilge Management:*

5.1.1 Design machinery spaces to be as dry as practical and provide means, such as piping insulation and other condensation containment features. Use drip pans and other oil containment devices to minimize contamination of bilge water.

5.1.2 Means, based upon unique ship/machinery design, shall be provided to prevent the introduction of synthetic oils and emulsifying agents into bilge water or the ship's OPAS. Synthetic oils have specific gravity very close to 1.0, therefore compounding the complexity of the oil/water separation problem. Means might include:

5.1.2.1 Dedicated drain lines piped from drip pans under machinery using synthetic oils to a waste synthetic oils storage device.

5.1.2.2 Others as specified by the OPAS/ship designer that meet the prohibition on introduction of synthetics into the ships bilge water and/or OPAS.

5.2 *Oil Pollution Abatement System—General:*

5.2.1 The goal of the OPAS is to reduce the volume of oil-contaminated water that must be held onboard the ship in dedicated waste oil or sludge tanks. This is accomplished by processing oily waste water through oil-water separator equipment to produce OPAS permeate meeting regulatory limits that can be discharged overboard.

5.2.2 The system shall not utilize dilution as a means of obtaining pollution discharge limits.

5.2.3 From Resolution MEPC.017(49): The OPAS must be capable of handling any oily mixtures from the machinery space bilges and be expected to be effective over the complete range of oils which might be carried on board ship, and deal satisfactorily with oil of very high relative density, or with a mixture presented to it as an emulsion. Cleansing agents, emulsifiers, solvents, or surfactants used for cleaning purposes may cause the bilge water to emulsify. Proper measures should be taken to minimize the presense of these substances in the bilges of a ship. With the possibility of emulsified bilge water always present, the oil-water separator must be capable of separating the oil from the emulsion to produce an effluent with an oil content not exceeding 15 ppm.

5.2.4 All OPAS components shall minimize the effort required for their draining, accessing, cleaning, maintenance, and preservation.

5.2.5 The OPAS system shall operate as specified herein within relative humidity limits of 5 to 95 %.

5.2.6 The OPAS equipment shall not be damaged nor shall subsequent operational performance be degraded as a result of exposure to salt fog.

5.2.7 When in a non-operating state, the OPAS shall not be damaged nor shall subsequent operational performance be degraded as a result of all external components being subjected to seawater spray.

5.2.8 The OPAS shall minimize turbulent fluid flow, oil and water mixing and emulsification, and oil droplet size reduction.

5.2.9 The oily waste holding tank shall be designed as a baffled settling tank, allowing bilge water to separate into oil and water with means provided to pump bulk oil to the waste oil tank.

5.2.10 Effluent exceeding the oil content limit shall be recirculated to the oil-water separator by means other than centrifugal pumps per 5.2.17.1. A dedicated waste oil pump shall be provided for handling of waste oil and transfer of waste oil to shore or the ship's incinerator (if provided).

5.2.11 If waste oil is to be held on board rather than being destroyed, the waste oil tank(s) shall satisfy the requirement for sludge tanks given in MARPOL 73/78 Annex 1, Regulation 17, Unified Interpretation 8.1.

5.2.11.1 For vessels less than 400 GT, oily waste shall be permitted to be stored in the bilge.

5.2.12 Waste oil incinerators, if provided, shall meet Specification F1323.

5.2.13 The oil-water separator shall operate manually and automatically based on float switches in the oily waste holding tank(s).

5.2.14 The OPAS shall be automated to take suction from oily water generating spaces by means of level switches.

5.2.15 An oil-water separator shall be provided and shall be sized to process the oily water at a rate equal to the daily generation of oily water.

5.2.16 An automatic stopping device shall be fitted downstream of the oil-water separator to monitor oil-water separator effluent.

5.2.17 Suction from spaces that generate oily water shall be by means of a dedicated oily waste transfer pump(s).

5.2.17.1 OPAS pumps shall impart low shear force into the bilge water in all suction lines before the oil-water separation device, including oily waste holding tank, therefore centrifugal pumps shall not be used for this purpose.

5.2.17.2 For vessels greater than 400 GT, OPAS design shall collect oily water in a dedicated oily waste holding tank sized to hold seven days of oily water production during normal routine operations.

