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MILITARY STANDARD

PREVENTIVE COMPOUNDS, PHOSPHATE COATINGS AND INHIBITORS

FSC 6850

DEPARTMENT OF DEFENSE
Washington, D. C. 20301

Preventive Compounds, Phosphate Coatings and Inhibitors

MIL-STD-1216

1. This Military Standard is mandatory for use by all departments and agencies of the Department of Defense, to assure that selection of new items is limited to essential items, for which no comparable standard item exists. This document is not intended to restrict any service in selecting new items required to support state-of-the-art changes.

2. Recommended corrections, additions, or deletions should be addressed to Commanding Officer, Edgewood Arsenal, ATTN: SMUEA-TSE-SM, Edgewood Arsenal, Maryland 21010.

FOREWORD

This is the first book format standard generated on Preventive Compounds, Phosphate Coatings and Inhibitors. This standard is mandatory for use by all departments and agencies of the Department of Defense in the selection of items for application. It is intended to prevent the entry of unnecessary items (sizes, types, varieties) into the Department of Defense logistics system. This is not a procurement document. This document is not intended to restrict any service in selecting new items required to support state-of-the-art changes.

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TABLES

1. SCOPE

1.1 Coverage. This standard is a presentation of nomenclature, symbols, physical and chemical properties and requirements, military and typical commercial uses, directions for use, packaging data, labeling, general safety precautions, storage information, and shelf life of military preventive compounds, phosphate coatings and inhibitors coming under FSC 6850. This standard does not necessarily include all classifications of the items represented by the title or those which are commercially available. It does contain items preferred for use in the selection of preventive compounds, phosphate coatings and inhibitors for application by the Department of Defense. This standard covers the following thirty-eight items.

NAME	NO. OF ITEMS
BOILER COMPOUND	2
BOILER COMPOUND, BRIQUETS	1
COATING COMPOUND, OXIDE BLACK	2
CORROSION PREVENTIVE, AIRCRAFT ENGINE	1
CORROSION PREVENTIVE, AIRCRAFT ENGINE, GAS TURBINE	2
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GUM PREVENTIVE COMPOUND, GASOLINE	2
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INHIBITOR, CORROSION, LIQUID COOLING SYSTEM (DICHROMATE)	2
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INHIBITOR, CORROSION, LUBRICATING OIL (OUTDOOR USE)	2
INHIBITOR, CORROSION, PETROLEUM FUEL	1
INHIBITOR, CORROSION, SOLUBLE OIL	2
INHIBITOR, CORROSION, VAPOR BARRIER	3
INHIBITOR, CORROSION, WATER SOLUBLE	1
INHIBITOR, PICKLING CHEMICAL (HYDROCHLORIC)	1
INHIBITOR, PICKLING CHEMICAL (SULFURIC)	4
LEAK PREVENTIVE COMPOUND, RADIATOR	1
LEAK PREVENTIVE COMPOUND, RADIATOR, ANTISEEPAGE	1
PHOSPHATE COATING, METAL	3

1.2 Application. Items listed herein accommodate essential requirements of the military and defense agencies, and will effect continued economies in all logistics functions when properly employed in new applications.

2. REFERENCED DOCUMENTS

The issues of the following documents in effect on the date of invitation for bids form a part of this standard to the extent specified herein.

Federal Specifications

O-I-490	Inhibitor, Corrosion, Liquid Cooling System
O-I-501	Inhibitors, Pickling (For Use With Sulfuric Acid)
O-L-160	Leak Preventive Compound, Radiator
PPP-C-300	Chemicals, Liquids, Packaging and Packing of
PPP-C-301	Chemicals, Dry and Paste, Packaging and Packing of
TT-C-490	Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings
VV-G-800	Gum Preventive Compound, Gasoline

Military Specifications

MIL-B-3242	Boiler Compound, Navy
MIL-C-4339	Corrosion Preventive, Soluble Oil for Water Injection Systems
MIL-C-5545	Compound, Corrosion Preventive, Aircraft Engine, Heavy Oil Type
MIL-C-6529	Corrosion Preventive, Aircraft Engine
MIL-C-8188	Corrosion Preventive Oil Gas Turbine Engine, Aircraft Synthetic Base
MIL-C-13924	Coating, Oxide, Black, for Ferrous Metals
MIL-C-46110	Coating Compound, Oxide Black
MIL-C-51047	Compound, Antiseepage, For Cooling System, Internal Combustion Engine
MIL-I-17433	Inhibitor, Pickling Chemical, Hydrochloric Acid Bath
MIL-I-19528	Inhibitor, Corrosion, Liquid Cooling System (Dichromate Type)
MIL-I-19841	Inhibitor, Corrosion, Soluble Oil
MIL-I-22110	Inhibitors, Corrosion, Volatile, Crystalline
MIL-I-25017	Inhibitor, Corrosion, Fuel Soluble
MIL-L-6081	Lubricating Oil, Jet Engine
MIL-L-6082	Lubricating Oil, Aircraft Reciprocating Engine (Piston)
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-P-16232	Phosphate Coatings, Heavy, Manganese or Zinc Base (For Ferrous Metals)
MIL-P-50002	Phosphate Coating Compounds, for Phosphating Ferrous Metals

Military Handbook

MIL-HDBK-205	Phosphatizing and Black Oxide Coating of Ferrous Metals

Rules and Regulations

DoT Code of Federal Regulations Title 49 - Transportation, Parts 171 to 190.

