

MIL-STD-1214

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MILITARY STANDARD

ESTERS AND METAL

ORGANICS, TECHNICAL GRADE



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DEPARTMENT OF DEFENSE
Washington D. C. 20301

Esters and Metal Organics, Technical Grade

MIL-STD-1214

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 the Commanding Officer, Edgewood Arsenal, ATTN: SMUEA-TSE-SM, Edgewood Arsenal, Maryland 21010.

FOREWORD

This is the first book format standard generated on esters and metal organics, technical grade. This document is mandatory for use by all departments and agencies of the Department of Defense in selecting 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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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 all military standard esters and metal organics. 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 technical grade industrial esters and metal organics for application by the Department of Defense. This standard covers the following sixty items.

| <u>NAME</u> | <u>NO. OF ITEMS</u> |
|--|---------------------|
| ALUMINUM STEARATE, TECHNICAL | 1 |
| AMYL ACETATE, TECHNICAL | 2 |
| n-BUTYL ACETATE, TECHNICAL | 3 |
| n-BUTYL STEARATE, TECHNICAL | 3 |
| CALCIUM OXALATE, TECHNICAL | 1 |
| CALCIUM RESINATE, TECHNICAL | 2 |
| CALCIUM STEARATE, TECHNICAL | 1 |
| COPPER NAPHTHENATE, TECHNICAL | 1 |
| DIBUTYL PHTHALATE, TECHNICAL | 3 |
| DIETHYLENE GLYCOL MONOETHYL ETHER ACETATE, TECHNICAL | 2 |
| DIETHYL PHTHALATE, TECHNICAL | 1 |
| b,b'-DIHYDROXYDIETHYL SULFIDE, TECHNICAL | 3 |
| DIMETHYL PHTHALATE, TECHNICAL | 1 |
| DIOCTYL PHTHALATE, TECHNICAL | 5 |
| DIPHENYLPHTHALATE, TECHNICAL | 1 |
| ETHYL ACETATE, TECHNICAL | 4 |
| ETHYLENE GLYCOL MONOETHYL ETHER ACETATE, TECHNICAL | 2 |
| FERRIC AMMONIUM CITRATE, TECHNICAL | 2 |
| FERRIC AMMONIUM OXALATE, TRIHYDRATE, TECHNICAL | 2 |
| FERRIC OXALATE, TECHNICAL | 1 |
| FERRIC SODIUM OXALATE, TECHNICAL | 1 |
| HYDROGENATED METHYL ABIETATE, TECHNICAL | 2 |
| LEAD ACETATE, TRIHYDRATE, TECHNICAL | 1 |
| LECITHIN, TECHNICAL | 1 |
| LITHIUM STEARATE, TECHNICAL | 1 |
| P-METHYLAMINOPHENOL SULFATE, TECHNICAL | 1 |
| NICKEL FORMATE, DIHYDRATE, TECHNICAL | 1 |
| SODIUM ACETATE, ANHYDROUS, TECHNICAL | 1 |
| TITANIUM POTASSIUM OXALATE, DIHYDRATE, TECHNICAL | 1 |
| TRI-n-BUTYL BORATE, TECHNICAL | 1 |
| TRICRESYL PHOSPHATE, TECHNICAL | 6 |
| TRIPHENYL PHOSPHATE, TECHNICAL | 1 |
| ZINC STEARATE, TECHNICAL | 1 |

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

2. REFERENCED DOCUMENTS

The issues of the following documents in effect on the date of invitations for bid from a part of this standard to the extent specified herein.

Federal Specifications

| | |
|-----------|---|
| 0-E-760 | Ethyl Alcohol (Ethanol), Denatured Alcohol, and Proprietary Solvent |
| 0-F-166 | Ferric Ammonium Oxalate, Trihydrate, Technical, Blueprint Processing. |
| 0-M-232 | Methanol (Methyl Alcohol) |
| PPP-C-300 | Chemicals, Liquid; Packaging and Packing of |
| PPP-C-301 | Chemicals, Dry and Paste; Packaging and Packing of |
| TT-A-511 | Amyl Acetate (For use in organic coatings) |
| TT-B-838 | Butyl Acetate; Normal (For use in organic coatings) |
| TT-D-301 | Dibutyl Phthalate; Plasticizer (For use in organic coatings) |
| TT-E-751 | Ethyl Acetate, Technical, Organic Coatings Use |
| TT-I-735 | Isopropyl Alcohol |
| TT-N-95 | Naphtha, Aliphatic |
| TT-N-97 | Naphtha, Aromatic |
| TT-S-735 | Standard Test Fluids, Hydrocarbon |
| TT-T-548 | Toluene, Technical |
| TT-T-656 | Tricresyl Phosphate |
| TT-T-662 | Triphenyl Phosphate (For use in organic coatings) |

Military Specifications

| | |
|-------------|---|
| JAN-C-263 | Calcium Stearate |
| JAN-C-628 | Calcium Oxalate (For use in ammunition) |
| JAN-D-242 | Diethylphthalate (For use in explosives) |
| JAN-D-709 | Dimethylphthalate (For use in explosives) |
| MIL-A-15206 | Aluminum Stearate |
| MIL-B-21465 | Butyl Stearate-Normal |
| MIL-C-20470 | Calcium Resinate |
| MIL-D-218 | Dibutylphthalate Technical |
| MIL-D-13796 | Di-2 Ethylhexylphthalate |
| MIL-D-14130 | b,b'-Dihydroxydiethyl Sulfide, Technical (Thiodiglycol) |
| MIL-D-38705 | Diocetyl Phthalate, Technical |
| MIL-D-50006 | Diphenylphthalate, Technical |
| MIL-E-7125 | Ethylene Glycol Monoethyl Ether Acetate |

| | |
|-------------|---|
| MIL-L-3061 | Lecithin (for use in explosives) |
| MIL-L-51131 | Lithium Stearate |
| MIL-M-17231 | Mildew Resistant Compound, Copper Napthenate |
| MIL-S-12055 | Sodium Acetate, Anhydrous, Technical |
| MIL-T-9188 | Tricresyl Phosphate, for use as an Aviation Gasoline Additive |

Standard

Fed. Std. No. 102 Preservation, Packaging, and Packing Levels

Rules and Regulations

DoT Shipping Regulations, Title 49 - Chapter I of the Code of Federal Regulations.

3. GLOSSARY

3.1: Definitions

Anhydride - An oxide which, when combined with water, yields an acid or a base.

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

Autoignition Point - The temperature at which the combustion of a substance will occur spontaneously. This action is independent of the presence of an ignitor such as an electrical spark or flame.

Boiling Point - The temperature at which the vapor pressure of a substance is equal to the external pressure. In this standard, if there is no mention of the external pressure at which the boiling point was determined, it is understood to be approximately 1 atmosphere (760 mm mercury).

Centipoise - A standard unit of viscosity equal to 0.01 poise. A poise is the unit of viscosity expressed as one dyne per second per square centimeter.

Cloud Point - The temperature of a petroleum oil at which paraffin wax or other solid substances begin to crystallize out or separate from solution when the oil is chilled under definite prescribed conditions.

Colloid - The stage between solution and suspension of a solid in a liquid with no apparent settling. In general, particle diameters range from about 0.2 microns to about 0.005 microns in such colloidal solutions (suspensions).

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Decomposition - The chemical separation of a substance into two or more simpler substances, which may differ from each other and from the original substance.

Deliquescent - Able to take up water vapor until dissolved.

Density - The concentration of matter expressed as a ratio of its mass per unit volume.

Dextrin - A soluble gummy carbohydrate formed by the decomposition of starch by heat, acids, or enzymes.

Dropping Point - The temperature at which a lubricating grease passes from a semisolid to a liquid state under prescribed conditions of the test.

Explosive Limits - When combustible vapor is mixed with air in the proper proportions, ignition will produce an explosion. The proper proportion is called the explosive range. The explosive range includes all concentrations of a mixture of flammable vapor or gas in air, in which a flash will occur or a flame will travel if the mixture is ignited. The lowest percentage at which this occurs is the lower explosive limit; and the highest percentage, the upper explosive limit. Explosive limits are expressed in percent by volume of vapor in air and, unless otherwise specified, under normal conditions of temperature and pressure.

Formula Weight - The sum of the atomic weights of all the atoms appearing in a chemical formula. In this standard the formula weight is computed according to the international atomic weight values of 1961.

Freezing Point - The temperature at which a liquid and solid exist together in equilibrium and the transition from a liquid to a solid occurs.

Hydrate - A compound formed by the bonding of molecules of water with other molecules or atoms.

Hydrolysis - A double decomposition reaction involving the splitting of water into its ions and the formation of a weak acid or base or both.

Hygroscopic - Able to absorb moisture from the atmosphere but not particularly enough to dissolve. All deliquescent substances are hygroscopic, but not all hygroscopic substances are deliquescent.

Incendiary - Pertaining to or designating missiles containing chemicals which ignite upon bursting of the shell.

Iodine Number - The percentage of iodine that will be absorbed by a chemically unsaturated substance in a given time under arbitrary conditions. A measure of unsaturation.

Melting Point - The temperature at which a liquid and a solid exist together in equilibrium and the transition from a solid to a liquid occurs.

Miscible - The property of liquids which enables them to be mixed with one another in all proportions without separation, or to exhibit mutual solubility in all proportions.

