INCH-POUND
MIL-DTL-24800
30 September 1996

DETAIL SPECIFICATION

CLEANING COMPOUND - AQUEOUS - OXYGEN SYSTEMS COMPONENTS

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for an aqueous, inorganic cleaning compound to be used in immersion, ultrasonic, spray, and pumped cleaning of oxygen system piping and components.

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 documented 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03R42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6850

SPECIFICATIONS

FEDERAL

A-A-50433	- Grease, Sea Water Wash Resistant.
QQ-A-250	- Aluminum and Aluminum Alloy Plate and Sheet: General Specification for.
QQ-A-250/4	- Aluminum Alloy 2024, Plate and Sheet.
QQ-B-654	- Brazing Alloys, Silver.
QQ-N-281	- Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections.
QQ-N-286	- Nickel-Copper-Aluminum Alloy, Wrought, (UNS NO5500).
QQ-S-763	- Steel Bars, Wire, Shapes, and Forgings, Corrosion Resisting.
WW-T-700	- Tube, Aluminum and Aluminum Alloy, Drawn, Seamless, 5052, General Specification for.

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MIL-T-1368	- Tube and Pipe, Nickel-Copper Alloy, Seamless and Welded.
MIL-P-5425	- Plastic Sheet, Acrylic, Heat Resistant.
MIL-P-5510	- Packing, Preformed, Straight Thread Tube Fitting Boss, Type I Hydraulic (-65° to 160°F).
MIL-P-5516	- Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 160°F.
MIL-H-5606	- Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance.
MIL-R-6855	- Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for.
MIL-M-7866	- Molybdenum Disulfide, Technical, Lubrication Grade.
MIL-A-8625	- Anodic Coatings For Aluminum and Aluminum Alloys.
MIL-S-8660	- Silicone Compound, NATO Code Number S-736.
MIL-L-9000	- Lubricating Oil, Shipboard Internal Combustion Engine, High Output Diesel.
MIL-C-15726	- Copper-Nickel Alloy, Sheet, Plate, Strip, Bar, Rod and Wire.
MIL-S-16216	- Steel Plate, Alloy, Structural, High Yield Strength (HY-80 and HY-100).
MIL-T-16420	- Tube, Copper-Nickel Alloy, Seamless and Welded (Copper Alloy Numbers 715 and 706).
MIL-L-17331	- Lubricating Oil, Steam Turbine and Gear, Moderate Service.
MIL-H-17672	- Hydraulic Fluid, Petroleum, Inhibited.
MIL-S-21923	- Synthetic Rubber Compound, Butadiene-Styrene Type, Ozone Resistant, for Low Temperature Service.
MIL-G-22050	- Gasket and Packing Material, Rubber, for Use With Polar Fluids, Steam, and Air at Moderately High Temperatures.
MIL-F-22606	- Flask Compressed Gas and End Plugs for Air, Oxygen and Nitrogen.
MIL-S-22698	- Steel Plate, Shapes and Bars, Weldable Ordinary Strength and Higher Strength: Structural.
MIL-S-23008	- Steel Castings, Alloy, High Yield Strength (HY-80 and HY-100).
MIL-T-24107	- Tube, Copper (Seamless), Copper Alloy Numbers C10100, C10200, C10300, C10800, C12000, C12200, and C14200).
MIL-G-24139	- Grease, Multipurpose, Water Resistant.
DOD-G-24508	- Grease, High Performance, Multipurpose. (Metric)
DOD-L-24574	- Lubricating Fluid for Low and High Pressure Oxidizing Gas Systems.
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.

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MIL-P-25732 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275°F (135°C).
MIL-G-27617 - Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant.
MIL-R-81828 - Rubber, Chlorosulfonated Polyethylene Elastomer, Sheet and Molded Shapes, Ozone Resistant.
MIL-R-83248 - Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant.
MIL-R-83285 - Rubber, Ethylene-Propylene, General Purpose.
MIL-P-83461 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275°F (135°C).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-1330 - Cleaning and Testing of Shipboard Oxygen, Nitrogen and Hydrogen Gas Piping Systems.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

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 are those cited in the solicitation.

DEPARTMENT OF DEFENSE

SD-14 - Listing of Toxic Chemicals, Hazardous Substances, and Ozone-Depleting Chemicals.

(Application for copies should be addressed to Office of the Assistant Secretary of Defense for Economic Security, Standardization Program Division, 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA-WSTF-TP-629 - Test Protocol and Quality Assurance Program for the Navy Submarine Atmosphere Material Control Program.

(Application for copies should be addressed to the Lyndon B. Johnson Space Center, White Sands Test Facility, Las Cruces, NM 88004.)

NAVY ENVIRONMENTAL HEALTH CENTER (NEHC)

NEHC-TM-M92-2 - Reproductive Hazards in the Workplace: A Guide for Occupational Health Professionals.

(Application for copies should be addressed to the Navy Environmental Health Center, 2510 Walmer Ave, Norfolk, VA 23513.)

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA-600-4-90-027 - Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms.
EPA-Method-1664 - N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons).

(Application for copies should be addressed to the Water Resource Center, Mail Code RC-4100, 401 M Street, SW, Washington, DC 20460.)

2.3 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 148 - Standard Specification for Aluminum-Bronze Sand Castings. (DoD adopted)
ASTM B 150 - Standard Specification for Aluminum Bronze, Rod, Bar, and Shapes. (DoD adopted)
ASTM B 167 - Standard Specification for Nickel-Chromium-Iron Alloys (UNS NO6600, NO6601, NO06690, N06025, and N06045) Seamless Pipe and Tube. (DoD adopted)
ASTM B 171 - Standard Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers.
ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy, Sheet and Plate. (DoD adopted)
ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes. (DoD adopted)
ASTM B 265 - Standard Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate. (DoD adopted)
ASTM B 337 - Standard Specification for Seamless and Welded Titanium and Titanium Alloy Pipe. (DoD adopted)
ASTM B 446 - Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS NO6625) Rod and Bar.
ASTM D 471 - Standard Test Method for Rubber Property - Effects of Liquids. (DoD adopted)
ASTM D 501 - Standard Test Methods of Sampling and Chemical Analysis of Alkaline Detergents. (DoD adopted)
ASTM D 512 - Standard Test Methods for Chloride Ion in Water. (DoD adopted)
ASTM D 543 - Standard Test Method for Resistance of Plastics to Chemical Reagents.
ASTM D 1193 - Standard Specification for Reagent Water. (DoD adopted)
ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
ASTM D 1280 - Standard Test Method of Total Immersion Corrosion Test for Soak Tank Metal Cleaners.
ASTM D 1292 - Standard Test Method for Odor in Water.
ASTM D 1331 - Standard Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents.
ASTM D 1457 - Standard Specification for Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials. (DoD adopted)
ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds. (DoD adopted)
ASTM D 2116 - Standard Specification for FEP-Fluorocarbon Molding and Extrusion Materials. (DoD adopted)
ASTM D 2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds. (DoD adopted)
ASTM D 2512 - Standard Test Method for Compatibility of Materials with Liquid Oxygen (Impact Sensitivity Threshold and Pass-Fail Techniques).
ASTM D 2579 - Standard Test Method for Total Organic Carbon in Water. (DoD adopted)
ASTM D 3921 - Standard Test Method for Oil and Grease and Petroleum Hydrocarbons in Water.
ASTM D 3935 - Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material.

ASTM's (Continued)

ASTM D 4052 - Density and Relative Density of Liquids by Digital Density Meter.
ASTM D 4066 - Standard Specification for Nylon Injection and Extrusion Materials (PA). (DoD adopted)
ASTM D 4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials. (DoD adopted)
ASTM D 4181 - Standard Specification for Acetal (POM) Molding and Extrusion Materials. (DoD adopted)
ASTM D 4281 - Standard Test Method for Oil and Grease (Fluorocarbon Extractable Substances) by Gravimetric Determination.
ASTM D 4779 - Standard Test Method for Total, Organic, and Inorganic Carbon in High Purity Water by Ultraviolet (UV) or Persulfate Oxidation, or Both, and Infrared Detection.
ASTM E 70 - Standard Test Method for pH of Aqueous Solutions With the Glass Electrode. (DoD adopted)
ASTM F 483 - Standard Test Method for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals.
ASTM F 1104 - Standard Test Method for Preparing Aircraft Cleaning Compounds, Liquid Type, Water Base, For Storage Stability Testing.
ASTM G 72 - Standard Test Method for Autogenous Ignition Temperature of Liquids and Solids in a High-Pressure Oxygen-Enriched Environment.

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this document takes precedence. Nothing in the specification, however, shall supersede 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 inspections in accordance with 4.3.

3.2 Composition. The cleaning compound shall be an aqueous, inorganic solution meeting the performance characteristics of 3.4. The cleaning composition shall not intentionally contain carbon-hydrogen bonded material, or material that is not completely soluble. Examples of prohibited material include polar organic surface active agents, polar solvents, or dispersable fluorocarbon surface active agents. If any of these prohibited materials are present as a result of being a trace impurity in another ingredient(s), the concentration shall not exceed the limits specified in 3.4.3.