3. GLOSSARY

3.1 Definitions

Anhydrous - Pertaining to a salt which has no water of hydration present in the crystalline structure.

Bacterial - Pertaining to or consisting of the various forms of bacteria.

Coating - A finished or protective layer.

Compound - A substance composed of atoms or ions of two or more different elements.

Corrosion - The deterioration of a substance, usually a metal, because of a reaction with its environment.

Flash Point - The lowest temperature at which a combustible liquid will give off a flammable vapor which will burn momentarily.

Fungal - Pertaining to or caused by fungi.

Granular - A substance which has been converted into small grain-like particles.

Hazardous Substance - A substance or mixture of substances which is (1) toxic; (2) corrosive; (3) an irritant; (4) a strong sensitizer; (5) flammable, or which (6) generates pressure through decomposition, heat, or other means, if such substance or mixture of substances may cause substantial personal injury or substantial illness during or as a direct result of any customary or reasonably anticipated handling or use.

Inhibitor - Compound or material that has the effect of slowing down or stopping an undesired chemical change such as corrosion, oxidation, or polymerization.

Pour Point - The lowest temperature at which a liquid will flow when a test container is tilted.

Silicates - Members of the very widely occurring compounds characterized by the presence of the elements silicon, oxygen, and one or more metals with or without hydrogen.

Toxic - Poisonous

Vapor - A substance in the gaseous state (sometimes restricted to substances in the gaseous state when below their critical points).

Viscosity - The internal resistance offered by a fluid (liquid or gas) to flow. Viscosity is a characteristic property and is a measure of the combined effects of adhesion and cohesion.

Volatile - A substance which evaporates rapidly due to its high vapor pressure.

3.2 Abbreviations. The same abbreviation is used for all tenses, the possessive case, and the singular and plural forms of a given word.

COC - Cleveland Open Cup

F - Fahrenheit

gal - gallon

DoT - Department of Transportation

lb - pound

max - maximum

min - minimum

oz - ounce

pt - pint

4. GENERAL REQUIREMENTS

4.1 Chemical and physical requirements. All values given in tables of chemical and physical requirements are in percent by weight unless otherwise indicated.

4.2 Packaging data and labeling. All liquid and solid chemicals included in this standard shall be packaged in accordance with Federal Specifications PPP-C-300, and PPP-C-301 and all applicable documents mentioned in these specifications.

4.3 Safety. All hazardous chemicals in this standard are indicated as such immediately beneath each item name. General safety and hygienic measures should be exercised in the handling and use of all chemicals. For more specific information on hazardous chemicals the appropriate safety and medical authorities must be consulted in order to determine personal protective measures and environmental controls.

4.4 Shelf life. Factors such as moisture, temperature, type and conditions of container, exposure to sunlight and the atmosphere cause variations in shelf life. Ideal storage conditions are outlined for each item. An approximate period of time after which this material will no longer be suitable for its intended use is also presented. The term ambient temperature denotes temperatures from above freezing to 100°F, but not consistantly over 100°F, when stored out of direct sunlight. This is in keeping with the varied locations of military installations. The term "dry" is usually used to denote an area where condensation does not come in contact with the packages or containers (for example, storing on pallets away from walls in an enclosure or building). Periodic examinations of the containers or material should be made more frequently when storage conditions vary from the ideal. For applications where quality may be critical, each compound should be analyzed prior to use. Shelf life is dated from the date of manufacture. All chemicals in this standard shall not be older than one year from the date of manufacture when purchased except where specified otherwise under storage data.

5. DETAIL REQUIREMENTS

5.1 Name. BOILER COMPOUND
(HAZARDOUS)

5.1.1 Specifications. MIL-B-3242; Boiler Compound, Navy.

5.1.2 Technical description. This boiler compound shall be in powder form mixed in the following proportions by weight (dry basis), anhydrous disodium phosphate - 4 parts, anhydrous sodium carbonate - 3 parts, and dried corn-starch - 1 part.

5.1.3 Use data. This boiler compound is intended for military use in treatment of boiler water obtained only from sea water distillate. Typical commercial applications are the same.

5.1.4 Packaging data and labeling. For military use this boiler compound is packaged in 50 pound quantity fiberboard drums, and 100 pound fiber-board drums.

5.1.5 Storage data. Boiler compound should be stored in a dry area to prevent it from caking. When stored under ideal conditions the material has an indefinite shelf life.

5.2 Name. BOILER COMPOUND, BRIQUETS
(HAZARDOUS)

5.2.1 Specifications. None.

5.2.2 Technical description. Briquets shall be formed under pressure after the ingredients have been thoroughly mixed. Each briquet shall weight from 0.8 to 1 pound, and shall be so shaped as to pass readily through a 3 1/2 inch diameter aperture. When placed in water, briquets shall dissolve slowly and shall neither become soft nor disintegrate within 5 hours of the commencement of submergence.

Table I. - Chemical composition of briquets

Item	Percent
Quebracho or chestnut tannin (sulfited or unsulfited)	14 to 15
Sodium sulfite (90 to 97 percent pure)*	50 to 55
Anhydrous disodium phosphate	14 to 15
Soda ash (ordinary light)	10 to 11
Binder (max)	10

* Impurities to consist of sodium sulfate, sodium carbonate, or equivalent.