5.2.18 Water and contaminants shall be directed to the OPAS.

5.2.18.1 The cargo fuel slop tank shall have a connection to the OPAS.

5.2.18.2 Materials used to fabricate the structure, systems, and equipment shall have material properties and behavior suitable for the manufacturing and installation processes selected, in-service environment, and function performed.

5.2.18.3 Selected materials shall support the ship's required service life without degrading the performance of ship structure, systems, and equipment during the specified ship operational profiles.

5.2.19 System components, such as valves, fittings, pumps, and motors, shall be standard items, such as those complying with Practice F1030 and Specifications F992, F993, F998, F1098, F1122, F1298, F1510, or F1511 that are easy to maintain and replace.

5.2.19.1 Fasteners shall meet Specifications A307, A563, F467, or F468.

5.2.19.2 System components shall be in accordance with ANSI B16.1, B16.5, B16.11, or B16.24.

5.2.20 OPAS shall be designed and constructed with corrosion resistant materials having the longest life for valves, fittings, and piping materials given the expected operating environment.

5.2.20.1 Direct contact of electrolytically dissimilar metals is prohibited unless electrolytic corrosion precautions are used. OPAS design must be of compatible materials and components.

5.2.21 All equipment and systems shall minimize the production and use of hazardous materials during their manufacture and life cycle.

5.2.21.1 Alternatives to hazardous materials shall be used where practicable.

5.2.21.2 Coatings or paints shall not contain any heavy metals, such as, chromium, lead, tin or other materials banned by regulatory authorities.

5.2.21.3 Asbestos, mercury, cadmium, and polychlorinated biphenyls (PCBs), shall not be used in the construction of the OPAS or any subsystem.

5.2.22 The OPAS shall remain safe while secured or during operation.

5.2.23 To ensure crew safety, overflow alarms and monitors shall be installed in all operating spaces.

5.2.24 A stowage locker for an oil spill response kit shall be provided and be located convenient to locations of potential oil spill areas.

5.2.25 The OPAS shall be capable of intermittent operation of relatively short time intervals and shall be capable of being secured for long periods without disrupting the treatment system's efficiency and ability to activate.

5.2.26 *Electrical System:*

5.2.26.1 The power supply to the electrical control system shall be from a two-wire branch circuit that has a grounded conductor, otherwise, an isolation transformer with a two-wire secondary shall be provided. When an isolation transformer is provided, one side of the secondary winding shall be grounded.

5.2.26.2 One side of all coils shall be electrically located in the grounded side of the circuit. All switches, contacts, and overcurrent devices shall be electrically located in the ungrounded or "hot" side of the circuit. All electrical contacts of every safety device installed in the same control circuit shall be electrically connected in series. However, special consideration shall be given to arrangements when certain devices are wired in parallel.

5.2.26.3 All electrical components and devices shall have a voltage rating commensurate with the supply voltage of the control system.

5.2.26.4 All electrical devices shall be at least NEMA Type 2 (Driptight). Electric equipment exposed to the weather shall be at least NEMA Type 4.

5.2.26.5 All electrical and mechanical control devices shall be of a type tested and accepted by a nationally recognized testing agency for service in a shipboard environment.

5.2.26.6 The design of the control circuits shall be such that limit and primary safety controls shall directly open a circuit that functions to interrupt the supply of fuel to combustion units.

5.2.26.7 Electrical systems shall comply with IEEE 45-2002 including the use of low smoke cables. The electrical systems shall be designed to minimize radiated and conducted electrical emissions and shall not be susceptible to electrical fields.

5.2.26.8 The OPAS and associated control systems shall be impervious to electro magnetic interference (EMI) effects, nor cause degradation of other systems.

5.2.26.9 Electrical power required for OPAS components shall be consistent with the ship's electrical power distribution system.

5.2.26.10 Lighting and electronics power will be 115V -60Hz, 3-phase, 2-wire ungrounded. Supplied power will be in accordance with IEEE 45-2002.

5.2.27 *Electrical Controls and Conductors:*

5.2.27.1 All wiring shall be rated for the maximum operating temperature to which it has the potential to be exposed. Such wiring shall be in accordance with National Electrical Code, NFPA No. 70. All wiring between components shall have copper conductors not less than size No. 18 AWG and constructed in accordance with the National Electrical Code, NFPA No. 70.