3.3 Navy oxygen cleaner (NOC).

3.3.1 NOC composition. The NOC composition shown in table I meets the performance characteristics of 3.4 when manufactured as specified in 3.3.2 and packaged as specified in 5.1.

3.3.2 NOC manufacture. Unless otherwise approved by the preparing activity, NOC shall be blended in welded stainless steel tanks; piping and components shall be stainless steel; hoses shall be Teflon lined; and gaskets shall be Viton or Teflon. The cleaning compound shall be filtered through a 0.1 micron membrane filter. Filters shall be constructed of stainless steel, Teflon, polysulfone, or polyethylene, and shall contain no plasticizer, adhesive or other extractable material. Production of the cleaning compound shall utilize dedicated equipment which shall not be used for any other purpose. A recirculating pump, or other method approved by the preparing activity, shall be used to ensure complete blending of the cleaning compound. The minimum blending time when recirculating NOC through a pump shall be determined as follows:

Minimum blending time = (0.693/W)(V)(5)

where: W = pump flow rate in gallons per minute
V = batch tank volume in gallons

3.3.3 NOC raw materials. Raw materials used for the NOC composition cleaning compound shall meet the requirements shown in table II when tested as specified in table X.

3.3.4 NOC in-process requirements. In-process verification of the NOC composition cleaning compound shall meet the requirements shown in table III when tested as specified in table XI. Adjustments to meet the requirements of table III shall only be accomplished with raw materials meeting the requirements of 3.3.3.

3.3.5 NOC end item requirements. End item verification of the NOC composition cleaning compound shall meet the requirements shown in table IV when tested as specified in table XII.

TABLE I. Nominal NOC composition.

Component 1/	Percent by weight
Polysilicate solution	25.0
Water	73.0
Sodium molybdate dihydrate	0.5
Fluoboric acid 2/	1.5

1/ Components shall be added in the order listed.
2/ Fluoboric acid shall be added to the batch diluted at least least 5:1 with water at a rate not greater than 2 gallons per minute. The batch shall be recirculated while the fluoboric acid is being added.

TABLE II. NOC raw material requirements.

Component	Property	Requirement
Polysilicate	Appearance	Clear and colorless
	Insoluble Matter (wt %, max)	0.1
	SiO_2/Na_2O weight ratio	1.80 to 2.00
	Total silica (wt % SiO_2)	24.1 to 27.0
	Total alkalinity (wt % Na_2O)	13.4 to 14.2
	Specific gravity (°BE)	44.1 to 45.1
Water	Reagent grade water	ASTM D 1193 Type II
	Chlorides (ppm, max)	<2.0
	Total organic carbon (mg/L, max)	1.0
Sodium molybdate dihydrate	Assay (wt %)	99.5 to 103.0
	pH of 5 wt % solution	7 to 10
	Insoluble matter (wt %, max)	0.005
Fluoboric acid	Assay (wt %)	48 to 52
	Boric acid content (wt %, max)	2.0
	Specific gravity at 25°C (min)	1.365

TABLE III. NOC in-process requirements.

Property	Requirement
Polysilicate anion concentration (% by weight)	9.3 to 10.3
Fluoboric acid concentration (% by weight)	1.5 ± 0.15
Sodium molybdate dihydrate concentration (% by weight)	0.5 ± 0.05
Chlorides (ppm, max)	3.4.12
pH	11.90 to 11.99
Total alkalinity (mL NOC, max)	15.0
Insoluble matter (mg/L, max)	3.4.13
Non-volatile residue by filtration (mg/L, max)	3.4.9
Surface tension (dynes/cm^2)	50 to 60
Specific gravity (25/20°C)	1.090 to 1.1055
Odor	3.4.14
Foam	3.4.7
Appearance	3.4.15

TABLE IV. NOC end item requirements.

Property	Requirement
pH	11.90 to 11.99
Total alkalinity (mL NOC, max)	15.0
Non-volatile residue by filtration (mg/L, max)	3.4.9
Odor	3.4.14
Foam	3.4.7
Appearance	3.4.15

3.4 Performance characteristics.

3.4.1 Cleaning efficiency. Cleaning efficiency shall be determined by the ability of the cleaning compound to remove each of the materials (soils) specified in table V through precision ultrasonic, high soil loading and pipe cleaning as specified below.

3.4.1.1 Precision ultrasonic cleaning. The cleaning compound shall remove not less than the percentage specified in table V of the soil weight deposited on each test coupon when tested as specified in 4.6.1.

3.4.1.2 High soil loaded ultrasonic cleaning. The cleaning compound shall remove not less than the percentage by weight specified in table V of the soil deposited on each test coupon when tested as specified in 4.6.1.

3.4.1.3 Pipe cleaning. The cleaning compound shall remove not less than the percentage by weight specified in table V of the soil deposited on each test coupon when tested as specified in 4.6.2.

TABLE V. Cleaning efficiency.

Soil	Specification	Cleaning efficiency (% removal by weight)		
		Precision cleaning 3.4.1.1	High soil loading 3.4.1.2	Pipe cleaning 3.4.1.3
Lubricating oil	MIL-L-9000 & MIL-L-17331	99.0	98.0	99.0
Hydraulic oil	MIL-H-5606 & MIL-H-17672	99.0	98.0	99.0
Waterproof grease	A-A-50433	99.0	95.0	99.0
Waterproof grease	MIL-G-24139 & DOD-G-24508	99.0	75.0	35.0
CTFE fluorinated oil	Commercial	99.0	98.0	99.0
CTFE fluorinated grease with silica filler	Commercial	99.0	95.0	90.0
CTFE fluorinated grease with halocarbon filler	Commercial	99.0	80.0	45.0
PFPE fluorinated oil	DOD-L-24574	99.0	98.0	99.0
PFPE fluorinated grease	MIL-G-27617, Type III	99.0	50.0	95.0
Molycote	MIL-M-7866	99.0	-	99.0
Silicone oil, 30K cp	Commercial	99.0	95.0	99.0
Silicone grease with molycote filler	Commercial	99.0	95.0	99.0
Silicone grease	MIL-S-8660	99.0	45.0	99.0

3.4.2 Flammability. The cleaning compound shall not be ignitable in the presence of a 2000 pounds per square inch gauge (psig) oxygen atmosphere at a temperature of 800 degrees Fahrenheit (°F) [425 degrees Celsius (°C)], when tested in accordance with ASTM G 72. In addition, the cleaning compound shall not react with liquid oxygen when tested in accordance with ASTM D 2512.

3.4.3 Toxicity.

3.4.3.1 Prohibited material. The cleaning compound shall not contain any of the following material. If any of these prohibited materials are present as a result of being a trace impurity in another ingredient(s), the concentration shall not exceed the limits specified in 3.4.3.2.

(a) Toxic chemicals, hazardous substances, ozone depleting chemicals, or volatile organic compounds identified in Defense Standardization Program Manual SD-14.
(b) Known carcinogenic or potentially carcinogenic materials identified by the Occupational Safety and Health Administration (OSHA) as regulated carcinogens, or International Agency for Research on Cancer (IARC) latest monographs, or the latest annual report of the National Toxicology Program (NTP).
(c) Navy occupational chemical reproductive hazards identified in Navy Environmental Health Center (NEHC) technical manual NEHC-TM-M92-2.

3.4.3.2 Off-gassing limits. When tested in accordance with NASA WSTF-TP-629, the cleaning compound shall evolve none of the following:

(a) Detectable halogenated compounds, ammonia, or mercury at 38°C (100°F) and at 82°C (180°F).
(b) Individual hydrocarbon or inorganic compounds greater than 1.0 parts per million (ppm) by volume at 38°C (100°F) and at 82°C (180°F).
(c) Total hydrocarbon (as methane) greater than 5.0 ppm by volume at 38°C (100°F).
(d) Total hydrocarbon (as methane) greater than 10.0 ppm by volume at 82°C (180°F).

3.4.3.3 Effluent toxicity limit. The cleaning compound shall not exhibit a TLm_{96} aquatic LC_{50} less than 5000 ppm, when tested for effect on flathead minnows (Pimephales promelas) in accordance with EPA-600-4-90-027.

3.4.3.4 Medical review. The cleaning compound, the cleaning compound composition, the results of the NASA TP-WSTF-629 at 38°C (100°F) and at 82°C (180°F), the effluent toxicity results, and the product material safety data sheet shall be submitted to the Bureau of Medicine and Surgery (BUMED) and Navy Environmental Health Center (NEHC) for toxicity review. The cleaning compound shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the preparing activity to the appropriate medical service who will act as advisor to the contacting agency.

3.4.4 Corrosivity. The cleaning compound shall cause no weight loss in excess of the limits specified in table VI when tested in accordance with ASTM D 1280 or ASTM F 483, except that immersion shall be for 24 hours at 77 ± 1°C (170 ± 2°F).

3.4.5 Rubber compatibility. The cleaning compound shall cause no change in excess of that shown in table VII when tested in accordance with ASTM D 471, except that immersion shall be for 24 hours at 77 ± 1°C (170 ± 2°F).