5.2.3 Use data. The briquets are intended for military use in the treatment of boiler feed-water. They are to be used where the natural alkalinity of the water is not sufficient to maintain the alkalinity of the boiler water within required limits. The briquets are compounded for use with zeolite softened water which has not been deaerated. Water treated with briquets must be prevented by positive means from mixing with any water supply used for potable purposes. Typical commercial applications are the same.

5.2.4 Packaging data and labeling. For military use briquets are packaged in 100 pound unit quantity steel drums with a lug type cover.

5.2.5 Storage data. This material should be stored in a dry area. When stored under ideal conditions it will have an indefinite shelf life.

5.3 Name. COATING COMPOUND, OXIDE BLACK
(HAZARDOUS)

5.3.1 Specifications. MIL-C-46110; Coating Compound, Oxide Black; for use in blackening ferrous metals to conform to MIL-C-13924, Class 1 (for wrought iron, plain carbon, and low alloy steels only).

5.3.2 Technical description. Oxide black coating compound shall consist of ground flake or granular sodium hydroxide and granular or bead sodium nitrate intimately blended together as a coarse, dust-free material. The

coating compound shall contain no added sulfur compounds other than those present in the basic chemical ingredients. The particle size shall not be greater than 1/4 inch maximum for any dimension. Oxide black as covered by this standard shall be of the following categories:

Alkaline oxidizing process (for wrought iron, plain carbon, and low alloy steel).

Alkaline-chromate oxidizing process (for certain corrosion resistant steels).

Fused salt oxidizing process (for corrosion resistant steel alloys having a draw temperature above 900°F).

Alkaline oxidizing process (for 300 series corrosion resistant steel alloys only).

5.3.3 Use data. Black oxide coatings are particularly suited for moving parts that cannot tolerate the dimensional build-up of more corrosion resisting finishes. They are not recommended on parts going into long-term storage, or for parts subjected to outdoor exposure. The coating presents a pleasing black appearance, frequently employed for decorative purposes or decrease in light reflection. Information on the procedure for blackening including concentration of solution, temperature of solution, and time of immersions are noted in MIL-HDBK-205, Phosphatizing and Black Oxide Coating of Ferrous Metals. Typical commercial application is the same as that for military use.

5.3.4 Packaging data and labeling. For military use black oxide is packaged in 2 pound unit quantity cans and 100 pound unit quantity fiberboard drums with polyethylene bag-type liners which will not be adversely affected by the contents. Each container shall bear a poison label to conform to the Federal Caustic Poison Act and a warning label.

WARNING! CAUSES SEVERE BURNS TO SKIN AND EYES
Avoid contact with skin, eyes, and clothing.
Do not take internally.
When handling wear goggles or face shield.
While making solutions, add slowly to surface of solution to avoid violent spattering.
In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

5.3.5 Storage data. This material should be stored in a dry area. It rapidly deliquesces in the air and absorbs carbon dioxide. Contact with air must be avoided as much as possible. Under ideal conditions it has an indefinite shelf life.

5.4 Name. CORROSION PREVENTIVE, AIRCRAFT ENGINE

5.4.1 Specifications. MIL-C-6529; Corrosion Preventive, Aircraft Engine.

5.4.2 Technical description. The concentrate material shall contain no material of known toxicity, and the vapor shall not cause discomfort or injury. The concentrate material shall be an additive designed to be mixed with lubricating oils.

Table II. - Requirements of corrosion preventive, aircraft engine

Ash content (max percent by weight)	0.015
Carbon residue (max percent by weight)	2.0
Flash point (min)	400°F
Pour point (max)	10°F
Viscosity (Saybolt Universal Second at 210°F)	90 to 110

5.4.3 Use data. For military use the concentrate material is intended, after mixing with lubricating oil, to prevent corrosion damage to aircraft engines and equipment. The mixture for turbojet aircraft engines should be 1 part concentrate to 3 parts lubricating oil qualified under Specification MIL-L-6081, grade 1010, and for reciprocating aircraft engines 1 part concentrate to 3 parts lubricating oil qualified under Specification MIL-L-6082, grade 1100. Typical commercial applications are the same as those for the military.

5.4.4 Packaging data and labeling. For military use corrosion preventive concentrate is packaged in 5 gallon unit quantity pails.

5.4.5 Storage data. Preferably, the containers should be stored on pallets above the ground. Before use, the unit containers shall be thoroughly cleaned free from all dirt, water, or other contaminating materials which will affect satisfactory performance of the corrosion preventive. This material has an indefinite shelf life.

5.5 Name. CORROSION PREVENTIVE, AIRCRAFT ENGINE, GAS TURBINE

5.5.1 Specifications. MIL-C-8188; Corrosion-Preventive Oil, Gas Turbine Engine, Aircraft Synthetic Base.

5.5.2 Technical description. The corrosion-preventive oil shall be transparent, uniform in appearance, and shall be free from sediment and suspended water. Additives to impart oxidation stability, corrosion inhibiting properties, and antiwear properties are permitted, except that metal-organic compounds of titanium are prohibited. If a tricresyl phosphate additive is used, it shall not contain more than one percent of the ortho isomer. The concentrate material shall contain no material of known toxicity, and the vapor shall not cause discomfort or injury.