Penetration - The depth, in tenths of a millimeter, that a standard cone penetrates a sample of lubricating grease that has been agitated in a standard grease worker under prescribed conditions of weight, temperature, and time, thereby measuring its consistency.

Refractive Index - A constant characteristic of each substance which represents the ratio of the velocity of light in a vacuum to that in the substance.

Saponification Number - The number of milligrams of potassium hydroxide required to saponify one gram of a sample of an ester or mixture.

Specific Gravity - The ratio of the mass of a body to the mass of an equal volume of water at 4°C or other specified temperature. In this standard the first temperature indicates the temperature of the substance and the second indicates the temperature of the water it is referred to.

Technical Grade - Denotes a quality of chemicals which are generally used for industrial solvents and manufacturing applications. Generally, specific processes are not employed by the manufacturer to limit all the impurities, aside from the normal precautions which are taken in the manufacturing process. A technical chemical may be specially processed to reduce specific impurities so as to suit the chemical to a given industrial application. In such cases, the identification of the items must be further expanded to indicate the specific impurities limitation.

Vapor Pressure - The pressure exerted when a solid or liquid is in equilibrium with its own vapor. The vapor pressure is a function of the substance and of the temperature.

Viscosity - The 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. It is normally expressed in poises, but may be expressed in values ascribed by individuals who devised scales of values which suit their particular needs. In this standard, the Gardner - Holdt Scale is used in one instance with values of Z, and Z₂ expressed. This scale designates units of

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viscosity by letters of the alphabet with the letter A equal to approximately 0.5 poise and the letter Z equal to approximately 22.7 poises. Subscript numerals are added in descending order to the A for values below 0.5 poise and in ascending order to the Z for viscosities greater than 22.7 poises.

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

APHA - American Public Health Association

ASTM - American Society for Testing and Materials

bp - boiling point

C - Celsius (Centigrade)

DoT - Department of Transportation

F - Fahrenheit

FW - formula weight

gal - gallon

gm - gram

IUPAC - International Union of Pure and Applied Chemistry

max - maximum

mg - milligram

MIL-STD - Military Standard

min - minimum

ml - milliliter

mm - millimeter

pct - percent

wt - weight

4. GENERAL REQUIREMENTS

4.1 Chemical and Physical Requirements. When military or federal specifications establish requirements for degrees of purity of the chemicals listed herein, those chemical and physical properties affected are tabulated as requirements. When no specific limitations are imposed or no specification exists, the chemical and physical properties are tabulated as constants or typical properties.

4.2 Nomenclature. The Department of Defense item names as used throughout this standard, are in capital letters. Other names that are sometimes used commercially are in small letters immediately beneath.

4.3 Packaging Data and Labeling. All liquid chemicals included in this standard shall be packaged in accordance with PPP-C-300 and all applicable documents mentioned in this specification. All dry and paste chemicals shall be packaged in accordance with PPP-C-301 and all applicable documents mentioned in this specification. All chemicals included in this standard shall be packaged and packed to the protection level as required in accordance with Federal Standard No. 102.

4.4 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.

4.5 Shelf Life. Factors such as moisture, temperature, type and condition of container and exposure to sunlight and the atmosphere cause variations in shelf life. The chemicals covered by this standard, unless otherwise stated, are considered to have an indefinite shelf life, regulated for the most part by the rate of deterioration of the containers and closures. The term "cool" denotes temperatures from above freezing up to 110 degrees Fahrenheit but not consistently over 100 degrees when stored out of direct sunlight. The term "dry" is usually used to denote an area where condensation does not come in contact with the packages or contents.

4.6 Solubility Data. Solubility is given only for the most common solvents.

4.7 Temperature. If the temperature at which a property was determined is not specified, it is understood to be room temperature (20 to 25°C or 68 to 77°F).

4.8 Use Data. Typical commercial uses are given without regard to specific grades.

4.9 Substitutability and interchangeability. None of the chemicals in this standard are completely interchangeable with other chemicals. Certain chemicals in this standard may be used as substitutes for specific application of other chemicals. This limited application would be at the discretion of the user.

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5. DETAIL REQUIREMENTS

5.1 Name. ALUMINUM STEARATE TECHNICAL $Al(C_{18}H_{35}O_2)_3$ FW 877.42
Aluminum Tristearate

5.1.1 Specifications. MIL-A-15206, Aluminum Stearate.

5.1.2 Technical description. Aluminum stearate is a tribasic soap. This compound is a white powder having a neutral to slightly fatty-acid odor, a specific gravity of 1.010, and a melting point of 103°C. It is insoluble in water, but is soluble in alcohol, benzene, turpentine, and alkalis.

Table I - Chemical and physical requirements of aluminum stearate, technical

| Property | Requirement, pct by wt |
|------------------------------|------------------------|
| Aluminum oxide (Al_2O_3) | 5.80 to 6.90 |
| Water soluble salts (max) | 1.75 |
| Iron (Fe, max) | 0.10 |
| Moisture (max) | 1.50 |
| Free fatty acid | 25 to 35 |

5.1.3 Use data. Aluminum stearate, technical is intended for military use as a drier in paints and other protective coatings. Typical commercial applications include use in paint and varnish driers; greases; waterproofing agents; cement additives; lubricants; cutting compounds; flatting agents; cosmetics and pharmaceuticals; and additives for chewing gum.

5.1.4 Packaging data and labeling. Aluminum stearate, technical is packaged for military use in 50 pound unit quantity drums.

5.1.5 Storage data. Store in cool, dry area away from definite fire hazards. Keep containers tightly sealed. When stored as recommended this material has an indefinite shelf life.

5.2 Name. AMYL ACETATE, TECHNICAL $CH_3COOC_5H_{11}$ FW 130.19
Amyl Acetic Ester
Pentyl Acetate
Banana Oil
Pear Oil
(HAZARDOUS)

5.2.1 Specifications. TT-A-511, Amyl Acetate (For use in organic coatings).

5.2.2 Technical description. This material is usually a mixture of isomers, principally the isoamyl, normal-, and secondary-amyl acetates. It is a colorless liquid with a distinctive banana-like odor, very slightly soluble in water and miscible with alcohol and ether. The chemical and physical properties vary according to composition and degree of purity. For military use, the synthetic type amyl acetate shall be clear and free from sediment and suspended matter, shall be no darker than no. 10 on the platinum-cobalt scale, and shall leave no residual odor after drying from filter paper for two hours. It shall be miscible without turbidity with 19 volumes of 10° Heptane at 20°C and shall be completely soluble in 85 percent sulfuric acid.

Table II - Chemical and physical requirements of amyl acetate, technical

| Property | Requirements |
|---|----------------|
| Specific gravity, (20/20°C) | 0.860 to 0.870 |
| Nonvolatile matter from 100 ml (gm, max) | 0.005 |
| Acidity (mg KOH per gm sample, max) | 0.28 |
| Distillation: | |
| Initial bp, 760 mm pressure (°C, min) | 126 |
| Distillate below 130°C (pct by volume, max) | 10 |
| Distillate below 140°C (pct by volume, max) | 75 |
| Dry point, 760 mm pressure (°C) | 155 |
| Ester content (pct by wt) | 85 to 88 |
| Water solubility (pct by wt, max) | 0.5 |

5.2.3 Use data. Amyl acetate, technical is intended for military use as a solvent; for testing gas filter units; and for use in organic coatings. Typical commercial applications include use as a solvent for organic nitrocellulose compounds; as an ingredient in paints and lacquers; in the making of drycleaning compounds; bronzing liquids, linoleum, oil cloth, and soap solvent. It is also extensively used in photo engraving.

5.2.4 Packaging data and labeling. Amyl acetate technical is packaged for military use in 1 pint unit quantity bottles, and 5 gallon unit quantity drums. Since this material is a mixture of isomers, the flash point may vary from lot to lot. When the flash point is determined to be at 80°F or below, it must be shipped as a flammable liquid and bear the DoT red label. When the flash point exceeds 80°F no DoT label is required. In addition, each container shall bear the following precautionary label:

CAUTION!

Keep away from heat and open flame.
Avoid prolonged breathing of vapor.
Use with adequate ventilation.
Avoid prolonged or repeated contact
with skin.

5.2.5 Storage data. Store in tightly closed containers in a cool place away from definite fire hazards and powerful oxidizing agents. If stored as recommended, this material has an indefinite shelf life.

5.3 Name. n-BUTYL ACETATE, TECHNICAL $CH_3COO(CH_2)_3CH_3$ FW 116.16
Acetic Acid, Butyl Ester
Butyl Ethanoate
(HAZARDOUS)

5.3.1 Specifications. TT-B-838, Butyl Acetate; Normal (For use in organic coatings).

5.3.2 Technical description. n-Butyl acetate is a colorless liquid with a characteristic fruity odor. It is a medium-evaporating solvent, only slightly soluble in water, but miscible with alcohol, ether and hydrocarbons.

Table III - Chemical and physical requirements
of n-butyl acetate, technical

| Property | Requirement |
|---|----------------|
| Acidity (pct as acetic acid, max) | 0.01 |
| Distillation range: | |
| Initial bp (°C, min) | 118.0 |
| Dry point (°C, max) | 128.0 |
| Ester content (pct as butyl acetate, min) | 90 |
| Nonvolatile matter (gm per 100 ml) | 0.005 |
| Specific gravity (20/20°C) | 0.874 to 0.876 |
| Color (platinum - cobalt scale, max) | 10 |

In addition to the requirements listed above for military use this material shall be clear and free from sediment, shall be miscible without turbidity with 19 volumes of 10° Heptane at 20°C, and shall leave no residual odor after drying on filter paper for 2 hours.