3.4.6 Plastic compatibility. The cleaning compound shall cause no change in excess of that shown in table VIII, when tested in accordance with ASTM D 543, except that immersion shall be for 24 hours at 77 ± 1°C (170 ± 2°F).

TABLE VI. Total immersion corrosion limits.

Alloy	Specification	Limit ($mg/cm^2/24hrs$)
Aluminum 5052-0	WW-T-700	0.70
Aluminum 5456	ASTM B 209, HT116	0.10
Aluminum 6061-T6	ASTM B 221	0.04
Aluminum 2024-T3	QQ-A-250 & QQ-A-250/4	0.04
Aluminum 2024-T3 1/	QQ-A-250/4	0.04
Brazing Material BCuP-5	QQ-B-654	0.50
Bronze	CDA922	0.10
Copper C12200-H80	MIL-T-24107	0.60
Copper-Nickel C715-70/30	MIL-T-16420 MIL-C-15726	0.10 0.04
Inconel NO6600	ASTM B 167 CW ASTM B 167 HF	0.10 0.04
Inconel NO6625	ASTM B 446 CR	0.04
Naval Brass 464	ASTM B 171	0.20
Nickel-Aluminum-Bronze C95800	ASTM B 148	0.50
Nickel-aluminum-Bronze C63000-HR50	ASTM B 150	0.04
Nickel-Aluminum-Bronze C64200-HR50	ASTM B 150	0.60
Nickel-Copper	MIL-T-1368 QQ-N-281 CL-A QQ-N-286 Cold Aged	0.50 0.60 0.70
Stainless Steel 304	MIL-P-24691 & MIL-P-24691/3 QQ-S-763 Cold	0.04 0.70
Stainless Steel 316	QQ-S-763 Cold	0.08
Steel ABS Grade EH36	MIL-S-22698	0.08
Steel HY-100	MIL-S-16216 MIL-S-23008	0.04 0.80
Steel 4130	MIL-F-22606	0.04
Titanium, pure	ASTM B 337	0.04
Titanium 6Al-4V	ASTM B 265 GR5	0.04

1/ Sulfuric acid anodized in accordance with MIL-A-8625 and sealed by boiling in demineralized water for 15 minutes.

TABLE VII. Rubber compatibility limits.

Rubber	Specification 1/	Durometer hardness (change in units)	Tensile strength (% change)	Ultimate elongation (% change)	Volume (% change)
Buna-N	MIL-P-5510	6	5	10	1.7
	MIL-P-5516 - Class A	1	10	12	1.3
	MIL-P-5516 - Class B	2	20	20	1.5
	MIL-P-25732	2	20	20	1.5
	MIL-P-83461	2	10	12	0.4
Buna-S	MIL-S-21923	1	12	20	1.2
Polychloroprene	MIL-R-6855	3	5	15	3.0
Hypalon-40	MIL-R-81828	6	15	10	2.5
Ethylene Propylene	MIL-G-22050 - 65DH	4	5	5	0.5
	MIL-G-22050 - 80DH	4	5	5	1.5
	NAS-1613 - 70DH	6	20	12	1.7
	NAS-1613 - 80DH	4	35	12	0.5
	MIL-R-83285 - 60DH	2	15	5	1.2
	MIL-R-83285 - 80DH	1	5	5	1.3
KEL-F	Commercial	3	5	45	0.2
Thiokol FA	Commercial	6	10	20	1.2
Adiprene	Commercial	7	55	85	2.0
Viton	MIL-R-83248 - 75DH	6	15	25	2.3
	MIL-R-83248 - 90DH	4	10	30	0.7
Silicone	Commercial	1	5	55	0.2

1/ DH = Durometer hardness.

3.4.7 Foaming. The cleaning compound shall exhibit no visible foam when tested as specified in 4.6.3.

3.4.8 Oil and grease. The cleaning compound shall contain no more than 1.0 ppm of oil or grease when tested as specified in table IX.

3.4.9 Non-volatile residue. The cleaning compound shall contain no more than 1.0 ppm filterable non-volatile residue when tested as specified in appendix A.

3.4.10 High temperature stability. The compound shall not precipitate, separate or exhibit other non-homogeneities after being held at the manufacturer's recommended maximum operating temperature or 80 ± 1°C (175 ± 2°F), whichever is greater, for 168 hours and allowed to return to standard conditions, when tested as specified in 4.6.4.

3.4.11 Low temperature stability. The compound shall not precipitate, separate or exhibit other non-homogeneities after being held at 2.5 ± 1°C (37 ± 2°F) for 168 hours and allowed to return to standard conditions, when tested as specified in 4.6.5.

3.4.12 Chlorides. The cleaning compound shall have not greater than 2.0 ppm chloride concentration when tested as specified in table IX.

3.4.13 Insoluble matter. The cleaning compound shall contain not greater than 1.0 ppm insoluble matter when tested as specified in 4.6.8.

3.4.14 Odor. The cleaning compound shall have no odor when tested as specified in 4.6.9.

TABLE VIII. Plastic compatibility limits.

Plastic	Specification	Tensile strength (% change)	Weight (% change)
Delrin (polyacetal)	ASTM D 4181	5.0	0.1
Acrylonitrile butadiene styrene (ABS)	Commercial	5.0	1.2
Epoxy, unfilled	Commercial	25	2.2
Fluorinated ethylene propylene (FEP)	ASTM D 2116	5.0	0.1
Surlyn	Commercial	25	1.0
Acrylic	MIL-P-5425 Finish A	25	1.5
Polyamide (Nylon 6,6)	ASTM D 4066	40	6.0
Polycarbonate (Lexan)	ASTM D 3935	5.0	0.3
Polyethylene, HD	ASTM D 1248	6.0	0.1
Polypropylene, unfilled	ASTM D 4101	7.0	0.1
VESPEL (polyimide), graphite filled	Commercial	5.0	0.7
Polytetrafluoroethylene (PTFE)	ASTM D 1457	15	0.1
Polyurethane	Commercial	6.0	2.5
Polyvinyl chloride (PVC) Rigid	ASTM D 1784	5.0	0.5
Polyvinyl chloride (PVC) Non-rigid	ASTM D 2287	10	1.0
Polyetherimide (injection molded)	Commercial	5	1.0
Polyamide-imide (injection molded)	Commercial	10	1.0

3.4.15 Appearance. The cleaning compound shall be a clear, water white liquid free of any oil or solids when tested as specified in 4.6.10.

3.4.16 Extended storage stability. After storage for 1 year as specified in 4.6.11, the cleaning compound shall meet the performance requirements of 3.4.7 through 3.4.15, when tested as specified in table IX.

3.4.17 Service tests. Service tests of production samples shall be initiated upon completion of all laboratory tests at Government field activities to demonstrate the ability of the cleaning composition to clean oxygen piping and components using the aqueous oxygen cleaning process specified in MIL-STD-1330 and other Government approved aqueous oxygen cleaning processes specified by the preparing activity.

4. VERIFICATION

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

(a) First article inspection (see 4.3 and 6.3).
(b) NOC conformance inspection (see 4.4 and 6.4).
(c) Alternative product (compositions other than as specified in 3.3.1) conformance inspection (see 4.5 and 6.4).

4.2 Inspection conditions. Unless otherwise specified in the test method, all inspections shall be performed in accordance with standard conditions. Standard condition shall be a temperature of 22 ± 2°C (72 ± 4°F) and a relative humidity of 50 ± 20 percent.

4.3 First article inspection. The first article inspections for an alternative product (compositions other than as specified in 3.3.1) shall consist of all tests specified in table IX.

TABLE IX. First article inspections.

Property	Requirement	Test method
Flammability	3.4.2	ASTM G 72 & ASTM D 2512
Toxicity	3.4.3	
off-gas toxicity	3.4.3.2	NASA WSTF-TP-629
effluent toxicity	3.4.3.3	EPA-600-4-90-027
medical review	3.4.3.4	1/
Cleaning efficiency	3.4.1	
precision ultrasonic	3.4.1.1	4.6.1
high soil loading	3.4.1.2	4.6.1
pipe cleaning	3.4.1.3	4.6.2
Corrosivity	3.4.4	2/ ASTM D 1280 or F 483
Rubber compatibility	3.4.5	2/ ASTM D 471
Plastic compatibility	3.4.6	2/ ASTM D 543
Foaming	3.4.7	4.6.3
Oil and grease	3.4.8	3/ ASTM D 2579, D 4779, D 3921, D 4281, or EPA 1664
Non-volatile residue	3.4.9	Appendix A 3/
High temperature stability	3.4.10	4.6.4
Low temperature stability	3.4.11	4.6.5
Chlorides	3.4.12	ASTM D 512
Insoluble matter	3.4.13	4.6.8
Odor	3.4.14	4.6.9
Appearance	3.4.15	4.6.10
Extended storage stability	3.4.16	4.6.11
Service tests	3.4.17	4/ MIL-STD-1330

1/ Performed by BUMED and NEHC.
2/ Immersion time shall be for 24 hours at 77 ± 1°C (170 ± 2°F).
3/ Equivalent military or commercial test methods may be used with prior Government approval.
4/ Conducted at approved Government field activities. Additional Government approved test methods may be specified by the authorizing activity.