Table III. - Properties of corrosion-preventive oil

Flash point COC (min)	400°F
Pour point (max)	-75°F
Total acid number (max)	0.30
Viscosity, centistokes at 100°F (min)	11.0
Viscosity, centistokes at 210°F (min)	3.0

5.5.3 Use data. For military use the corrosion-preventive oil is intended for the preservation of turboprop and turbojet engines when used with oil as specified in MIL-L-7808. The corrosion-preventive oil should be capable of limited use, not to exceed 25 hours, as an aircraft engine lubricant and will be used for both preservation and final acceptance runs of aircraft engines requiring the use of Specification MIL-L-7808 oils. Typical commercial applications are the same as those for military use.

5.5.4 Packaging data and labeling. For military use corrosion-preventive oil is packaged in 1 gallon unit quantity cans and 5 gallon unit quantity pails.

5.5.5 Storage data. See 5.4.5.

5.6 Name. CORROSION PREVENTIVE, AIRCRAFT ENGINE, HEAVY OIL

5.6.1 Specifications. MIL-C-5545; Compound Corrosion Preventive, Aircraft Engine, Heavy Oil Type.

5.6.2 Technical description. The corrosion preventive shall not contain materials known to be toxic. It shall be a thoroughly mixed one-to-one (1:1) proportion of the corrosion preventive and any oil conforming to MIL-L-6082 grade 1100. A dye, National Brilliant Oil Blue BMA or an equivalent, shall be completely dissolved in the corrosion preventive, and shall be present as one part in 10,000 by weight for identification purposes.

5.6.3 Use data. The corrosion preventive compound is intended for military use on internal parts and surfaces of engines and equipment to prevent

damage by corrosion. This corrosion preventive compound is to be employed only for static preservation and is to be removed from the engine prior to flight. Typical commercial users are the same as those for the military.

5.6.4 Packaging data and labeling. For military use this corrosion preventive is packaged in 5 gallon and 55 gallon unit quantity drums.

5.6.5 Storage data. Preferably, the containers should be stored on pallets above the ground. Before use, the unit containers shall be thoroughly cleaned free from all dirt, water, or other contaminating materials which will affect satisfactory performance of the corrosion preventive. This material has an indefinite shelf life.

5.7 Name. CORROSION PREVENTIVE, SOLUBLE OIL

5.7.1 Specifications. MIL-C-4339; Corrosion Preventive, Soluble Oil for Water Injection Systems.

5.7.2 Technical description. The soluble oil shall contain not less than 85 percent, by weight, mineral oil and shall contain suitable emulsifying and corrosion preventive agents. These agents shall have a petroleum metal sulfonate as a principal constituent. The soluble oil shall contain a minimum of fatty acids and fatty acid soaps. The finished oil shall be clear and homogeneous. It shall not contain suspended matter, or sediment.

Table IV. - Properties of corrosion preventive, soluble oil

Ash content (max percent by weight)	0.20
Pour point (max)	30°F
pH (temp of 77°F)	8.5 to 10.0
Water content (max percent by weight)	3.0

5.7.3 Use data. For military use the finished oil is intended to be used to prevent corrosion caused by water-alcohol mixtures in ground handling equipment and aircraft water injection systems. This oil is not intended for preservation of other components. Typical commercial applications are the same as those for the military.

5.7.4 Packaging data and labeling. For military use corrosion preventive soluble oil is packaged in 1 and 5 gallon unit quantity cans.

5.7.5 Storage data. See 5.4.5

5.8 Name. GUM PREVENTIVE COMPOUND, GASOLINE (HAZARDOUS)

5.8.1 Specifications. VV-G-800; Gum Preventive Compound, Gasoline.

5.8.2 Technical description. The gasoline gum preventive shall be a mixture of antioxidant of the aminophenol of phenylenediamine type, and metal deactivator of the disalicylidene propylenediamine type dissolved in toluene. The compound material shall provide protective performance equal to or better than the comparison formulation listed

41.0 grams N, N'-disecondary butyl-para-phenylenediamine
10.3 grams N, N'disalicylidene-1,2-diaminopropane
1 gallon toluene (toluol) conforming to TT-T-548.

5.8.3 Use data. For military use gasoline gum preventive is intended to be added to gasoline to retard the formation of gum in small power units and vehicle fuel tanks during extended storage periods. It is to be added at the rate of 3 parts by volume gum preventive to 1000 parts by volume of gasoline (1 ounce gum preventive per 2-1/2 gallon gasoline). For use in the tropics it is to be added at the rate of 6 parts by volume of gum preventive to 1000 parts by volume of gasoline. Typical commercial uses are the same.

5.8.4 Packaging data and labeling. For military use gum preventive compound is packaged in 4 ounce unit quantity bottles and 1 gallon unit quantity cans. Each container shall bear the following label:

WARNING!
FLAMMABLE, VAPOR HARMFUL
Keep away from heat and open flame.
Keep containers closed.
Use with adequate ventilation, avoid prolonged breathing of vapor.
Avoid prolonged or repeated contact with the skin.

5.8.5 Storage data. This material should be stored at an ambient temperature of not more than 100°F, in a dry and well ventilated area away from heat and open flame. Before use the unit containers shall be thoroughly cleaned free from all dirt, water, or other contaminating materials which will affect satisfactory performance of the gum preventive compound. When stored under ideal conditions this material will have an indefinite shelf life.