Table IV - Physical constants of n-butyl acetate

| Property | Constant |
|---|-----------|
| Autoignition point (°F) | 790 |
| Explosive limits (pct by volume in air) | 1.7 to 15 |
| Flash point (open cup, °F) | 90 |
| Melting point (°C) | -77.2 |
| Refractive index (20°C) | 1.3951 |
| Vapor density (air = 1.00) | 4.00 |

5.3.3 Use data. n-Butyl acetate is intended for military use as an ingredient in protective coatings and a solvent for nitrocellulose. Typical commercial applications include use in the manufacture of airplane dopes, artificial leather, celluloid products, cement, coated paper, plastic, wood, linoleum, fingernail enamel and printing compounds. It is also used as a solvent for other natural and synthetic resins and for chemical and pharmaceutical processing.

5.3.4 Packaging data and labeling. n-Butyl acetate technical is packaged for military use in 1 quart unit quantity cans 5 gallon unit quantity pails, and 55 gallon unit quantity drums. All containers must bear the following label:

CAUTION!

Keep away from heat and open flame.
Avoid prolonged breathing of vapor.
Use with adequate ventilation.
Avoid prolonged or repeated contact
with skin.

5.3.5 Storage data. Store in tightly closed containers in a cool place away from open flame and definite fire hazards. Containers should be kept plainly labeled and their condition checked at least annually.

5.4 Name. n-BUTYL STEARATE, TECHNICAL $C_{17}H_{35}COOC_4H_9$ FW 340.59
Butyl Octadecanoate
Octadecanoic Butyl Ester (IUPAC)

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5.4.1 Specifications. MIL-B-21465, n-Butyl Stearate, Technical.

5.4.2 Technical description. n-Butyl stearate is normally a colorless, stable, oily liquid with a faint, fatty odor. The material is insoluble in water, but soluble in alcohol and ether and miscible with mineral and vegetable oils. Among the requirements of this material for military use are those listed in Table V below.

Table V - Chemical and physical requirements of n-butyl stearate, technical

| Property | Requirement |
|-------------------------------------|----------------|
| Acidity, as stearic acid (pct, max) | 0.5 |
| Flash point (open cup, °F, min) | 370 |
| Iodine number (max) | 6.0 |
| Saponification number | 165 to 176 |
| Specific gravity (20/20°C) | 0.850 to 0.860 |

In addition, the material shall be free of suspended matter and shall exhibit no turbidity when one volume is mixed with 19 volumes of 66° gasoline.

Table VI - Physical constants of n-butyl stearate

| Property | Constant |
|------------------------------------|------------|
| Boiling point (°C, 25 mm pressure) | 220 to 225 |
| Melting point (°C) | 19.5 |
| Refractive index (20°C) | 1.4430 |
| Vapor density (air = 1.00) | 11.4 |

5.4.3 Use data. n-Butyl stearate is intended for military use as a lubricant and propellant powder. Typical commercial applications include use: as constituent in polishes, special lubricants and coatings; in lubricants for metals, textiles and moldings; in wax polishes as the dye solvent; in plasticizer for laminated fiber products, rubber hydrochloride, chlorinated rubber, and cable lacquers; in carbon paper; as an emollient in cosmetic and pharmaceutical products; and as damp-proofer for concrete.

5.4.4 Packaging data and labeling. For military use n-butyl stearate, technical is packaged in 7 and 35 pound unit quantity cans; and 380 pound unit quantity drums.

5.4.5 Storage data. Store in a cool, well ventilated area, away from open flame, areas of definite fire hazard, and powerful oxidizing agents indefinitely.

5.5 Name. CALCIUM OXALATE, TECHNICAL $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ FW 146.12
(HAZARDOUS)

5.5.1 Specifications. Jan-C-628, Calcium Oxalate (For use in Ammunition).

5.5.2 Technical description. Calcium oxalate is a white, crystalline powder. It is soluble in dilute hydrochloric acid, dilute nitric acid, but insoluble in acetic acid and water. Among the requirements of this material for military use are those listed in Table VII below.

Table VII - Chemical and physical requirements of calcium oxalate, technical

| Property | Requirement |
|---|-------------|
| Barium salts (pct, max) | 0.5 |
| Calcium (pct, min) | 26.6 |
| Material insoluble in dilute HCL (pct, max) | 0.5 |
| Material soluble in water (pct, max) | 0.4 |
| Moisture (pct, max) | 0.5 |
| Oxalate (pct, min) | 58.4 |

In addition, this material shall be grit-free and a minimum of 99.0 percent shall pass through a No. 100 US Standard sieve.

5.5.3 Use data. Calcium oxalate, technical is intended for military use in pyrotechnic compositions. Typical commercial applications include use in making oxalic acid and organic oxalates.

5.5.4 Packaging data and labeling. For military use calcium oxalate, technical is packaged in 16 gallon (100 pound) unit quantity drums. The containers shall be provided with a liner of such construction as to prevent contamination by dust or other foreign material. Each container shall bear the following label:

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CALCIUM OXALATE
WARNING!
HARMFUL IF SWALLOWED
CAUSES SKIN IRRITATION

Avoid breathing dust.
Avoid contact with skin and eyes.
Do not take internally.
Keep away from feed or food products.
In case of contact, immediately flush
skin or eyes with plenty of water for
at least 15 minutes; for eyes, get
medical attention.

5.5.5 Storage data. This material should be stored in a ventilated, cool, dry area. Because of the corrosive quality of oxalates, these containers should be inspected semi-annually. When stored under ideal conditions this material has an indefinite shelf life.

5.6 Name. CALCIUM RESINATE, TECHNICAL $\text{Ca}(\text{C}_{44}\text{H}_{62}\text{O}_4)_2$ FW 1350.04
(HAZARDOUS)

5.6.1 Specifications. MIL-C-20470, Calcium Resinate.

5.6.2 Technical description. Calcium resinate is in the form of yellowish-white amorphous powder or yellow or brown lumps depending on the method of derivation. It is fused in lumps and precipitated in the form of powder. The material is insoluble in water but is soluble in acid, amyl acetate, butyl acetate, ether, and amyl alcohol.

Table VIII - Chemical and physical requirements of
calcium resinate, technical

| Property | Requirement | |
|---|-------------|--------------|
| | Fused | Precipitated |
| Calcium resinate content (pct, min) | 56.0 | 77.0 |
| Acid number (max) | 64 | 33 |
| Chloroform insoluble matter (pct, max) | 2.0 | 3.0 |
| Flame test | Yellow-red | Yellow-red |
| Granulation through 60 sieve (pct, min) | -- | 75 |
| Granulation through 4 sieve (pct, min) | 90 | -- |
| Water content (pct, max) | 2.0 | 5.0 |

5.6.3 Use data. Calcium resinate is intended for military use in the manufacture of pyrotechnics. Typical commercial applications of this material include use in waterproofing; manufacturing paint dryers, porcelains, perfumes, cosmetics, and enamels; for fabrics, wood, and paper; as an amber substitute; and in tanning leather.

5.6.4 Packaging data and labeling. For military use calcium resinate fused is packaged in 16 gallon unit quantity steel drums; calcium resinate precipitated is packaged in 55 gallon unit quantity steel drums. The steel drums shall be with open head provided with a twist-lock closure or bolted ring closure. The lip shall have a tubular rubber gasket. The drums shall be provided with a polyethylene bag liner. Desiccant shall be placed on top of the sealed bag. The material shall be shipped as a flammable solid bearing a yellow label in accordance with DoT Regulations. Each container shall bear the following label:

FLAMMABLE!

Store in a cool place away from
areas of acute fire hazard
and open flame.

5.6.5 Storage data. Calcium resinate can be stored outside provided that the drums are turned upside down so that water will not leak through the lid into the drum. Maximum storage time is two years from the date of manufacture.

5.7 Name. CALCIUM STEARATE, TECHNICAL $\text{Ca}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$ FW 607.04

5.7.1 Specifications. JAN-C-263, Calcium Stearate.

5.7.2 Technical description. Calcium stearate is a fatty acid derivative in white, granular, powder form. It is insoluble in water, but slightly soluble in hot alcohol, and decomposed by many acids and alkalies. For military use, in addition to the requirements listed in Table IX, the material shall be grit-free with a minimum of 98 percent passing through a No. 100 US Standard sieve and 95 percent passing through a No. 200 US Standard sieve.

Table IX - Chemical and physical requirements of
calcium stearate, technical

| Property | Requirement |
|--|---------------|
| Acidity or alkalinity, (pct, max) | 0.01 |
| Calcium content (pct) | 9.2 ± 0.2 |
| Melting point, ($^{\circ}\text{C}$, min) | 150 |
| Moisture, (pct, max) | 3.0 |
| Water-soluble salts (pct, max) | 0.25 |

5.7.3 Use data. Calcium stearate is intended for military use as a binder and lubricant in the pelleting of explosives. Typical commercial applications include use in waterproofing fabrics, cement, stucco; as a releasing agent for plastic molding powders; lubricant for pills and tablets; in pencils and wax crayons; anticaking agent in food.