4.3.1 First article service test samples. Production samples shall be provided for service tests. The samples shall be packaged as specified in 5.1. Samples shall be forwarded in accordance with instructions contained in the authorizing letter granting the service test, which will be sent to the manufacturer on satisfactory completion of all laboratory tests. The identification of each drum shall be as follows:

Cleaning Compound - Aqueous - Oxygen Systems Components
First article service test samples
Specification MIL-DTL-24800
Manufacturer's name and product number
Submitted by (name and date) for first article testing in accordance with authorization (reference authorizing letter)

4.4 NOC conformance inspections. Manufacture of NOC products shall consist of the following conformance inspections:

(a) Raw material inspections (see 4.4.2).
(b) In-process inspections (see 4.4.3).
(c) End-item inspections (see 4.4.4).

4.4.1 NOC lot formation. Unless otherwise specified, a lot shall consist of all the cleaning compound produced by one supplier, at one plant, from the same materials, under essentially the same manufacturing conditions, provided the operation does not exceed 24 hours. When the process is considered a batch operation, each batch shall constitute a lot.

4.4.2 NOC raw materials inspections. Each lot or batch of raw materials used for the production of NOC compound shall be inspected as specified in table X (see 6.9.1).

4.4.3 NOC in-process inspections. Each lot or batch of NOC compound produced shall be inspected as specified in table XI (see 6.9.2). A sample shall be taken not greater than 168 hours prior to end-item packaging.

4.4.4 NOC end-item inspections. The first, last, and every fifth end-item 55 gallon container or every tenth end-item 5 gallon container from each lot or batch shall be tested as specified in table XII (see 6.9.3).

4.5 Alternative product conformance inspection. Conformance inspection of alternative products (compositions other than as specified in 3.3.1) shall consist of the following:

(a) Raw material inspections (see 4.5.2).
(b) In-process inspections (see 4.5.3).
(c) End-item inspections (see 4.5.4).

TABLE X. NOC raw materials inspections.

Component	Property 1/	Test method
Polysilicate	Appearance	4.6.10
	Insoluble matter	ASTM D 501 Sec 56-57
	SiO_2/Na_2O ratio	ASTM D 501
	Total silica	ASTM D 501 Sec 51-53
	Total alkalinity	ASTM D 501 Sec 48-50
	Specific gravity	ASTM D 4052
Water	Reagent grade water	ASTM D 1193
	Chlorides	ASTM D 512 Method C
	Total organic carbon	ASTM D 2579/D 4779
Sodium molybdate dihydrate	Assay	ACS method
	pH (5% solution)	ASTM E 70
	Insoluble matter	ASTM D 501 Sec 88-89
Fluoboric acid	Assay	4.6.6
	Boric acid content	4.6.6
	Specific gravity	ASTM D 4052

1/ Property requirement in table II.

TABLE XI. NOC in-process inspections.

Property 1/	Test method
Polysilicate anion concentration	4.6.7
Fluoboric acid concentration	ICP-AA 2/
Sodium molybdate dihydrate concentration	ICP-AA 2/
Chlorides	ASTM D 512
pH	Appendix B
Total alkalinity	Appendix C
Surface tension	ASTM D 1331
Specific gravity (25/20°C)	ASTM D 4052
Insoluble matter	4.6.8
Non-volatile residue by filtration	Appendix A
Odor	4.6.9
Foam	4.6.3
Appearance	4.6.10

1/ Property requirement in table III.
2/ Using inductively coupled plasma (ICP) atomic absorption (AA) spectroscopy and assuming that all molybdenum is in the form of sodium molybdate dihydrate and that all boron is in the form of fluoboric acid.

TABLE XII. NOC end item inspections.

Property 1/	Test method
pH	Appendix B
Total alkalinity	Appendix C
Non-volatile residue by filtration	Appendix A
Odor	4.6.9
Foam	4.6.3
Appearance	4.6.10

1/ Property requirement in table IV.

4.5.1 Alternative product lot formation. Unless otherwise specified, a lot shall be as specified in 4.4.1.

4.5.2 Alternative product raw material inspections. Each lot or batch of raw materials used for the production of an alternative product shall be inspected in accordance with a raw material conformance inspection plan acceptable to the preparing activity. The raw material conformance inspection plan shall specify each component with applicable property requirements, test methods and sampling frequency for determining the acceptability of each raw material for each alternate product (see 6.10.1).

4.5.3 Alternative product in-process inspections. Prior to end-item packaging, each lot or batch of an alternative product shall be inspected in accordance with an in-process conformance inspection plan acceptable to the preparing activity. The in-process conformance inspection plan shall specify the properties, requirements, test methods and sampling frequency for determining the acceptability of in-process cleaning compound. As a minimum, the in-process inspections for alternative compositions shall consist of the applicable tests in table XI, and any other requirement and test method necessary to specify the chemical compound and concentration for each constituent other than water (see 6.10.2).

4.5.4 Alternative product end-item inspections. For each alternative product, end-items shall be inspected in accordance with an end-item conformance inspection plan acceptable to the preparing activity. The end-item conformance inspection plan shall specify the properties, requirements, test methods and sampling frequency for determining the acceptability of end-item cleaning compound. As a minimum, the end-item inspections for alternative compositions shall consist of the applicable tests in table XII (see 6.10.3).

4.6 Methods of inspection.

4.6.1 Cleaning efficiency (precision and high soil loaded).

4.6.1.1 Test apparatus. An ultrasonic cleaner with generator power of not less than 3 watts per square inch of radiated surface, generator frequency of not less than 25 kilohertz (kHz), and capable of maintaining the temperature of its contents at 68 ± 3°C (155 ± 5°F) shall be used.

4.6.1.2 Specimen preparation. Three MONEL coupons, 1.0 by 4.0 by thickness of 0.125 to .250 inch shall be cleaned by wiping with laboratory grade tissue wet with reagent grade acetone. The coupons shall be thoroughly dried then weighed (W_1). One surface of each of the three coupons shall be coated with a soil [10 ± 1 mg for precision cleaning (see 3.4.1) and 200 ± 5 mg for high soil loading (see 3.4.1.2)] in table V. The coated coupon weight shall be recorded as W_2.

4.6.1.3 Procedure. The three coupons shall be immersed in the operating ultrasonic tank maintained at 68 ± 3°C (155 ± 5°F) for not greater than 15 minutes. The coupons shall then be removed and immersed in an unagitated tank of deionized water at 40 ± 3°C (105 ± 5°F) for 15 ± 5 minutes, followed by drying in an oven at 105 ± 3°C (220 ± 5°F) for 25 ± 5 minutes. The coupons shall be weighed (W_3). This procedure shall be repeated for each soil and weight condition. Each cleaning efficiency shall be calculated as follows with the average of the three coupons reported:

$$\% \text{ Cleaning efficiency} = [(W_2 - W_3)/(W_2 - W_1)](100)$$

4.6.2 Pipe cleaning efficiency.

4.6.2.1 Pipe cleaning system. A pipe flow test system shall be constructed that will permit a flow of cleaning compound of 6 feet/second through the pipe flow cleaning fixture at 71 ± 3°C (160 ± 5°F) for 60 ± 5 minutes. The pipe flow test system can be either closed loop (to recirculate the compound) or open loop (no recirculation).

4.6.2.2 Pipe cleaning fixture. The pipe cleaning fixture shall consist of two 3/4-inch diameter pipes perpendicular to each other in a pipe tee. Each pipe shall be a minimum of 12 inches in length. Contamination carriers shall be fabricated by welding or brazing 5-inch, 1/4-20 threaded stainless steel or brass rod to 3/4-inch threaded pipe plugs. The fixture shall be installed into the cleaning system so that flow is perpendicular to the threaded rod when the contamination carrier is inserted into the unused port of the pipe tee fitting.

4.6.2.3 Procedure. The pipe flow contamination carrier shall be cleaned by scrubbing with a nylon brush, wet with reagent grade acetone. The carrier shall be dried and the weight recorded as W_1. Two contamination carriers shall be evenly coated with 200 ± 5 mgs of a soil from table V, except for Molycote which shall be 20 ± 5 mgs. The coated carriers shall be weighed (W_2). The contamination carrier shall be inserted into the unused port of the pipe flow fixture and be flushed with 71 ± 3°C (160 ± 5°F) cleaning compound flowing at 6 feet per second (ft/sec) for 60 ± 5 minutes. The contamination carrier shall be removed from the fixture and immersed in an unagitated tank of deionized water at 40 ± 3°C (105 ± 5°F) for 15 ± 5 minutes, followed by drying in an oven at 105 ± 3°C (220 ± 5°F) for 25 ± 5 minutes. The dried carrier shall then be reweighed (W_3). The procedure shall be repeated twice for each soil. Each pipe cleaning efficiency shall be calculated as follows with the average of the two contamination carriers reported:

$$\% \text{ Cleaning efficiency} = [(W_2 - W_3)/(W_2 - W_1)](100)$$

4.6.3 Foaming. A 500 milliliter (mL) quantity of cleaning compound shall be transferred to a clean 1 liter container. The jar shall be capped and vigorously shaken by hand for 15 seconds, then allowed to stand undisturbed for 5 minutes, then visually examined for any evidence of foam.