5.9 Name. INHIBITOR, CORROSION, LIQUID COOLING SYSTEM

5.9.1 Specifications. O-I-490; Inhibitor, Corrosion, Liquid Cooling System.

5.9.2 Technical description. The corrosion inhibitor shall consist of a blend of sodium borate, mercaptobenzothiazole, and disodium phosphate mixed in the proportions necessary to conform to the weight requirements specified in Table V. The raw materials used in the manufacture of the corrosion

inhibitor shall be intimately mixed and processed so as to produce a uniform free-flowing product.

Table V. - Weight requirements for 6 and 8-1/2 ounce packages of corrosion inhibitor for liquid cooling systems

Composition	6 oz (170g) Package weight in grams		8-1/2 oz (242g) Package weight in grams	
	min	max	min	max
Mercaptobenzothiazole	24.8	26.6	35.3	36.7
$Na_2B_4O_7$, anhydrous	67.0	68.8	95.5	97.9
Na_2HPO_4, anhydrous	14.7	16.5	21.1	23.5

5.9.3 Use data. For the military this corrosion inhibitor is intended for use in the cooling systems of liquid-cooled internal combustion engines; specifically to inhibit water and ethylene glycol antifreeze. It is intended for use at the optimum rate of 1 ounce of the inhibitor to 2 quarts of water. This inhibitor shall not be used in the cooling system of liquid cooled aircraft engines. Typical commercial application is the same as that for military.

5.9.4 Packaging data and labeling. For military use this material is packaged in 6 ounce and 8-1/2 ounce unit quantity cans. Each container shall be labeled as follows:

"Contents".....ounces by weight (insert 6 or 8-1/2 as applicable.)
"Direction for use - Use one (1) ounce of inhibitor to two (2) quarts of water in the cooling system of internal combustion engines. Do not use in liquid cooled aircraft engines."

5.9.5 Storage data. This material should be stored at an ambient temperature of not more than 100°F, and in a dry place. When stored under ideal conditions the maximum shelf life is approximately five years.

5.10 Name. INHIBITOR CORROSION, LIQUID COOLING SYSTEM
Dichromate

5.10.1 Specifications. MIL-I-19528; Inhibitor, Corrosion, Liquid Cooling System, (Dichromate Type).

5.10.2 Technical description. The inhibitor shall consist of a solution of the ingredients listed in Table VI; the quantities shown in the table

are those required for one gallon of the solution. Prior to packing in containers the inhibitor shall be filtered to remove all residue so the solution will be clear and free from any sediment or foreign matter.

Table VI. - Composition of corrosion inhibitor, (dichromate type)

Ingredient	Quantity
Sodium dichromate - $Na_2Cr_2O_7.2H_2O$	46.0 ounces
Sodium hydroxide - NaOH (min 98 percent)	12.9 ounces
Distilled water - H_2O	113.9 ounces

5.10.3 Use data. For military use this corrosion inhibitor is intended to retard chemical reactions in closed water cooling systems of internal combustion engines. Typical commercial applications are the same.

5.10.4 Packaging data and labeling. For military use this corrosion inhibitor, is packaged in 1 gallon and 5 gallon unit quantity cans. Each container shall bear the following label:

COOLING SYSTEM CORROSION INHIBITOR
A DICHROMATE TYPE CORROSION INHIBITOR
FOR THE FRESH WATER COOLING SYSTEMS
OF INTERNAL COMBUSTION ENGINES.

DANGER!
CAUSES SEVERE BURNS TO SKIN AND EYES.
MAY CAUSE RASH OR EXTERNAL ULCERS.

Do not get in eyes, on skin, on clothing. Do not take internally. When handling, wear goggles or face shield. While making solutions, add slowly to surface of solution to avoid violent spattering. In case of contact, immediately flush skin with plenty of water; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

Initial and weekly doses should be added in accordance with the following:

Capacity Cooling System	Initial Dose	Weekly Dose
25 gal	1/2 pt (8 oz)	1 oz
50 gal	1 pt	2 oz
100 gal	2 pts	4 oz

5.10.5 Storage data. Containers of corrosion inhibitor should be stored at an ambient temperature of not more than 100°F and in a dry area out of sunlight. The containers should be kept tightly closed. Under these ideal conditions this material will have an indefinite shelf life.

5.11 Name. INHIBITOR, CORROSION, LUBRICATING OIL (INDOOR USE)

5.11.1 Specifications. None.

5.11.2 Technical description. Corrosion inhibitor, lubricating oil, shall be a solvent type rust inhibiting oil with very good water dispersing properties. It shall be an all around thin film rust preventive for indoor exposure only that meets accepted salt spray and humidity requirements. It shall have a flash point of not less than 150°F. The useable temperature range of this corrosion inhibitor shall be 68°F to 77°F.

5.11.3 Use data. For military use corrosion inhibitor lubricating oil, is intended to be used as a rust inhibitor on parts or materials which have been black oxide finished. It will also protect highly finished parts during working processes. The solvent will evaporate leaving a transparent residual film. Typical commercial applications are the same as those for the military.

5.11.4 Packaging data and labeling. For military use corrosion inhibitor is packaged in 1 gallon unit quantity cans.

5.11.5 Storage data. The corrosion inhibitor should be in covered storage away from heat or open flame and it should be kept from freezing. When stored under ideal conditions this material has an indefinite shelf life.