5.7.4 Packaging data and labeling. For military use calcium stearate, technical is packaged in 55 gallon unit quantity drums.

5.7.5 Storage data. Store in a cool dry place away from definite fire hazards. If stored under these conditions the shelf life of this material should be indefinite.

5.8 Name. COPPER NAPHTHENATE, TECHNICAL $(C_{11}H_{19}COO)_2Cu$ FW 317.87
(HAZARDOUS)

5.8.1 Specifications. MIL-M-17231, Mildew Resistant Compound; Copper Naphthenate.

5.8.2 Technical description. Copper naphthenate, technical is a green-blue liquid, soluble in gasoline and mineral oil distillates. In addition to the requirements listed in Table X, it shall be manufactured from naphthenic acid occurring in petroleum which shall have an acid number not less than 180 and shall contain not more than 25 percent unsaponifiable matter.

Table X - Chemical and physical requirements of copper naphthenate, technical

| Property | Requirement |
|----------------------------------|-------------|
| Copper content (pct as metal) | 8 ± 0.1 |
| Flash point ($^{\circ}F$, min) | 250 |
| Volatile matter (pct, max) | 5 |

5.8.3 Use data. Copper naphthenate, technical is intended for military use in the mildew-resistant treatment of fiber rope. Typical commercial applications include use as a powerful germicide, insecticide, and fungicide; also as a preservative for wood, canvas, and rope.

5.8.4 Packaging data and labeling. Copper naphthenate, technical is packaged for military use in 55 gallon unit quantity removable head drums.

5.8.5 Storage data. Store away from definite fire hazards and oxidizing materials. If stored as recommended the shelf life of this material is indefinite.

5.9 Name. DIBUTYL PHTHALATE, TECHNICAL $C_6H_4(COOC_4H_9)_2$ FW 278.35
DBP
(HAZARDOUS)

5.9.1 Specifications. TT-D-301, Dibutyl Phthalate; Plasticizer (For use in organic coatings), MIL-D-218, Dibutylphthate, Technical.

5.9.2 Technical description. Dibutyl phthalate is a colorless, nonvolatile nontoxic, stable, oily liquid. It is only slightly soluble in water, but is miscible with the common organic solvents. In addition to the requirements listed in Table XI, this material shall be clear and free from sediment and suspended matter, and shall be miscible without turbidity with 19 volumes of 10° Heptane at 20°C.

Table XI - Chemical and physical requirements of dibutyl phthalate, technical

| Property | Requirement |
|-------------------------------------|----------------|
| Acidity (mg KOH per gm sample, max) | 0.067 |
| Ash (pct by wt, max) | 0.01 |
| Color (platinum cobalt scale, max) | 20 |
| Ester content (pct by wt, min) | 99 |
| Flash point (open cup, °F, min) | 340 |
| Refractive index (20°C) | 1.490 to 1.492 |
| Specific gravity (20/20°C) | 1.046 to 1.050 |

5.9.3 Use data. Dibutyl phthalate, technical is intended for military use as an adhesive and plasticizer for resins, and in the manufacture of smokeless powder. Typical commercial applications include use as a plasticizer in protective coatings; as a nitrocellulose solvent; as a solvent for textile lubricating agents; and in the making of safety glass, leather, airplane dope, and insecticides.

5.9.4 Packaging data and labeling. For military use dibutyl phthalate, technical, is packaged in 1 and 5 pound unit quantity bottles, and 55 gallon unit quantity drums.

5.9.5 Storage data. Store DBP material in a cool, well ventilated area away from definite fire hazards and oxidizing agents. This material has an indefinite shelf life if stored in tightly sealed containers free of moisture. This material need not be checked until the time of use.

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5.10 Name. DIETHYLENE GLYCOL MONOETHYL ETHER ACETATE, TECHNICAL FW 176.21
 $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OC}_2\text{H}_5$
 2-(2-Ethoxyethoxy)ethyl acetate
 (HAZARDOUS)

5.10.1 Specifications. None.

5.10.2 Technical description. Diethylene glycol monoethyl ether acetate is a hygroscopic, colorless liquid, soluble in all proportions in water, alcohol, acetone, and ordinary organic solvents.

Table XII - Physical constants of diethylene glycol monoethyl ether acetate, technical

| Property | Constant |
|-------------------------------------|----------|
| Boiling point (760 mm pressure, °C) | 217.4 |
| Flash point (open cup, °F) | 230 |
| Melting point (°C) | -25 |
| Specific gravity (20/20°C) | 1.0114 |
| Vapor density (air - 1.00) | 6.07 |

5.10.3 Use data. Diethylene glycol monoethyl ether acetate is intended for military use as a solvent. Typical commercial applications include use as a solvent for organic compounds such as dyes, nitrocellulose, and cellulose acetate. It is also used in printing; as an adhesive for sealing coated cellophane; in cosmetics; in paint and varnish removers; and in wetting agents.

5.10.4 Packaging data and labeling. For military use diethylene glycol monoethyl ether acetate is packaged in 1 pint and 1 quart unit quantity bottles.

5.10.5 Storage data. Store in a well ventilated area away from open flame and definite fire hazards. Keep containers tightly sealed. If stored as recommended the shelf life of this material will be indefinite.

5.11 Name. DIETHYL PHTHALATE, TECHNICAL $\text{C}_6\text{H}_4(\text{COOC}_2\text{H}_5)_2$ FW 222.24
 Ethyl phthalate
 DEP
 (HAZARDOUS)

5.11.1 Specifications. JAN-D-242, Diethyl Phthalate (For Use in Explosives).

5.11.2 Technical description. Diethyl Phthalate is a water-white, stable, odorless liquid, with a bitter taste. It is miscible with alcohols, ketones, esters, or aromatic hydrocarbons. It is partly miscible with aliphatic solvents, and insoluble in water.

Table XIII - Chemical and physical requirements of diethyl phthalate, technical

| Property | Requirement |
|---|-------------|
| Acidity as phthalic acid (pct, max) | 0.03 |
| Ash (pct, max) | 0.01 |
| Ester content as diethyl phthalate (pct, min) | 99.0 |
| Specific gravity (15/15°C) | 1.12 ± 0.01 |

In addition to the requirements listed in Table XIII, the color of 25 ml of this material shall be no darker than that of 0.5 ml of a 0.1N iodine solution in 100 ml of distilled water.

5.11.3 Use data. Diethyl phthalate is intended for military use in the manufacture of propellant powder. Typical commercial applications include use as a solvent for nitrocellulose, cellulose acetate; plasticizer; wetting agents; insecticidal sprays; camphor substitutes; plastics; perfumery, as fixative and solvent; alcohol denaturant; mosquito repellants, and as a plasticizer in solid rocket propellants.

5.11.4 Packaging data and labeling. For military use diethyl phthalate technical is packaged in 55 gallon unit quantity drums.

5.11.5 Storage data. This material should be stored in a cool, well ventilated area away from definite fire hazards and oxidizing agents. It has an indefinite shelf life if stored in tightly sealed containers free of moisture. This material need not be checked until time of use.

5.12 Name. b,b'-DIHYDROXYDIETHYL SULFIDE, TECHNICAL $S(CH_2CH_2OH)_2$ FW 122.19
Thiodiglycol
Thiodiethylene Glycol
2,2'-Thiodiethanol
(HAZARDOUS)

5.12.1 Specifications. MIL-D-14130, b,b'-Dihydroxydiethyl Sulfide, Technical (Thiodiglycol).

5.12.2 Technical description. b,b'-Dihydroxydiethyl sulfide is a syrupy, colorless liquid. It is soluble in water, acetone, alcohol, and chloroform; and is slightly soluble in benzene, carbon tetrachloride, and ether.

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Table XIV - Chemical and physical requirements of
b,b'-dihydroxydiethyl sulfide, technical

| Property | Requirement |
|--|----------------|
| Acidity (mg KOH/gm sample, max) | 1.0 |
| Alkalinity (mg H ₂ SO ₄ /gm sample, max) | 1.0 |
| Ash (pct by wt, max) | 0.02 |
| b,b'-dihydroxydiethyl sulfide (pct by wt, min) | 96.0 |
| Mercaptans as mercaptoethanol (pct by wt, max) | 0.50 |
| Specific gravity (20/20°C) | 1.181 to 1.186 |
| Water (pct by wt, max) | 1.0 |

In addition to the requirement listed in Table XIV, this material shall be substantially free of suspended matter and shall be no darker than a light greenish yellow by visual observation with transmitted light.

5.12.3 Use data. b,b'-Dihydroxydiethyl sulfide is intended for military use in the manufacture of chemicals. Typical commercial applications include use in organic synthesis; as a solvent for use in textile printing; and as an antioxidant.

5.12.4 Packaging data and labeling. For military use b,b'-dihydroxydiethyl sulfide is packaged in 100 gram unit quantity amber colored bottles, and in 5 and 55 gallon unit quantity steel drums. Each container shall bear the following label:

CAUTION!

Emits highly toxic fumes when heated
to decomposition.
Do not use with hydrochloric acid.
May react with oxidizing materials.

5.12.5 Storage data. Store in tightly sealed containers arranged to maintain individual lot identity of the product. If so stored, the shelf life will be indefinite.