4.6.4 High temperature stability. A 500 mL quantity of cleaning compound shall be placed in a clean 1 liter teflon lined glass or stainless steel container, loosely covered, then heated to the manufacturer's recommended maximum operating temperature or 80 ± 1°C (175 ± 2°F) whichever is greater, and maintained at that temperature for 168 hours. The cleaning compound shall then be allowed to cool to room temperature while still in the container, then visually examined for any evidence of precipitation, separation of other non-homogeneity.

4.6.5 Low temperature stability. A 500 mL quantity of cleaning compound shall be placed in a clean 1 liter teflon lined glass or stainless steel container, capped, then placed in a cold chamber at 2.5 ± 1°C (37 ± 2°F) for 168 hours. The cleaning compound shall then be allowed to warm to room temperature while still in the container, then visually examined for precipitation, separation of other non-homogeneity.

4.6.6 Fluoboric acid.

4.6.6.1 Reagents.

(a) 30% Calcium chloride solution (adjusted to pH 4.0).
(b) Demineralized water (ASTM D 1193 type II).
(c) 0.1% Methyl-orange solution.
(d) 1% Phenolphthalein solution.
(e) Sodium hydroxide solution (1.0 N).
(f) Sorbitol.
(g) Mannitol-D powder (Commercial Edible No. 10).

4.6.6.2 Procedure. 1.0 ± 0.5 gm of fluoboric acid (weight A) shall be diluted with 100 mL demineralized water in a 500 mL reflux flask. Add 50 mL of 30% calcium chloride solution, and reflux for 1 hour. Cool to ambient, and transfer contents to a 500 mL beaker. Add 6 drops of 0.1% methyl-orange solution and 6 drops of 1% phenolphthalein solution. Titrate with 1.0 N sodium hydroxide solution (normality B) until a phenolphthalein red end-point is observed or pH 8.0 ± 0.1 when measured in accordance with ASTM E 70. Record the quantity of titrate (volume C). Add 10 ± 1 gm of mannitol-D powder or sorbitol, stir, and titrate with 1.0 N sodium hydroxide solution (normality B) to a phenolphthalein red end-point or pH 8.0 ± 0.1 when measured in accordance with ASTM E 70. Record the quantity of titrate (volume D). Calculate the fluoboric acid and boric acid content as follows:

$$\% \text{ Fluoboric acid} = [(C)(B)(2.195)]/(A)$$

$$\% \text{ Boric acid} = [(D)(B)(6.184)]/[(A)(9.534)]$$

4.6.7 Polysilicate anion concentration. Twenty grams of the NOC cleaning compound (weight = A) shall be transferred to a 250-mL beaker. Add 80 mL of ASTM D 1193 type II demineralized water. Perform a pH titration with 1.0 N hydrochloric acid solution (normality = B) using 0.5 mL increments until 30 mL of hydrochloric acid solution have been added. Plot the pH against the volume of titrant and determine the volume required to reach the second inflection point (volume = C). The second inflection point should occur between a pH of 4 and 3. Calculate the polysilicate anion concentration as follows:

$$\% \text{ Polysilicate anion} = [(10.7)(B)(C/A)] - (D)(E) - (F)(G)$$

where: D is the fluoboric acid concentration from 4.4.3
E is the fluoboric acid assay from 4.4.2
F is the sodium molybdate concentration from 4.4.3
G is the sodium molybdate assay from 4.4.2

4.6.8 Insoluble matter. Perform the test procedure as specified in appendix A, with the following exceptions:

(a) Step A.5.7 - the oven shall maintain a temperature of 212 to 221°F (100 to 105°C).
(b) Step A.7.1 - two 500 to 600 mL NOC samples shall be collected.
(c) Step A.7.2 - the total sample size shall be 1 liter.
(d) Steps A.9.4 through A.9.10 - shall be performed a total of five times.
(e) Step A.9.11 - the oven temperature shall be 100 to 105°C (212 to 221°F), and the time shall be 50 to 60 minutes.
(f) Step A.10.2 - the insoluble matter shall be as measured in Step A.10.1.

4.6.9 Odor. Odor shall be determined in accordance with ASTM D 1292, except that no dilution shall be performed and the use of more than one tester is not required.

4.6.10 Appearance. Appearance shall be determined by visually examining 500 mL of cleaning composition for clarity, color, oil and solids in a clear and white container. The inspection shall be performed by a person with normal visual acuity, natural or corrected, under bright white light of not less than 100 foot candles. A general purpose two D-cell flashlight, with fresh batteries and lamp, positioned 18 inches directly above a surface will illuminate the surface with an intensity of not less than 100 foot-candles.

4.6.11 Extended storage stability. Extended storage stability shall be determined by storing the cleaning composition for 1 year in accordance with ASTM F 1104, except the packaging shall be that selected by the manufacturer for delivering the cleaning composition to the Government. The cleaning composition shall then be tested as specified in table XII to determine compliance with 3.4.7 through 3.4.15.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The cleaning compound is intended for the precision cleaning of oxygen system piping and components including valves, regulators, piping, flasks and connectors. This cleaning compound is a critical item for cleaning oxygen systems and components during manufacture, maintenance and repair. To be effective, this cleaning compound must be used in accordance with the oxygen cleaning process specified in MIL-STD-1330, or equal. The quality of this product directly affects the safe performance of oxygen systems.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification.
(b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

(c) When first article is required (see 3.1).
(d) Packaging requirements (see 5.1 and 6.5).

6.3 First article inspection. Use of any cleaning composition that has not satisfactorily completed first article testing could result in catastrophic equipment failure and personnel injury or death. Letters of authorization for submittal of production samples for first article service tests may be obtained from the Department of the Navy, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160. For cleaning compositions other than as specified in 3.3.1, the preparing activity should request that the manufacturer furnish copies of a first article inspection report. Included with the report should be:

(a) Data showing that the material conforms to 3.2 (composition) and 3.4 (performance characteristics).
(b) Material safety data sheets prepared in accordance with FED-STD-313.
(c) Certification that no change shall be made to the product composition after the product has been shipped to the preparing activity for first article service testing.

6.4 Conformance. Failure to meet conformance requirements may result in the failure of the cleaning composition to perform as demonstrated during first article testing. This can result in the catastrophic equipment failure and personnel injury or death. Purchase of cleaning compositions covered by this specification should require manufacture in an ISO 9002, Quality Systems - Model for Quality Assurance in Production, Installation and Servicing, or equivalent, certified facility, and require origin inspection-origin acceptance.

6.5 Packaging. Packaging that has not passed first article testing for extended storage stability (see 3.4.16) can contaminate the cleaning composition. This can cause hazardous flammable and toxic material to be introduced into the systems and components being cleaned resulting in catastrophic equipment failure and personnel injury or death. For the NOC composition cleaning compound, the only packaging that has passed first article testing for extended storage stability (see 3.4.16) was 5 and 55 gallon containers conforming to A-A-58020; where the interior steel surfaces are painted with a corrosion inhibiting primer; drums contain an unplasticized polyethylene liner which is not adhesively bonded to the drum interior, and prior to packaging, the interior of all containers were thoroughly spray cleaned with 49 to 65°C (120 to 150°F) demineralized water.

6.6 Patent notice. The Government has a royalty-free license under the following listed patent for the benefit of manufacturers of the NOC composition cleaning compound either for the Government or for use in equipment to be delivered to the Government.

U.S. PATENT NO'S.: 5,427,709 and 5,520,837

6.7 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent government mailing addresses for submission of data are listed in FED-STD-313. NOC composition cleaning compounds should include the following precautions, prepared by the Navy Environmental Health Center (NEHC), in the MSDS.

(a) Skin contact with NOC will result in irritation and chemical burns. Wear impervious protective clothing constructed of neoprene or other material of equivalent resistance to penetration so as to prevent skin contact. Use elbow length gloves (with cuffs) as minimum protection any time open containers of NOC are handled. Wash potentially exposed skin areas with soap and water at breaks, and at the conclusion of operations. Do not use organic solvents for this purpose. Thoroughly clean protective garments at the conclusion of the operation and store for reuse. Remove clothing which becomes contaminated as soon as possible and thoroughly

clean before reuse. Seek prompt medical assistance should a rash, chemical burn, or other adverse effect be experienced which may be related to working with NOC. Do not store or consume food and tobacco in areas where they could be contaminated with NOC.

(b) Eye contact with NOC could result in chemical burns. Wear chemical worker's goggles for all operations where eye contact with NOC could occur. Use a full length face shield for any operation where splashing of the material could occur. In the event of eye contact, personnel should flush their eyes thoroughly with freshwater for a minimum of 15 minutes, then seek prompt medical attention. Provide emergency eyewash systems near the work area, conforming to the design requirements of the American Nations Standards Institute (ANSI).