5.12 Name. INHIBITOR, CORROSION, LUBRICATING OIL (OUTDOOR USE)

5.12.1 Specifications. None.

5.12.2 Technical description. Corrosion inhibitor lubricating oil, for outdoor use is formulated from refined petroleum oil, petroleum sulfonate, petroleum oxidate, an anti-oxidant, and a coupling agent. The moisture absorbing soft film shall be 0.0015 inch thick. It shall have a light amber color with a mild petroleum oil odor, and with a flash point of not less than 180°F.

5.12.3 Use data. For military use corrosion inhibitor, is intended to be used as a rust and corrosion inhibitor for between-flight protection of jet turbine compressors and as a varnish and carbon remover for jet engine compressors. Typical commercial application is the same as that for the military.

5.12.4 Packaging data and labeling. For military use corrosion inhibitor, is packaged in 5 gallon unit quantity pails and 55 gallon unit quantity drums.

5.12.5 Storage data. Corrosion inhibitor, lubricating oil, should be stored in a covered storage area to prevent it from freezing. Containers should be kept closed or its solvent phase will evaporate increasing its viscosity and film thickness. The shelf life of this material under normal storage conditions shall exceed one year but should be checked periodically after it is a year old.

5.13 Name. INHIBITOR, CORROSION, PETROLEUM FUEL

5.13.1 Specifications. MIL-I-25017; Inhibitor, Corrosion, Fuel Soluble.

5.13.2 Technical description. Corrosion inhibitor, fuel soluble, shall be a homogeneous mixture of material uniform in appearance and visually free from grit, undissolved water, or other adulteration. The material shall be readily and completely soluble in all grades of automotive and aircraft engine fuels. The composition of this material has no limitations and is subject to any change according to required serviceability of the inhibitors. There shall be no adverse reactions on the properties of fuels to which it is added and it shall be thoroughly compatible with the fuel. It shall have a pour point of 0°F or less. The minimum allowable concentration added to the fuel shall not cause precipitation, cloudiness, or other evidence of noncompatibility. Corrosion inhibitor shall not cause injury or irritation to the skin and shall not emit poisonous, noxious, or irritant vapors.

5.13.3 Use data. For military use the corrosion inhibitor is intended as an additive in automotive and aircraft engine fuels for the prevention of corrosion in fuel handling, transportation, and storage equipment. The maximum allowable concentration for use shall be twenty pounds of finished corrosion inhibitor per 1000 barrels of fuel. Typical commercial applications are the same as those for the military.

5.13.4 Packaging data and labeling. For military use corrosion inhibitor, petroleum fuel, is packaged in 55 gallon unit quantity drums.

5.13.5 Storage data. See 5.6.5.

5.14 Name. INHIBITOR, CORROSION, SOLUBLE-OIL

5.14.1 Specifications. MIL-I-19841; Inhibitor Corrosion, Soluble-Oil.

5.14.2 Technical description. This material is a petroleum base soluble-oil corrosion inhibitor, compounded with such additives as necessary to minimize rust formation and corrosion in water systems. The pour point of the compound shall not exceed 30°F. Water content shall not exceed 3 percent. Corrosion inhibitor shall not cause injury or irritation to the skin and shall not emit poisonous, noxious, or irritant vapors.

5.14.3 Use data. For military use the corrosion inhibitor, soluble-oil, is intended to minimize rust formations and corrosion in water systems. Typical commercial application are the same.

5.14.4 Packaging data and labeling. For military use corrosion, inhibitor, soluble-oil, is packaged in 5 gallon unit quantity pails and 55 gallon unit quantity drums.

5.14.5 Storage data. See Storage data 5.6.5.

5.15 Name. INHIBITOR, CORROSION, VAPOR BARRIER (HAZARDOUS)

5.15.1 Specifications. MIL-I-22110; Inhibitors, Corrosion, Volatile Crystalline.

5.15.2 Technical description. Corrosion inhibitor, vapor barrier, shall be a composition of dicyclohexylamine nitrate and diisopropylamine nitrate. It shall be a single phase chemical which is volatile, vaporizing at a constant rate. The vapor shall be odorless, non-toxic, invisible, and rust inhibiting. This composition shall neutralize the action of oxygen and moisture, thus making it impossible for rust to form.

5.15.3 Use data. Corrosion, inhibitor, vapor barrier, is intended for military use as a preservative for ferrous metals, aluminum-base alloys, components containing zinc plate, cadmium, zinc base alloys, magnesium-base alloys, lead-base alloys, and alloys of other metals (including solders and brazing alloys) having less than 30 percent zinc and 9 percent lead. Direct contact with non-ferrous metals except aluminum and aluminum-base alloys shall be avoided. Packs containing this inhibitor must be sealed to prevent escape of vapor corrosion inhibitor vapors. Typical commercial applications are the same.

5.15.4 Packaging data and labeling. For military use corrosion inhibitor, vapor barrier, is packaged in 2 ounce unit quantity jars, 1 pound unit quantity cans, and 5 pound unit quantity cans. Each package shall bear the following precautionary label:

WARNING!
Use with adequate ventilation.
Wash hands thoroughly with soap
and water before handling or
eating food.
KEEP IN A COOL, DRY PLACE.

5.15.5 Storage data. Corrosion inhibitors, vapor barrier, shall be stored at an ambient temperature of not more than 100°F an in a dry area keeping containers tightly sealed to prevent the escape of vapors. Containers shall be checked every six months for volatility of composition.