5.13 Name. DIMETHYL PHTHALATE, TECHNICAL C₆H₄(COOCH₃)₂ FW 194.19
Dimethyl 1,2-benzenedicarboxylate
DMP
Methyl phthalate
Phthalic acid dimethyl ester
(HAZARDOUS)

5.13.1 Specifications. JAN-D-709, Dimethyl Phthalate (For Use in Explosives)

5.13.2 Technical description. Dimethyl phthalate is an odorless, light-fast, stable, nontoxic liquid. It is miscible with alcohol, ether or chloroform, and practically insoluble in water (0.43 gm/100 ml).

Table XV - Chemical and physical requirements of dimethyl phthalate, technical

| Property | Requirement |
|---|---------------|
| Acidity, as phthalic acid (pct, max) | 0.03 |
| Ash (pct by wt, max) | 0.01 |
| Ester content, as dimethyl phthalate (pct, min) | 99.0 |
| Specific gravity (15.5/15.5°C) | 1.196 ± 0.010 |

For military use, in addition to the requirements listed in Table XV, the color of 25 ml of this material shall be no darker than 0.5 ml of a 0.1N iodine solution added to 100 ml of distilled water.

Table XVI - Physical constants of dimethyl phthalate

| Property | Constants |
|-------------------------------------|-----------|
| Autoignition point (°F) | 1032 |
| Boiling point (760 mm pressure, °C) | 282 |
| Flash point (open cup, °F) | 325 |
| Melting point (°C) | 0.0 |
| Refractive index (20°C) | 1.5168 |
| Vapor pressure (mm at 20°C) | 0.01 |
| Vapor density (air = 1.00) | 6.69 |

5.13.3 Use data. Dimethyl phthalate, technical is intended for military use in the manufacture of propellant powder. Typical commercial applications include use as a plasticizer for nitrocellulose and cellulose acetate, resins, and rubber. It is also used in solid rocket propellants, lacquers, plastics, rubber, coating agents, safety glass, molding powders, insect repellents, and perfumes.

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5.13.4 Packaging data and labeling. For military use dimethyl phthalate is packaged in 55 gallon unit quantity drums.

5.13.5 Storage data. This material should be stored in a cool, dry area away from oxidizing materials. When stored under ideal conditions it has an indefinite shelf life.

5.14 Name. DIOCTYL PHTHALATE, TECHNICAL $C_6H_4[COOCH_2CH(C_2H_5)C_4H_9]_2$ FW 390.57
Di (2-ethylhexyl) phthalate
DOP
(HAZARDOUS)

5.14.1 Specifications. MIL-D-38705 Dioctyl Phthalate, Technical, and MIL-D-13796 Di-2-Ethylhexylphthalate

5.14.2 Technical description. Dioctyl phthalate is a clear, colorless, and odorless liquid. The material is insoluble in water, but miscible with mineral oil.

Table XVII - Chemical and physical requirements of dioctyl phthalate, technical

| Property | Requirement |
|--------------------------------------|----------------|
| Acidity, as phthalic acid (pct, max) | 0.01 |
| Color (ppm APHA Standard, max) | 50 |
| Ester content (pct by wt, min) | 99 |
| Flash point range (°F) | 413.6 ± 10.8 |
| Specific gravity (20/20°C) | 0.984 to 0.988 |
| Water (pct, max) | 0.04 |

5.14.3 Use data. Dioctyl phthalate is intended for military use as a lubricant for vacuum pumps; in a 1 to 1 mixture with bromochloromethane to control and extinguish fires involving metals such as magnesium and titanium; and in explosives and propellants. Typical commercial applications include use as a plasticizer for many resins and synthetic rubber.

5.14.4 Packaging data and labeling. For military use dioctyl phthalate is packaged in 100 gm and 1000 gm unit quantity bottles, 5 and 55 gallon unit quantity drums and bulk. Each container shall bear the following label:

DIOCTYL PHTHALATE, TECHNICAL
CAUTION!

Use only with adequate ventilation.
Avoid prolonged breathing of vapor.

5.14.5 Storage data. This material should be stored in a cool, well ventilated area away from definite fire hazards and oxidizing agents. It has an indefinite shelf life if stored in tightly sealed containers free of moisture. If bulk storage facilities are used, some arrangement should be made for drying the air which will enter the tank. This material need not be checked until the time of use.

5.15 Name. DIPHENYLPHTHALATE, TECHNICAL $C_{16}H_{14}(CO_2C_6H_5)_2$ FW 318.33
(HAZARDOUS)

5.15.1 Specifications. MIL-D-50006, Diphenylphthalate, Technical.

5.15.2 Technical description. Diphenylphthalate, technical is a yellow-white powder. It has a melting point of 70°C; its boiling point is 405°C; and its flash point is 435°F.

Table XVIII - Chemical and physical requirements of diphenylphthalate, technical

| Property | Requirement |
|--|-------------|
| Acidity, as phthalic acid (pct by wt, max) | 0.05 |
| Ash (pct by wt, max) | 0.20 |
| Ester content (pct by wt, min) | 99.0 |
| Loss in wt at 105°C (pct by wt, max) | 0.5 |
| Setting point (°C) | 69 to 70 |

5.15.3 Use data. Diphenylphthalate, technical is intended for military use as a deterrent coating in smokeless powder. Typical commercial applications include use in plasticizer; plasticizing compositions for ethylcellulose, nitrocellulose, and various synthetic resins.

5.15.4 Packaging data and labeling. For military use diphenylphthalate is packaged in 55 gallon unit quantity drums.

5.15.5 Storage data. Store in a well ventilated area away from open flame and definite fire hazards. Keep containers tightly sealed. If stored as recommended the shelf life of this material will be indefinite.

5.16 Name. ETHYL ACETATE, TECHNICAL $CH_3COOC_2H_5$ FW 88.11
Acetic ether
Acetic ester
Vinegar naphtha
(HAZARDOUS)

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5.16.1 Specifications. TT-E-751, Ethyl Acetate, Technical, Organic Coatings Use.

5.16.2 Technical description. Ethyl Acetate is a colorless liquid with an apple-like odor. The product is moderately soluble in water and miscible with alcohol and ether.

Table XIX - Chemical and physical requirements of ethyl acetate, technical

| Property | Requirements |
|---|----------------|
| Acidity (mg KOH per gm sample, max) | 0.10 |
| Color (platinum-cobalt scale, max) | 10 |
| Ester content, as ethyl acetate (pct by wt) | 85 to 88 |
| Nonvolatile matter (gm per 100 ml, max) | 0.005 |
| Specific gravity (20/20°C) | 0.882 to 0.887 |
| Water content (pct by wt, max) | 0.20 |

In addition to the requirements listed in Table XIX, this material shall be clear and free from sediment and suspended matter and shall leave no residual odor on drying. None of this material shall distill below 71.0°C or above 79.0°C.

Table XX - Physical constants of ethyl acetate

| Property | Constant |
|---|--------------|
| Autoignition point (°F) | 907 |
| Boiling point (760 mm pressure, °C) | 77 |
| Explosive limits (pct by volume in air) | 2.18 to 11.5 |
| Flash point (Tag open cup, °F) | 40 |
| Melting point (°C) | -83.6 |
| Refractive index (20°C) | 1.3919 |
| Vapor pressure (mm at 25°C) | 100 |
| Vapor density (air = 1.00) | 3.04 |

5.16.3 Use data. Ethyl acetate is intended for military use as an ingredient in cellulose lacquers, lacquer thinners and the manufacture of

explosives. Typical commercial applications include use as an ingredient in cellulose lacquers and thinners; in the production of lacquer, horse hair, artificial leather, inks, photographic film, and plastic wood; in textile sizing, printing compounds, washable wall paper, etc.

5.16.4 Packaging data and labeling. Ethyl acetate for military use is packaged in 1 quart, 1 gallon, and 5 gallon unit quantity cans, and 55 gallon unit quantity drums. Each container shall bear the red label in accordance with DoT regulations as well as the following label:

ETHYL ACETATE
WARNING! FLAMMABLE

Keep away from heat and open flame.
Keep container closed.
Use with adequate ventilation.
Avoid prolonged breathing of vapor.
Avoid prolonged or repeated contact
with skin.

5.16.5 Storage data. Store in a cool, well ventilated area away from definite fire hazards and open flame. Keep containers tightly closed and plainly marked. If stored as recommended, the shelf life of this material is indefinite.

5.16.6 Special features. Because ethyl acetate readily saponifies with alkali to ethyl alcohol and salt of acetic acid, the addition of a denaturant is required by the Treasury Department to prevent this solvent from being used as an illegal source of ethyl alcohol.

5.17 Name. ETHYLENE GLYCOL MONOETHYL ETHER ACETATE, TECHNICAL
 $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{OC}_2\text{H}_5$ FW 132.16
 Ethoxy acetate
 2-Ethoxyethol Acetate
 Ethyl glycol acetate
 (HAZARDOUS)

5.17.1 Specifications. MIL-E-7125, Ethylene Glycol Monoethyl Ether Acetate.

5.17.2 Technical description. Ethylene glycol monoethyl ether acetate is a colorless liquid with a mild, pleasant, ester-like odor. It is miscible with aromatic hydrocarbons, and slightly miscible with water.