(c) Over exposure to mists or vapors from NOC may result in sneezing, coughing, respiratory system irritation, and possibly chemical burns and subsequent edema in the upper airways. Based on off-gas testing at temperatures up to 82°C (180°F), such a possibility is unlikely considering the magnitude and frequency of use. In the event any adverse health effects are experienced, cease operations involving NOC and consult the cognizant medical department representative for additional guidance.

6.8 National stock numbers and sizes. The sizes and national stock numbers (NSN) for NOC cleaning compositions are listed in table XIII.

TABLE XIII. NOC national stock numbers and sizes.

Size/unit of issue	Military symbol/NATO code	NSN
5 Gallon (CN)	None	6850-01-389-3859
55 Gallon (DR)	None	6850-01-389-3880

6.9 Lot acceptance and rejection criteria of NOC products.

6.9.1 NOC raw materials inspections. Failure of a sample to meet the requirements as specified in table II should be cause to reject the entire lot or batch of applicable raw material(s).

6.9.2 NOC in-process inspections. Failure of the sample to meet the requirements as specified in table III should be cause to reject the entire lot or batch.

6.9.3 NOC end-item inspections. Failure of any selected sample to conform with any requirement specified in table IV should be cause to reject the entire inspection lot or batch.

6.10 Lot acceptance and rejection criteria of alternative products.

6.10.1 Alternative product raw material inspections. Failure of a sample to meet the requirements accepted by the preparing activity should be cause to reject the entire lot or batch of applicable raw material(s).

6.10.2 Alternative product in-process inspections. Failure of a sample to meet the requirements accepted by the qualifying activity should be cause to reject the entire lot or batch.

6.10.3 Alternative product end-item inspections. Failure of a sample to meet the requirements accepted by the preparing activity should be cause to reject the entire lot or batch.

6.11 Subject term (key word) listing.

Immersion
Off-gassing
Piping
Pumped cleaning
Spray
Ultrasonic cleaning

APPENDIX A

TEST PROCEDURE FOR NON-VOLATILE RESIDUE IN NAVY OXYGEN CLEANER BY GRAVIMETRIC ANALYSIS

A.1 SCOPE

A.1.1 Scope. This procedure covers the determination of non-volatile residue (NVR) in the Navy oxygen cleaner (NOC) by filtration and subsequent gravimetric analysis. The residue could consist of any insoluble low vapor pressure material in the NOC including particulate, gels, and inorganic as well as organic residues which are retained by a teflon membrane filter of pore diameter 0.45 micrometer. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 APPLICABLE DOCUMENTS

A.2.1 General. The documents listed in this section are specified in appendix A, of this specification. This section does not include documents 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 documented cited in appendix A, of this specification, whether or not they are listed.

A.2.2 Government documents.

A.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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

BB-N-411 - Nitrogen, Technical.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

A.3 PROCEDURE

A.3.1 Summary of test method. The NVR in NOC is determined by passing a given quantity of NOC through a 0.45 micrometer Teflon filter and measuring the increase in the weight of the filter. The NOC sample is either pushed through the filter by pressurizing a filtration reservoir containing the NOC sample with oil-free nitrogen, or the NOC sample is drawn through the filter by a vacuum. The filter collects the NVR residue contained in the NOC. The filter is subsequently washed with demineralized water, dried and weighed. The increase in the weight of the filter is a measure of the NVR in the NOC.

A.4 Significance and use.

A.4.1 NOC is an aqueous inorganic alkaline solution that is filtered to 0.1 micrometer during manufacture resulting in a material specification of 1.0 mg/L for insoluble matter. NOC removes oil and grease by displacement with the resultant removed contaminants existing in NOC as a filterable suspension. This test method measures the amount of NVR contained in NOC. The test is used to verify the level of NVR in NOC. The method will determine the amount of all types of NVR in NOC including organic material, particulate, and gels.

A.4.2 The filtrate is dried at a relatively low temperature. Therefore, this procedure is not expected to result in any appreciable loss of semi-volatile contaminates.

A.4.3 A variation of this test procedure is used to verify the cleanliness of Navy oxygen systems and components after cleaning with NOC.

A.4.4 This analysis is susceptible to interference from demineralized water contaminated with insoluble material, from a filtration column contaminated with dried NOC residue or ambient dust, and to homogenizer wear that could contaminate the NOC sample with particulate.

A.5 Apparatus.

A.5.1 Balance: accurate to 0.1 milligram (mg) with a zero drift less than 0.1 mg. A balance with an accuracy of 0.05 mg with a zero drift less than 0.05 mg is preferred. The balance shall be calibrated in accordance with the Navy Metrology and Calibration Program, or equivalent. Between calibrations, the accuracy of the balance should be verified using certified balance weights.

A.5.2 Balance weights: 1.0, 2.0, 5.0, and 10.0 mg, accurate to 0.02 mg (NIST Class S or ASTM Class 2) and made from non-magnetic material.

A.5.3 Membrane filter, pure teflon, disposable: 0.45 or 0.50 micrometer pore size, 47-millimeter diameter. Bonded or laminated membrane filters shall not be used.

A.5.4 Membrane filter holder & filtration reservoir: suitable to capture the 47-millimeter diameter filter specified in A.5.3, 250 mL capacity minimum, manufactured from stainless steel and/or teflon.

A.5.5 Laboratory homogenizer w/generator: homogenizer motor power of 500 to 1000 watts with a no load speed control of 10,000 to 30,000 revolutions per minute (rpm), and a 20 millimeter diameter saw tooth generator capable of homogenizing a 1 liter sample into a 1-5 micrometer emulsion at about 7,500 rpm loaded speed. A holder or stand for the homogenizer is recommended.

A.5.6 NOC sample/homogenizing bottles: 1 liter volume for collecting and homogenizing NOC samples. Ensure the opening is large enough to allow insertion of the homogenizer generator (item A.5.5). Sample bottles should be made from teflon, teflon lined glass, teflon lined plastic, or safety coated (exterior) glass with teflon lined lid, or corrosion resistant metal.

A.5.7 Drying oven: capable of maintaining a temperature of 55 to 60°C (131 to 140°F).

A.5.8 Graduated cylinder: 250 mL volume minimum, with minimum 50 mL graduations to measure 200 mL of homogenized NOC sample to be filtered; glass or polypropylene.

A.5.9 Vacuum collector: 500 mL to collect filtered NOC when using a vacuum to draw the NOC through the membrane filter; preferably plastic. The stopper used to seal the collector should be made of teflon.

A.5.10 Beaker: 250 mL to collect the filtered NOC, preferably plastic, when pressurizing the NOC sample.

A.5.11 Beaker: 250 mL to measure 100 mL of demineralized water used to wash the membrane filter; plastic or glass.

A.5.12 Erlenmeyer flask: 1 liter for rinsing the homogenizer; plastic or glass. Ensure the opening is large enough to allow insertion of the homogenizer generator (item A.5.5).

A.5.13 Petri dish: covered glass, for drying membrane filter in the oven.

A.5.14 Forceps: non-serrated tips, to handle filters.

A.5.15 Eye dropper or pipette: to transfer isopropyl alcohol to wet the membrane filter prior to filtration.

A.5.16 Teflon tape: to prepare threaded connections on the filtration reservoir.

A.5.17 Vacuum source: capable of drawing a vacuum of 10 inches Hg [5 psi differential (psid)] and controllable at 2 inches Hg (1 psid) increments; required if using a vacuum to draw the NOC through the membrane filter.

A.5.18 Nitrogen pressure source: capable of providing 5 psig and controllable at 1 psi increments; required if using pressure to push the NOC through the membrane filter.

A.6 Reagents.

A.6.1 Navy oxygen cleaner: conforming to this specification.

A.6.2 Demineralized water: conforming to ASTM D 1193 Type II.

A.6.3 Isopropyl alcohol: American Chemical Society (ACS) Grade, having an NVR of 5 ppm (.0005%) or less.

A.6.4 Nitrogen: conforming to BB-N-411 Type 1, Grades A, B, or C, Class 1, or equal.

A.7 Sample.

A.7.1 A 500 to 600 mL NOC sample shall be collected for NVR determination. The sample bottles use to collect the sample shall have been cleaned as specified in A.8. Care shall be exercised while collecting the sample to avoid contamination.

A.7.2 A 200 mL sample of homogenized NOC will be used for the gravimetric analysis.

A.8 Preparation and maintenance of apparatus.

A.8.1 Apparatus used in the procedure, including the sample bottles, homogenizer, homogenizing container, graduated cylinder, filtration reservoir, and demineralized water beaker shall have been cleaned using a MIL-STD-1330 component cleaning process or equivalent process.

A.8.2 Threaded connections in the filtration reservoir and filter support shall be wrapped with Teflon tape to prevent leakage of the NOC sample.

A.8.3 After contact with NOC, all apparatus shall immediately be rinsed with demineralized water to remove residual NOC, to prevent formation of inorganic deposits, and to maintain cleanliness.