5.16 Name. INHIBITOR, CORROSION, WATER SOLUBLE (HAZARDOUS)

5.16.1 Specifications. None.

5.16.2 Technical description. Water soluble corrosion inhibitor is in reality a rust inhibitor in powder form and the chemical analysis is as follows:

Calcium oxide CaO	10 percent
Sodium chromate $Na_2 CrO_4$	3 percent
Sodium phosphate tribasic Na_3PO_4	87 percent

5.16.3 Use data. For military use water soluble corrosion inhibitor is used in conjunction with an abrasive in the cleaning of ferrous metals. After cleaning, it is used as a rinse to prevent rust and corrosion of ferrous metals. It will increase the inside storage time of ferrous metals, and improve paint adhesion results. Typical commercial applications are the same.

5.16.4 Packaging data and labeling. For military use this corrosion inhibitor is packaged in 50 pound unit quantity fiber drums.

5.16.5 Storage data. This material should be stored in a warehouse to avoid contact with water. Containers that have been opened should be carefully resealed. Under normal storage conditions this material will have a shelf life in excess of three years and under ideal conditions, its shelf life is indefinite.

5.17 Name. INHIBITOR, PICKLING CHEMICAL (FOR USE WITH HYDROCHLORIC ACID)

5.17.1 Specifications. MIL-I-17433; Inhibitor, Pickling Chemical Hydrochloric Acid Bath.

5.17.2 Technical description. Pickling chemical inhibitor which when added to hydrochloric (muriatic) acid, diminishes the corrosive attack of the acid on metals and shall be a liquid nonfoaming product. The inhibitor shall contain not more than 0.01 percent of arsenic and be capable of uniformly dissolving in hydrochloric acid for maximum effectiveness immediately on mixing. The inhibited hydrochloric acid solution shall not stain metal nor leave films or deposits on metal surfaces.

5.17.3 Use data. For the military, this inhibitor is intended to be added to hydrochloric acid solutions and used in the removal of mill scale and waterborne deposits from the water side of the equipment. It shall be used in the dilution recommended by the manufacturer and only in conjunction with hydrochloric (muriatic) acid. Typical commercial applications are the same.

5.17.4 Packaging data and labeling. For the military this inhibitor is packaged in 1 gallon unit quantity cans. The containers shall be durable and legibly labeled with complete and concise directions on the use of the inhibitor in preparing inhibited hydrochloric acid.

5.17.5 Storage data. This material should be stored at an ambient temperature of not more than 100°F and in a dry area. Opened containers should be used as soon as practical. After six months storage, this material should be tested before use.

5.18 Name. INHIBITOR, PICKLING CHEMICAL, (FOR USE WITH SULFURIC ACID)

5.18.1 Specifications. O-I-501; Inhibitors, Pickling (For Use With Sulfuric Acid).

5.18.2 Technical description. This inhibitor shall be a formulation of compounds which when added to sulfuric acid pickling baths, diminish the attack of acid on descaled areas without appreciably retarding the descaling rate. The inhibited acid solution shall not stain the steel, and shall not leave films which would interfere with galvanizing, tinning, painting, electroplating, or other processes used for coating steel. The inhibitors shall not contain more than 0.10 percent arsenic. Inhibitors, shall be available in solid and liquid form and shall be either foaming or nonfoaming in type as specified in the contract or order.

5.18.3 Use data. For the military this inhibitor is intended to be used in the pickling of steel plate forgings and other steel articles. This inhibitor contains long-life, heat-stable products, and care should be taken to avoid excessive inhibitor build-up in the pickling bath and consequent long pickling cycles. It should be used only in conjunction with sulfuric acid, and should be used in the dilution as recommended by the manufacturers. Typical commercial applications are the same.

5.18.4 Packaging data and labeling. For military use, liquid form inhibitors are packaged in 1 and 5 gallon unit quantity cans. Powder form inhibitors are packaged in 50 pound and 200 pound unit quantity drums.

5.18.5 Storage data. This material should be stored in a cool dry area. The material should be tested before use after six months.

5.19 Name. LEAK PREVENTIVE COMPOUND, RADIATOR

5.19.1 Specifications. O-L-160; Leak Preventive Compound, Radiator.

5.19.2 Technical data. Cooling system leak preventive compound shall consist of a volatile solution containing a filler, a water-dispersible binder, and additives, such as preservatives and rust inhibitors, required to prevent deterioration of the compound within the container and to protect the cooling system metals. The material shall be nonabrasive and shall be free of silicates or materials subject to fungal or bacterial attack for which no preservative is provided, and free of any other material which may have a harmful effect on the radiator or other components of the cooling system of an engine. The compound shall not clog the tubes of the radiator and shall be readily removable from the cooling system by means of cooling system cleaners.

5.19.3 Use data. For military use the cooling system leak preventive compound is intended as a temporary seal for small cracks and pinhole leaks in a high velocity zone. The water soluble binder found in a leak preventive compound usually hardens only when in contact with air and heat. This compound is not intended to stop seepage of the coolant at the circulating pump shaft, nor is it intended to function as an antiseepage and cooling system conditioner. Typical commercial applications are the same.

5.19.4 Packaging data and labeling. For military use radiator leak preventive compound is packaged in 12 ounce unit quantity cans. Each container shall be marked with instructions for use.

5.19.5 Storage data. Radiator leak preventive compound should be stored in the package in which it is shipped until ready for use. When the containers are kept tightly closed this material has an indefinite shelf life.