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Table XXI - Chemical and physical requirements of ethylene glycol monoethyl ether acetate, technical

| Property | Requirement |
|-------------------------------------|----------------|
| Acidity (mg KOH per gm sample, max) | 0.19 |
| Ester content (pct by wt, min) | 95 |
| Specific gravity (20/20°C) | 0.971 to 0.967 |

In addition to the requirements listed in Table XXI, this material shall be clear and free from sediment and suspended matter; shall leave no residual odor on drying from filter paper; and shall be miscible without turbidity or sediment with 19 volumes of naphtha. It shall distill completely between 145° and 165°C with none being distilled below 145°C or above 165°C. Not more than 5 percent shall be distilled below 150°C and not less than 93 percent shall be distilled below 160°C.

Table XXII - Physical constants of ethylene glycol monoethyl ether acetate

| Property | Constant |
|--|----------|
| Autoignition point (°F) | 715 |
| Boiling point (760 mm pressure, °C) | 156.3 |
| Flash point (Cleveland open cup, °F) | 120 |
| Lower explosive limit (pct by volume in air) | 1.7 |
| Melting point (°C) | -61.7 |
| Vapor density (air = 1.00) | 4.72 |

5.17.3 Use data. Ethylene glycol monoethyl ether acetate is intended for military use as a solvent. Typical commercial applications include use as a solvent for nitrocellulose, oils and resins; retards "blushing" in lacquers; varnish removers; wood stains, textiles, and leather.

5.17.4 Packaging data and labeling. For military use ethylene glycol monoethyl ether acetate is packaged in 5 gallon unit quantity cans, and 55 gallon unit quantity drums.

5.17.5 Storage data. Store in a well ventilated area away from open flame and definite fire hazards. Keep containers tightly sealed. If stored as recommended the shelf life of this material will be indefinite.

5.18 Name. FERRIC AMMONIUM CITRATE, TECHNICAL
Iron Ammonium Citrate

5.18.1 Specifications. None.

5.18.2 Technical description. Ferric ammonium citrate, technical, is in the form of green flakes or granules containing about 14 to 16 percent iron. It is very deliquescent and is readily reduced by light to the bivalent ion. It is very soluble in water and insoluble in alcohol.

5.18.3 Use data. Ferric ammonium citrate is intended for military use as a sensitizing agent for blueprint paper. Typical commercial applications include use as a sensitizing agent for blueprinting, and as a medicine and animal feed additive.

5.18.4 Packaging data and labeling. For military use, ferric ammonium citrate, technical is packaged in 1 pound unit quantity bottles and 50 pound unit quantity drums. All material shall be so packaged as to protect it from light and moisture.

5.18.5 Storage data. Store in a cool place away from direct light. Keep containers tightly sealed to exclude moisture. If stored as recommended, this material will have an indefinite shelf life.

5.19 Name. FERRIC AMMONIUM OXALATE, TRIHYDRATE, TECHNICAL
 $(\text{NH}_4)_3 \text{Fe} (\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ FW 428.07
 Ammonioferric oxalate
 Iron ammonium oxalate

5.19.1 Specifications. O-F-166, Ferric Ammonium Oxalate, Trihydrate, Technical, Blueprint Processing.

5.19.2 Technical description. Ferric ammonium oxalate is in the form of green crystals. These crystals are soluble in water and are sensitive to light.

Table XXIII - Chemical and physical requirements of ferric ammonium oxalate trihydrate, technical.

| Property | Requirement |
|--|-------------|
| Chlorides (pct by wt, max) | 0.02 |
| Ferric ammonium oxalate (pct by wt, min) | 99.0 |
| Ferrous iron (pct by wt, max) | 0.05 |
| Water insolubles (pct by wt, max) | 0.2 |

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In addition to the requirements listed in Table XXIII, none of this material shall be retained on a US Standard No. 10 sieve and no less than 90 percent shall be retained on a No. 60 sieve.

5.19.3 Use data. Ferric ammonium oxalate, trihydrate, technical is intended for military use in the sensitization of blueprint paper. Typical commercial applications include use in blueprints and blueprint photography.

5.19.4 Packaging data and labeling. For military use ferric ammonium oxalate, trihydrate, technical is packaged in 1 pound unit quantity bottles and in 5 pound unit quantity fiber cans.

5.19.5 Storage data. Store in a cool place away from direct light. Keep containers tightly sealed to exclude moisture. If stored as recommended, this material will have an indefinite shelf life.

5.20 Name. FERRIC OXALATE, TECHNICAL $\text{Fe}_2(\text{C}_2\text{O}_4)_3$ FW 375.75
Iron Oxalate
(HAZARDOUS)

5.20.1 Specifications. None.

5.20.2 Technical description. Ferric oxalate is in the form of odorless, pale yellow, amorphous powder or scales. It is soluble in water and acids, and insoluble in alcohol or alkali. This material decomposes when heated to 100°C.

5.20.3 Use data. Ferric oxalate, technical is intended for military use in photography. Typical commercial applications include use as a catalyst in making oxygen and in the production of silver-tone photographic paper.

5.20.4 Packaging data and labeling. For military use, ferric oxalate, technical is packaged in 5 pound unit quantity bottles.

5.20.5 Storage data. Store in a cool, well ventilated area. Keep containers tightly closed to protect the material from moisture. If stored as recommended it will have an indefinite shelf life.

5.21 Name. FERRIC SODIUM OXALATE, TECHNICAL $\text{Na}_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 5\frac{1}{2} \text{H}_2\text{O}$ FW 487.96
Iron Soda Oxalate
(HAZARDOUS)

5.21.1 Specifications. None.

5.21.2 Technical description. Ferric sodium oxalate, technical appears as emerald-green crystals, which are easily decomposed by heat and light. The material is reduced to ferrous form by light. It is soluble in water; and it loses 4 waters of hydration when heated to its melting point, 100°C,

and all waters of hydration at its boiling point, 200°C.

5.21.3 Use data. Ferric sodium oxalate, technical is intended for military use in blueprinting. Typical commercial applications include use in photography and blueprinting.

5.21.4 Packaging data and labeling. For military use, ferric sodium oxalate, technical is packaged in 100 pound unit quantity drums. It shall be packaged to protect the material from light.

5.21.5 Storage data. Store in a cool, well ventilated area out of direct light. Keep containers tightly closed. If stored as recommended this material will have an indefinite shelf life.

5.22 Name. HYDROGENATED METHYL ABIETATE, TECHNICAL
(HAZARDOUS)

5.22.1 Specifications. None.

5.22.2 Technical description. Hydrogenated methyl abietate is derived from alcoholic esters of abietic acid, whereby the more reactive double bond is saturated with hydrogen, rendering it more resistant to oxidation and discoloration. The product is normally a colorless to yellow liquid, insoluble in water, but miscible with the usual organic solvents and with aliphatic hydrocarbons.

Table XXIV - Typical properties of a hydrogenated methyl abietate

| Property | Value |
|---|----------------------------------|
| Acid number (mg KOH per gm sample, max) | 8 |
| Color (Gardner standard, max) | 18 |
| Refractive index (20°C) | 1.515 to 1.520 |
| Specific gravity (25/25°C) | 1.018 to 1.028 |
| Viscosity (Gardner - Holdt, 25°C) | Z ₁ to Z ₂ |

5.22.3 Use data. Hydrogenated methyl abietate, technical is intended for military use as a plasticizer in organic coatings. Typical commercial applications include use as a solvent for ester gums, many resins, ethyl cellulose, and rubber; in the manufacture of varnish resins; and as an ingredient in adhesives.

5.22.4 Packaging data and labeling. For military use, hydrogenated methyl abietate is packaged in 5 and 55 gallon unit quantity drums.

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5.22.5 Storage data. Store in a cool, well ventilated area away from open flame, definite fire hazards and powerful oxidizing agents. Keep container closed. Storing in this manner will render an indefinite shelf life.

5.23 Name. LEAD ACETATE, TRIHYDRATE, TECHNICAL $Pb(C_2H_3O_2)_2 \cdot 3H_2O$ FW 379.33
 Sugar of Lead
 Salt of Saturn
 (HAZARDOUS)

5.23.1 Specifications. None.

5.23.2 Technical description. Lead acetate, trihydrate, technical appears as colorless crystals, white granules or powder. The material has a density of 2.55, melts at 75°C when rapidly heated; at a little above 100°C it begins to lose acetic acid; and it decomposes completely above 200°C. This material is soluble in water, slightly soluble in alcohol and freely soluble in glycerol. Lead acetate, trihydrate, absorbs CO_2 from the air, becoming an insoluble carbonate.

5.23.3 Use data. Lead acetate, trihydrate, is intended for military use in the manufacture of antifouling paint for ships and boats. Typical commercial applications include use in dyeing and printing cottons; weighting silks; manufacture of lead salts and chrome-yellow; also for various analytical procedures, e.g., detection of sulfide, determination of CrO_3 ; MoO_3 ; and for medical and veterinary use.

5.23.4 Packaging data and labeling. For military use, lead acetate, trihydrate, technical is packaged in 50 pound unit quantity drums. Drums must be provided with means of assuring air tightness. Each container shall carry the following warning label:

LEAD ACETATE
 WARNING! DUST HARMFUL

Avoid breathing dust.
 Wash thoroughly before eating or smoking.
 Keep away from feed or food products.

5.23.5 Storage data. Store in a cool, well ventilated area away from flame or definite fire hazards. Because the material readily absorbs CO_2 from the air, all containers must be kept sealed. Inspect semi-annually for condition of the containers.