A.9 Procedure.

A.9.1 Select a membrane filter that has equilibrated to ambient conditions.

A.9.2 Using forceps, weigh the filter to the nearest 0.1 mg; preferably to the nearest 0.05 mg.

A.9.3 Transfer the membrane filter to the filter holder and attach the filter holder to the filtration reservoir. Do Not Over Tighten. Over tightening may cause permanent deformation allowing the NOC sample to leak.

A.9.4 Homogenize the 500 to 600 mL NOC sample for 3 minutes at a speed of about 7,500 rpm.

A.9.5 Using an eye-dropper or pipette, wet the filter with about 1 mL of isopropyl alcohol. Allow at least 15 seconds for the isopropyl alcohol to fully wet the filter. This is observable as a change in filter color from opaque white when dry to translucent when wet.

A.9.6 Optional - Excessive isopropyl alcohol can react with NOC to form a white precipitate that may cause high NVR results. If this interference is suspected, the isopropyl alcohol can be removed from the filter by transferring 10 to 20 mL of demineralized water to the filter reservoir. Filter the demineralized water by vacuum or by pressurizing the reservoir with oil-free nitrogen before proceeding to step A.9.7.

A.9.7 Transfer 200 mL of homogenized NOC to the filter reservoir.

A.9.8 Filter the homogenized NOC at less than 50 mL per minute by vacuum or by pressurizing the reservoir with oil-free nitrogen. Very little pressure differential (less than 5 psid) will be required to obtain the desired filtration rate. Do Not Exceed a Filtration Rate of 50 Milliliters Per Minute.

A.9.9 Transfer 100 to 110 mL of demineralized water to the filter reservoir to wash the filter and reservoir of residual NOC.

A.9.10 Filter the demineralized water at less than 50 mL per minute by vacuum or by pressurizing the reservoir with oil-free nitrogen. Very little pressure differential (less than 5 psid) will be required to obtain the desired filtration rate. Do Not Exceed a Filtration Rate of 50 Milliliters Per Minute.

A.9.11 Remove the filter; place in a petri dish, and dry with petri dish cover ajar in an oven at 55 to 60°C (131 to 140°F) for 20 to 30 minutes.

A.9.12 Remove the petri dish with filter from the oven, transfer the filter to an ambient temperature petri dish and allow it to cool with cover ajar for at least 2 minutes.

A.9.13 Weigh the filter to the nearest 0.1 mg; preferably to the nearest 0.05 milligram.

A.10 Calculations. Calculate the level of NVR as follows:

A.10.1 Subtract the initial weight of the filter (step A.9.2) from the final weight of the filter (see A.9.13) after filtering NOC. Record this weight difference in milligrams.

A.10.2 Calculate the level of NVR in NOC by multiplying the net weight difference (from A.10.1) by five and report in milligrams per liter (mg/L).

APPENDIX B

TEST PROCEDURE FOR NAVY OXYGEN CLEANER pH BY SPECTROPHOTOMETRIC ANALYSIS

B.1 SCOPE

B.1.1 Scope. This procedure covers the determination of Navy oxygen cleaner (NOC) pH by spectrophotometric analysis. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

B.2 APPLICABLE DOCUMENTS

This section is not applicable.

B.3 PROCEDURE

B.3.1 Summary of test method. The pH of the NOC is determined by using a UV/Vis spectrometer to measure the absorbance of NOC with and without alizarin yellow R indicator solution at 491 nanometers (nm) and 385 nm. The difference in absorbance is computed at both wavelengths (absorbance of NOC + indicator - absorbance of NOC). The log of the ratio of the difference in absorbance at 491 nm and 385 nm is referenced to a calibration curve developed from primary and secondary pH standards to determine the pH of NOC.

B.4 Significance and use.

B.4.1 NOC is an aqueous inorganic alkaline cleaning solution having a pH of about 11.9. The solution is comprised of water, sodium silicate, sodium molybdate, and sodium fluoroborate. Accurate and consistent pH measurements of NOC have proven difficult to obtain when using hydronium ion concentration meters. The combination of sodium silicate, high pH, and high sodium ion concentration have resulted in erratic readings with both glass probes and ion selective field effect transistor (ISFET) probes.

B.4.2 The determination of the pH of NOC using a spectrophotometer is based on the methodology described in Robert-Baldo, Gillian; Morris, Michael J., and Byrne, Robert H., "Spectrophotometric Determination of Sea Water pH Using Phenol Red", Anal. Chem. 1985, 57, 2564-2567. This method is based on a spectrophotometric calibration curve derived from pH standards in the range of 10.0 to 12.6. Alizarin yellow R, an indicator in the 10 to 12 pH range, was chosen for the NOC pH analysis. Alizarin yellow R exhibits two absorption maxima between 300 nm and 600 nm. At a pH of 10, the indicator has a maximum in the absorbance at approximately 375 nm. As the pH rises to 12 the absorption peak at 375 decreases and a peak near 491 nm arises. However, results obtained in the literature show that to obtain the best correlation between the change in pH from 10 to 12.5 and the change in the absorbance of the indicator, the log of the ratio of the absorbance at 491 nm and at 385 nm (not 375 nm) should be used.

B.4.3 NOC mixed with tap water can introduce interfering ions such as calcium which will invalidate the analysis results.

B.5 Apparatus.

B.5.1 UV/Vis spectrophotometer: single or dual beam device with a wavelength range of at least 340 to 600 nm, a wavelength accuracy of at least plus or minus 2 nm and a precision of at least plus or minus 0.5 nm. The spectrophotometer shall be calibrated in accordance with the Navy Metrology and Calibration Program, or equivalent. Between calibrations, the accuracy of the spectrophotometer shall be verified with calibration filters.

B.5.2 Spectrophotometer cells: 10 mm path length absorption cells suitable for use in B.5.1. Matched cells shall be used with dual beam spectrophotometers. The cells should be of fused silica (quartz). Fused quartz has no absorption at 385 nm. Optical glass may be used. However, some absorption by the optical glass at 385 nm may be experienced.

B.5.3 pH meter: accurate to at least plus or minus 0.05 pH units within a range of 10.0 to 12.6.

B.5.4 Balance: accurate to 0.1 milligrams with a zero drift less than 0.1 milligrams.

B.5.5 Assorted lab ware: rinse bottles, sample bottles, micro pipettes, and graduated cylinders.

B.6 Reagents.

B.6.1 Navy oxygen cleaner: conforming to this specification.

B.6.2 Demineralized water: conforming to ASTM D 1193 Type II.

B.6.3 Alizarin yellow R indicator solution: saturated solution prepared by mixing 0.1 grams of alizarin yellow R to each 100 mL of demineralized water, allowing the mixture to stand until all undissolved solid has settled to the bottom of the container. The indicator solution is light-sensitive and shall be stored away from light in tightly sealed brown glass containers. The indicator solution has a shelf-life of 1 month.

B.6.4 0.2M Potassium chloride: ACS reagent grade KCl and demineralized water.

B.6.5 0.01M, 0.1M & 0.2M Sodium hydroxide: ACS reagent grade NaOH and demineralized water.

B.6.6 0.05M Sodium phosphate, tribasic: ACS reagent grade Na_3PO_4 and demineralized water.

B.6.7 0.05M Sodium phosphate, dibasic: ACS reagent grade Na_2HPO_4 and demineralized water.

B.6.8 0.025M Sodium carbonate: ACS reagent grade Na_2CO_3 and demineralized water.

B.6.9 0.025M Sodium bicarbonate: ACS reagent grade Na_2HCO_3 and demineralized water.

B.7 Procedure for calibration curve.

B.7.1 Prepare the pH standards listed in table XIV.

B.7.2 Measure and record the pH of each standard in accordance with ASTM E 70.

B.7.3 For single beam spectrophotometers, perform the following:

B.7.3.1 Measure and record the baseline absorbance of each pH standard at 385 nm and 491 nm.

B.7.3.2 Add 300 microliters (0.3 mL) of alizarin yellow R indicator (see B.6.3) solution to each 25 mL of pH standard. With the same cell used in B.7.3.1 or a matched cell, measure and record the absorbance of each pH standard with indicator solution at 385 nm and 491 nm.

B.7.3.3 Subtract the absorbance of the pH standards (see B.7.3.1) from the absorbance of the pH standards with indicator solution (see B.7.3.2), at 385 nm and 491 nm respectively. Record these values as abs_{385} and abs_{491}.

B.7.4 For dual beam spectrophotometers, perform the following:

B.7.4.1 Fill the reference beam cell with pH standard.

B.7.4.2 Fill the sample beam cell with pH standard containing indicator solution prepared by adding 300 microliters (0.3 mL) of alizarin yellow R indicator (see B.6.3) solution to each 25 mL of pH standard.

B.7.4.3 The absorbance of each pH standard is measured at 385 nm and 491 nm. Record these values as abs_{385} and abs_{491}.