5.20 Name. LEAK PREVENTIVE COMPOUND, RADIATOR, ANTISEEPAGE.

5.20.1 Specifications. MIL-C-51047; Compound, Antiseepage, For Cooling System, Internal Combustion Engine.

5.20.2 Technical description. Cooling system antiseepage compound shall be in the form of a loose granular material and shall be essentially a mixture of ground almond and ground roasted peanut shells, a polyvinyl alcohol, and a small amount of antirust material such as castor oil. The material shall be nonabrasive and free of any material which may have a harmful effect on the radiator or other components of the cooling system of an internal combustion engine. The compound shall not clog the tubes of the radiator or heater and shall be readily removable from the cooling system by means of cooling system cleaners.

Table VII. - Chemical requirements of leak preventive compound, radiator

Characteristic	Requirements	
	min	max
Apparent density of water insoluble material	1.10	1.15
Ash content of water insoluble material	0.5	1.0
Neutralization number	---	4.0
pH value of water mixture	5.1	5.6
pH value of ethylene glycol mixture	7.4	7.9
Polyvinyl alcohol	13.5	---
Volume of water insoluble material, milliliters	---	45.0
Water extractable material (other than polyvinyl alcohol), percent by weight	---	10.0
Water insoluble material, milliliters (ml)	75.0	---

5.20.3 Use data. For military use antiseepage compound is intended for sealing cracks and crevices in the cooling system of internal combustion engines, especially wet sleeve engines, and for stopping seepage of the coolant into the cylinder combustion chamber and into the crankcase of the engine. The compound is also intended for sealing pinhole leaks in the radiator and cooling system of internal combustion engines. The compound is not intended to stop seepage of the coolant at the circulating pump shaft. The compound is not intended to replace, and must be used in conjunction with, a corrosion inhibitor meeting specification O-I-490. Typical commercial applications are the same.

5.20.4 Packaging data. For military use radiator leak preventive compound, is packaged in 1.5 ounce unit quantity cans.

5.20.5 Storage data. Radiator leak preventive compound, should be stored in the packages in which they are received. This material has an indefinite shelf life.

5.21 Name. PHOSPHATE COATING, METAL

5.21.1 Specifications. MIL-P-50002; Phosphate Coating Compounds, For Phosphating Ferrous Metals; MIL-P-16232; Phosphate Coatings, Heavy, Manganese or Zinc Base (for Ferrous Metals); and TT-C-490; Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings.

5.21.2 Technical description. The raw materials used in the manufacture of these compounds shall be high quality, properly compounded and processed. The compounds shall not contain more than 0.0005 percent by weight of arsenic, and shall be free of dirt, wood chips, or other foreign material. The liquid compounds as furnished shall be clear and free from insoluble matter. The compound, manganese phosphate base powder, shall be a free flowing, granular, manganese dihydrogen phosphate material conforming to the chemical requirements of Table VIII.

Table VIII. - Chemical requirements of manganese phosphate base, powder

Ingredient	Requirement Percent by weight
Manganese Mn, min	18
Phosphate, PO_4, min	65
Nickel, Ni, min	0.1
Ratio of PO_4 to Mn, max	3.6

Manganese phosphate base compound, shall consist of an aqueous solution of manganese dihydrogen phosphate plus accelerators and shall conform to the chemical requirements of Table IX.

Table IX. - Chemical requirements of manganese phosphate base, liquid

Ingredient	Requirement Percent by weight
Manganese, Mn, min	6.2
Phosphate, PO_4, min	25.0
Nitrate, NO_3, min	1.0
Nickel, Ni, min	0.1

Zinc phosphate base compound, shall consist of an aqueous solution of zinc dihydrogen plus a nitrate accelerator conforming to the chemical requirements of Table X.

Table X. - Chemical requirements of zinc phosphate base, liquid

Ingredient	Requirement Percent by weight
Phosphate, PO_4, min	30
Nitrate, NO_3, min	15
Nickel, Ni, min	0.1
Zinc, Zn, min	$\frac{\% PO_4 + \% NO_3}{3.9}$

5.21.3 Use data. For military use zinc phosphate coating (light) is used for bonding of paint to iron, steel, zinc-coated steel, and aluminum. Manganese phosphate coating (heavy) is used for bearing surfaces and zinc phosphate coating (heavy) is used for non-bearing surfaces. These coatings are for cleaning metals and pretreatment for application of organic coatings (paint, varnish, lacquer, enamel, etc and are not to be used on parts subjected to outdoor exposure without coating. These coatings are not to be used on electrical wiring, coil steel spring or other spring steel. Typical commercial applications are the same as those for military use.

5.21.4 Packaging data and labeling. For military use liquid phosphate coating compounds are packaged in 1 gallon unit quantity polyethylene bottles, 13 gallon unit quantity polyethylene carboys, and 15 gallon unit quantity polyethylene drums. Powdered phosphate coating compounds are packaged in moisture resistant fiber drums.

5.21.5 Storage data. Phosphate coating compounds should be stored in a covered dry storage area, preferrably in a warehouse. These compounds should be kept from freezing. When stored under ideal storage conditions these compounds have an indefinite shelf life.

Notice. - Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.

User activities: Navy - MS, SH

Review activities: Army - MD, MI
Navy - AS

Assignee activity: Defense General Supply Center

Custodians: Army - MU
Navy - AS
Air Force - 68

Preparing activity: Army - MU

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