5.24 Name. LECITHIN, TECHNICAL $C_{43}H_{88}NO_9P$ (approx) FW 794.16
 Lecithol
 Ovolecithin
 Phospholutein

5.24.1 Specifications. MIL-L-3061, Lecithin (For use in Explosives).

5.24.2 Technical description. Lecithin is a mixture of the diglycerides of stearic, palmitic, and oleic acids, linked to the choline ester of phosphoric acid. The substance is found in all living organisms (plants and animals). It is a significant constituent of nervous tissue and brain substance. Lecithin is a yellowish-brown, hygroscopic, amorphous substance, but can be readily crystallized from ether at low temperatures. Although it is white when freshly prepared, it darkens rapidly on exposure to air. It is soluble in alcohol, ether, or chloroform, and swells in water to form a colloidal dispersion. Lecithin is generally obtained from soybeans as a byproduct in the manufacture of soybean oil.

Table XXV - Chemical and physical requirements
of lecithin, technical

| Property | Requirement |
|---|--------------|
| Acetone insoluble matter (pct by wt, min) | 62.0 |
| Acid number (mg KOH per gm sample, max) | 32 |
| Benzene insoluble matter (pct by wt, max) | 0.1 |
| Dropping point (°C) | 66 ± 3 |
| Iodine number | 95 to 105 |
| Moisture (pct, max) | 1.0 |
| Nitrogen (pct) | 0.95 ± .05 |
| Penetration (25°C, max) | 180 |
| Specific gravity (25/25°C) | 1.040 ± .005 |
| Unsaponifiable matter (pct by wt, max) | 3.0 |

5.24.3 Use data. Lecithin is intended for military use in explosives. Typical commercial applications include use as an emulsifier in margarine, chocolate, and the food industry in general. It is also used in pharmaceuticals, cosmetics, and the treatment of leather and textiles.

5.24.4 Packaging data and labeling. For military use, lecithin is packaged in 5 gallon unit quantity drums.

5.24.5 Storage data. Store in a cool, well ventilated area away from flame or definite fire hazards. Keep containers tightly closed to exclude air. If stored as recommended, this material will have an indefinite shelf life.

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5.25 Name. LITHIUM STEARATE TECHNICAL $\text{LiC}_{18}\text{H}_{35}\text{O}_2$ FW 289.9

5.25.1 Specifications. MIL-L-51131, Lithium Stearate.

5.25.2 Technical description. Lithium stearate appears as white crystals, with a specific gravity of 1.025. It is insoluble in water, alcohol or ethyl acetate; forms gels with mineral oils. For military use, in addition to the requirements listed in Table XXVI, the particles size of this material shall be such that a minimum of 99 percent shall pass through a US Standard sieve No. 100.

Table XXVI - Chemical and physical requirements of
lithium stearate, technical

| Property | Requirement |
|---|--------------|
| Iodine number of fatty acid (max) | 5.0 |
| Melting point of fatty acid ($^{\circ}\text{C}$, min) | 55 |
| Melting point of lithium stearate ($^{\circ}\text{C}$, min) | 200 |
| Moisture (pct by wt, max) | 1.5 |
| pH Value | 8 to 10 |
| Purity | |
| Lithium content (pct) | 2.2 to 2.8 |
| Stearate, as stearic acid (pct) | 94.6 to 97.8 |
| Water soluble material (pct by wt, max) | 0.1 |

5.25.3 Use data. Lithium stearate is intended for military use as a lubricant in fuzes. Typical commercial applications include use in cosmetics; plastics; waxes; greases, lubricant in powder metallurgy; corrosion inhibitor in petroleum; flatting agent in varnishes and lacquers, and in high temperature lubrication.

5.25.4 Packaging data and labeling. For military use lithium stearate is packaged in 55 gallon unit quantity drums.

5.25.5 Storage data. Lithium stearate should be stored in a cool, dry area. When stored under ideal conditions this material has an indefinite shelf life.

5.26 Name. p-METHYLAMINOPHENOL SULFATE TECHNICAL $(\text{HO} \underset{6}{\text{C}} \underset{4}{\text{H}} \underset{3}{\text{N}} \underset{2}{\text{H}} \underset{2}{\text{C}} \underset{4}{\text{H}})_2 \cdot \text{H}_2 \text{SO}_4$ FW 344.39
 Mono-methyl-para-aminophenol sulfate
 p-Hydroxymethylaniline sulfate
 (HAZARDOUS)

5.26.1 Specifications. None.

5.26.2 Technical description. p-Methylaminophenol sulfate appears as colorless, crystalline needles which discolor in air. The crystals melt at 250-260°C with decomposition. The solubility is 5 gm per 100 ml of cold water; 16.7 per 100 ml of boiling water. It is slightly soluble in alcohol, and insoluble in ether.

5.26.3 Use data. p-Methylaminophenol sulfate is intended for military use as a photographic developer. Typical commercial applications include use as a photographic developer and in dyeing furs.

5.26.4 Packaging data and labeling. For military use, this material is packaged in 1 pound unit quantity bottles. Each container must bear the following label:

p-METHYLAMINOPHENOL SULFATE
 WARNING!
 MAY CAUSE EYE AND SKIN
 IRRITATION. EMITS HIGHLY TOXIC
 FUMES WHEN HEATED TO
 DECOMPOSITION.

Do not get in eyes.
 Avoid contact with skin.
 Do not breathe vapor.
 Do not take internally.
 In case of contact, immediately
 flush with plenty of water for
 at least 15 minutes; for eyes,
 get medical attention.

5.26.5 Storage data. Keep containers tightly sealed and protected from light. If so stored, this material will have an indefinite shelf life.

5.27 Name. NICKEL FORMATE, DIHYDRATE, TECHNICAL $\text{Ni}(\text{HCOO})_2 \cdot 2\text{H}_2\text{O}$ FW 184.78

5.27.1 Specifications. None.

5.27.2 Technical description. Nickel formate, dihydrate, is in the form of green crystals, soluble in water. The product has a specific gravity of 2.154 (20/4°C) and decomposes with heat.

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5.27.3 Use data. Nickel formate, dihydrate, technical is intended for military use in the production of nickel catalysts which is its typical commercial applications as well.

5.27.4 Packaging data and labeling. For military use, nickel formate, dihydrate, technical is packaged in 1 pound unit quantity bottles.

5.27.5 Storage data. Store in a cool place, keeping containers tightly closed. If stored as recommended this material will remain usable for two years, after which it should be checked.

5.28 Name. SODIUM ACETATE, ANHYDROUS, TECHNICAL $\text{NaC}_2\text{H}_3\text{O}_2$ FW 82.03

5.28.1 Specifications. MIL-S-12055, Sodium Acetate, Anhydrous, Technical.

5.28.2 Technical description. Sodium acetate, anhydrous, is a white hygroscopic powder. It has a specific gravity of 1.528 (20/4°C). It is very soluble in hot water, soluble in cold water, and slightly soluble in alcohol.

Table XXVII - Chemical and physical requirements
of sodium acetate, anhydrous, technical

| Property | Requirement (pct by wt) |
|---|----------------------------|
| Acidity as acetic acid (max) | 1.00 |
| Impurities limitation (max): | |
| Calcium as calcium acetate, $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ | 0.20 |
| Chlorides as sodium chloride | 0.50 |
| Insoluble matter | 0.10 |
| Moisture | 0.50 |
| Sulfates as sodium sulfate, Na_2SO_4 | 0.50 |
| Total iron as Fe | 0.10 |
| Particles size: | |
| Passing No. 12 sieve (min) | 99.0 |
| Passing No. 200 sieve (min) | 25.0 |
| Sodium acetate, $\text{NaC}_2\text{H}_3\text{O}_2$, content (min) | 98.0 |

5.28.3 Use data. Sodium acetate, anhydrous, is intended for military use in the manufacture of chemicals. Typical commercial applications include use as an auxiliary in acetylations.

5.28.4 Packaging data and labeling. For military use, sodium acetate, anhydrous, is packaged in 25 pound unit quantity removable head steel drums.

5.28.5 Storage data. Keep stored in tightly sealed containers to prevent contact with air or moisture. If so stored, this material should remain usable indefinitely.

5.29 Name. TITANIUM POTASSIUM OXALATE, DIHYDRATE, TECHNICAL
 $\text{TiO}(\text{KC}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$ FW 354.17
 Potassium titanium oxalate
 Titanyl potassium oxalate
 (HAZARDOUS)

5.29.1 Specifications. None.

5.29.2 Technical description. Titanium potassium oxalate, dihydrate, technical is in the form of colorless, lusterless, nearly odorless crystals or crystalline powder. The product is very soluble in water.

5.29.3 Use data. Titanium potassium oxalate, dihydrate, technical, is intended for military use in dyes and photography. Typical commercial applications include use in the formulation of dyes for leather and other tannin materials. It is also used to fix tannin in cotton; as a mordant in textile dyeing; and in sensitizing aluminum for photography.

5.29.4 Packaging data and labeling. For military use, titanium potassium oxalate, dihydrate, technical is packaged in 1 pound unit quantity bottles. Each container must bear the following label:

TITANIUM POTASSIUM OXALATE, DIHYDRATE
 DANGER! CAUSES BURNS TO SKIN AND EYES

Do not get in eyes, on skin, on clothing.
 Do not take internally.
 In case of contact, immediately flush
 with plenty of water for at least 15
 minutes and get medical attention.