B.7.5 Tabulate the data so that the pH measurements from B.7.2 is the Y axis, and the corresponding data from B.7.3.3 or B.7.4.3, represented as the $\log(abs_{491}/abs_{385})]$, is the X axis.

B.7.6 Perform a linear regression of the data from B.7.5, and determine the equation of the line that best fits the data. A carefully prepared calibration curve should result in a correlation coefficient of 0.98 ± 0.02.

B.7.7 Record an equation for pH as a function of the log of the ratio of the two absorbance that yields:

$$pH = b + m[\log(abs_{491}/abs_{385})]$$

where: b is a constant representing the Y axis cross-connect determined from B.7.6

m is a constant representing the slope of the line determined from B.7.6

B.8 Procedure for pH of NOC.

B.8.1 Obtain a 25 mL, or greater, sample of NOC at room temperature (23 ± 3°C).

B.8.2 For single beam spectrophotometers, perform the following:

B.8.2.1 Measure and record the baseline absorbance of NOC at 385 nm and 491 nm.

B.8.2.2 Add 300 microliters (0.3 mL) of alizarin yellow R indicator (see B.6.3) solution to each 25 mL of NOC. With the same cell used in B.8.2.1 or a matched cell, measure and record the absorbance of NOC with indicator solution at 385 nm and 491 nm.

B.8.2.3 Subtract the absorbance of NOC without indicator (see B.8.2.1) from the absorbance of NOC with indicator solution (see B.8.2.2), at 385 nm and 491 nm respectively. Record these values as abs_{385} and abs_{491}.

B.8.3 For dual beam spectrophotometers, perform the following:

B.8.3.1 Fill the reference beam cell with NOC.

B.8.3.2 Fill the sample beam cell with NOC containing indicator solution prepared by adding 300 microliters (0.3 mL) of alizarin yellow R indicator (see B.6.3) solution to each 25 mL of NOC.

B.8.3.3 The absorbance of each pH standard is measured at 385 nm and 491 nm. Record these values as abs_{385} and abs_{491}.

B.8.4 Determine pH using the equation from B.7.7 and the values for abs_{385} and abs_{491} from B.8.2.3 or B.8.3.3. The accuracy of this analysis is plus or minus 0.1 pH units.

TABLE XIV. pH standards.

Reported pH 1/	Reagents	Composition (volume %)
12.6	0.20M KCl 0.20M NaOH Water	25.0 25.6 49.4
12.6	0.05M NaOH	100.0
11.9	0.01M NaOH	100.0
11.7	0.05M Na_3PO_4	100.0
11.5	0.05M Na_2HPO_4 0.10M NaOH Water	50.0 11.1 38.9
11.3	0.05M Na_2HPO_4 0.10M NaOH Water	50.0 7.6 42.4
10.9	0.05M Na_2HPO_4 0.10M NaOH Water	50.0 3.3 46.7
10.0	0.025M Na_2CO_3 0.025M $NaHCO_3$	50.0 50.0

1/ The 12.6 KCl/NaOH, 11.5, 11.3 and 10.9 pH standards were prepared as described in Bates, Roger G., and Bower, Vincent E, "Alkaline Solutions for pH Control", Anal. Chem., 1956, 28, 1322-1324.

APPENDIX C

TEST PROCEDURE FOR NAVY OXYGEN CLEANER TOTAL ALKALINITY BY TITRATION

C.1 SCOPE

C.1.1 Scope. This procedure covers the determination of the total alkalinity (quantity of base) contained in Navy oxygen cleaner (NOC) referenced to a pH of about 10.0. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

C.2 APPLICABLE DOCUMENTS

C.2.1 General. The documents listed in this section are specified in appendix C, of this specification. This section does not include documents 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 documented cited in appendix C, of this specification, whether or not they are listed.

C.2.2 Government documents.

C.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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL
TT-I-735 - Isopropyl Alcohol.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

C.2.3 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issue of the non-Government documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM E 319 - Standard Practice for the Evaluation of Single-Pan Mechanical Balances.

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

C.3 PROCEDURE

C.3.1 Summary of test method. The total alkalinity of the NOC is determined by measuring the amount of NOC that is necessary to neutralize a standard acid solution of potassium acid phthalate (KHP) in pure water. Thymolphthalein is used as the endpoint indicator (pH 10.0).

C.4 Significance and use. As addressed in appendix B of this specification, measurement of NOC pH with a hydronium ion concentration meter is extremely difficult. This test method measures the total alkalinity contained in NOC without the use of a pH meter. As the alkalinity of the NOC is depleted, the pH of the cleaner will decrease, and at a pH of 11.0 the cleaner will have lost most of the properties necessary for it to be an effective cleaner. Determining the total alkalinity at the time of manufacture will provide a measure of the cleaner's stability and capacity to be recycled and reused in the field. Determining the total alkalinity in the field can be a measure of the remaining useful life of the cleaner.

C.5 Apparatus.

C.5.1 Balance: accurate to 0.001 gram with a zero drift less than 0.001 gram and a capacity sufficient for the preparation of the KHP and thymolphthalein ph indicator solutions as specified in C.7. The accuracy of the balance should be verified using ASTM E 319 or an equivalent method.

C.5.2 Erlenmeyer flask: plastic or glass, 100 to 250 mL, for dissolving the KHP and performing the titration. Suitable beakers or volumetric containers may be used in place of the Erlenmeyer flask.

C.5.3 Graduated cylinder: plastic or glass, 50 to 100 mL, for measuring the volume of demineralized water used to dissolve the KHP, and for measuring the volume of isopropyl alcohol for making the indicator solution.

C.5.4 Eye-dropper or pipette: glass or plastic, for adding pH indicator to the KHP solution.

C.5.5 Buret: capacity 50 mL, with 0.1 mL graduation intervals, plastic or glass, for measuring the volume of NOC needed to neutralize the KHP solution.

C.6 Reagents.

C.6.1 Navy oxygen cleaner: conforming to this specification.

C.6.2 Demineralized water: conforming to ASTM D 1193 Type II.

C.6.3 Potassium acid phthalate or potassium biphthalate (KHP): primary standard or acidimetric standard, crystals, ACS reagent grade or better, CAS No. 877-24-7. Do not use powdered KHP since it does not completely dissolve.

C.6.4 Thymolphthalein: pH indicator, powder, CAS No. 125-20-2.

C.6.5 Isopropyl alcohol: conforming to TT-I-735 or better.

C.7 Reagent preparation.

C.7.1 Prepare a 4.0% wt/vol KHP solution by adding 100.0 ± 1.0 mL of demineralized water (see C.6.2) to each 4.0 ± 0.1 gram of dry KHP (see C.6.3). The KHP may not dissolve in the water immediately. After adding the water, gently swirl or stir the contents for about 1 minute being careful not to deposit solid KHP on the sides of the flask. Let the flask stand for about 10 minutes and swirl or stir the contents for an additional minute. The KHP solution has a 3 month shelf life when stored in a tightly sealed glass container.

C.7.2 Prepare a 0.2% wt/vol thymolphthalein pH indicator solution by adding 50 ± 1.0 mL of isopropyl alcohol (see C.6.5) to each 0.1 ± 0.01 grams of thymolphthalein (see C.6.4). The solution may have to sit for about 4 hours to allow the thymolphthalein to completely dissolve. The pH indicator solution should be clear, water white with no precipitate. The pH indicator solution has a 1 month shelf life when stored in a tightly sealed brown glass or plastic container.

C.8 Procedure.

C.8.1 Transfer 50.0 ± 1.0 mL of the 4.0% KHP solution (see C.7.1) into the Erlenmeyer flask.

C.8.2 Add five drops of the 0.2% thymolphthalein pH indicator solution (see C.7.2) into the Erlenmeyer flask. The KHP solution should be clear.

C.8.3 Fill a 50 mL buret with NOC test solution. Record to the nearest 0.1 mL the level of the solution in the buret.

C.8.4 Slowly add NOC to the KHP solution while swirling the flask until a blue color endpoint persists for 30 seconds. Record to the nearest 0.1 mL the final level of NOC solution in the buret.

C.9 Calculation. Subtract the final level (from C.8.4) of NOC solution in the buret from the initial level (from C.8.4) of NOC solution in the buret. Record this volume difference in milliliters. Report this number as the total alkalinity - mL of NOC.

Custodian:
Air Force - 68
Army - EA
Navy - SH

Preparing activity
Navy - SH
(Project 6850-1174)

Reviewing activities:
Army - MI
Navy - AS
DLA - GS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the comment number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-DTL-24800	2. DOCUMENT DATE (YYMMDD) 960930

3. DOCUMENT TITLE
CLEANING COMPOUND - AQUEOUS - OXYGEN SYSTEMS COMPONENTS

4. NATURE OF CHANGE (identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) DSN (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC) MR. NEIL ANTIN, NAVSEA 03Y2A ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial: DSN: TPOC: 703-602-5552 8-332-5552
c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND ATTN: SEA 03R42 2531 JEFFERSON DAVIS HIGHWAY ARLINGTON, VA 22242-5160	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466 Telephone 703-756-2340 DSN 289-2340