5.29.5 Storage data. Store in a cool place, keeping containers tightly closed. If stored as recommended this material will remain usable for two years, after which it should be checked.

5.30 Name. TRI-n-BUTYL BORATE, TECHNICAL $\text{B}(\text{OC}_4\text{H}_9)_3$ FW 230.16
 Boric acid, tributyl ester
 Tributoxyborine

5.30.1 Specifications. None.

5.30.2 Technical description. Tri-n-butyl borate is a water-white liquid which decomposes in water but is readily miscible with organic liquids such as alcohol, chloroform, carbon tetrachloride, diacetone, and naphtha.

Table XXVIII - Physical constants of tri-n-butyl borate

| Property | Constant |
|--------------------------------------|------------|
| Boiling point (760 mm pressure, °C) | 230 to 231 |
| Flash point (Cleveland open cup, °F) | 200 |
| Melting point (°C) | -70 |
| Refractive index (26°C) | 1.4080 |
| Specific gravity (20/4°C) | 0.8567 |
| Vapor density (air = 1.00) | 7.95 |

5.30.3 Use data. Tri-n-butyl borate, technical is intended for military use as a shielding oil in nuclear reactors for absorption of thermal neutrons. Typical commercial applications include use with crystalline boric acid as an impregnating agent to render textiles fire resistant; to inhibit the formation of wax crystals in oil at low-temperature; as a gas welding flux; as a drying agent for nonaqueous systems; and as an antigelling agent.

5.30.4 Packaging data and labeling. Tri-n-butyl borate, technical is packaged in 55 gallon unit quantity drums for military use. There are no specific DoT Shipping Regulations pertaining to this material.

5.30.5 Storage data. Because tri-n-butyl borate hydrolyzes readily in water, the material should be kept in tightly sealed containers. If stored as recommended, it should remain stable indefinitely.

5.31 Name. TRICRESYL PHOSPHATE, TECHNICAL $(\text{CH}_3\text{C}_6\text{H}_4)_3\text{PO}_4$ FW 368.37
Tolyl phosphate
Tritolyl phosphate
(HAZARDOUS)

5.31.1 Specifications. TT-T-656, Tricresyl Phosphate; and MIL-T-9188, Tricresyl Phosphate, For Use As An Aviation Gasoline Additive.

5.31.2 Technical description. Tricresyl phosphate, technical, is an isomeric mixture of phosphate esters of cresylic acid derived from petroleum or coal tar. It is an oily, stable, nonvolatile, flame resistant liquid

practically colorless and odorless; and insoluble in water, but miscible with all common organic solvents and thinners, linseed oil, castor oil, and other oils. Since this material is a mixture of isomers, the chemical and physical characteristics are dependent upon specific requirements occasioned by its eventual use. These requirements are outlined in the tables below and pertain to the concentrated material for general applications and the concentrated and blended material for aviation gasoline additives.

5.31.2.1 General application material.

Table XXIX - Chemical and physical requirements of tricresyl phosphate, technical (for general applications per TT-T-656)

| Property | Requirement |
|---|----------------|
| Acidity (mg KOH per gm sample, max) | 0.02 |
| Color (Hazen platinum-cobalt scale, max) | 100 |
| Ester content as tricresyl phosphate (pct by wt, min) | 99 |
| Nonvolatile matter (pct by wt, min) | 99.80 |
| Phosphite content (pct by wt, max) | 0.05 |
| Refractive index | 1.550 to 1.560 |
| Specific gravity (20/20°C) | 1.150 to 1.180 |

In addition to the requirements listed in Table XXIX, this material shall be clear and free from sediment and suspended matter and shall have substantially no odor. It shall be free from oxidizable substances when tested with potassium permanganate solution and shall be miscible without turbidity with 19 volumes of 10° heptane at 20°C.

5.31.2.2 Gasoline additive material.

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Table XXX - Chemical and physical requirements of tricresyl phosphate, technical (aviation gasoline additive per MIL-T-9188)

| Property | Requirement |
|-------------------------------------|----------------|
| Acidity (mg KOH per gm sample, max) | 0.2 |
| Cloud point (°F, max) | 0 |
| Color (ASTM standard, max) | 1.5 |
| Ester content (pct by wt, min) | 99.0 |
| Nonvolatile matter (pct by wt, min) | 99.8 |
| Phosphorous content (pct by wt) | 8.0 to 8.5 |
| Specific gravity (20/20°C) | 1.160 to 1.175 |

For the material described in Table XXX, the supplier must certify that the cresols from which it is produced contain not more than 5 percent phenols. This material may be any or all of the isomers of tricresyl phosphate, but when used to prepare reduced ester blends the manufacturer must certify that it contains less than 10 percent ortho-isomer by weight. This is identified as Type I (concentrated) material of MIL-T-9188 and is the base material for the Type II (medium) and Type III (light) blends of the same specification. In addition to the stated requirements, it shall be free from sediment, suspended matter, grit, or other adulteration; shall contain a minimum of water; and shall be free from oxidizable substances when tested with potassium permanganate solution. Blended materials are blends of the concentrated tricresyl phosphate in carrier solvents which must be very soluble in the concentrated material and compatible with aviation gasoline. Recommended carrier solvents are listed below and may be used singly or in any combination thereof to satisfy the requirements for these blends listed in Table XXXII.

| <u>Solvent</u> | <u>Specification</u> |
|--------------------------------------|----------------------|
| Ethanol | O-E-760 |
| Hydrocarbon Fluid, Aviation Alkylate | TT-S-735 |
| Isopropyl Alcohol | TT-I-735 |
| Methanol | O-M-232 |
| Naphtha, Aliphatic | TT-N-95 |
| Naphtha, Aromatic | TT-N-97 |
| Toluene | TT-T-548 |

Table XXXI - A typical formation of
blended tricresyl phosphate
MIL-T-9188

| Ingredient | Approximate pct by vol | |
|-----------------------------|------------------------|-------------|
| | Medium blend | Light blend |
| Tricresyl phosphate, Type I | 55 | 14 |
| Isopropyl alcohol | 4 | 8 |
| Toluene | 30 | 57 |
| Alkylate | 11 | 21 |

Table XXXII - Chemical and physical requirements of
blended tricresyl phosphate (MIL-T-9188)

| Property | Requirement | |
|--|--------------|--------------|
| | Medium blend | Light blend |
| Cloud point (°F, max) | -20 | -20 |
| Color (ASTM standard, max) | 1.5 | 1.5 |
| Concentration 99 pct tricresyl phosphate (gal per gal) | .513 to .552 | .128 to .138 |

5.31.3 Use data. Military and typical commercial uses for this material are given below.

5.31.3.1 Military. The tricresyl phosphate for general application is intended for military use as an antiwear agent for lubricants, in the manufacture of organic coatings, for lubrication of vacuum pumps in conjunction with oxygen systems, and as an air filter adhesive. The aviation gasoline additive material is intended for military use as a lead scavenger to prevent engine fouling and is subject to the following limitations:

a. The concentrated additive is intended to be incorporated into aviation gasoline only by the supplier of the gasoline who has the necessary materials and equipment to accomplish the blending. It is intended for use by refineries or contracting agencies and not by subsequent handlers or consumers of the fuel.

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b. The medium blend additive is intended for use as a direct additive to aviation gasoline and no special materials or equipment are required. It is suitable for use by handlers and consumers and is the blend of choice for addition to large volume lots of aviation gasoline. One gallon of this blend is the correct portion for addition to 4,000 gallons of gasoline containing 4.6 ml tetraethyl lead per gallon in order to provide the required theory concentration.

c. The light blend additive is intended for use as a direct additive to aviation gasoline and no special materials or equipment are required. It is suitable for use by handlers and consumers and is the blend of choice for addition to lesser volume lots of aviation gasoline. Seven fluid ounces (205-208 ml) of this blend is the correct portion for addition to 55 gallons of gasoline containing 4.6 ml tetraethyl lead per gallon in order to provide the required theory concentration.

5.31.3.2 Commercial. Typical commercial applications include use as a plasticizer for polyvinyl chloride, polystyrene and nitrocellulose; as a fire retardant for nitrocellulose and vinyl chloride; in solvent mixtures; in waterproofing and fireproofing compositions; as an additive to extreme pressure lubricants; and as a hydraulic fluid and heat exchange medium.

5.31.4 Packaging data and labeling. For military use the tricresyl phosphate used for general applications is packaged in 1 and 5 gallon unit quantity cans and in 55 gallon unit quantity drums. Each container shall bear the following label:

WARNING: TOXIC
CONTAINS TRICRESYL PHOSPHATE

Avoid inhaling, swallowing, or
contact with skin.
In case of contact, remove soiled
clothing and thoroughly wash
exposed skin.

The medium blend aviation gasoline additive material is packaged in 1 and 5 gallon unit quantity cans and the light blend material is packaged in 1/2 pint unit quantity cans containing 200 cc of blend. Each container of blend shall bear the following in red letters:

POISONOUS. Avoid skin contact.

5.31.5 Storage data. The general applications material and aviation gasoline additive blends should be stored in a well ventilated area away from open flame and definite fire hazards, with containers kept tightly sealed. Stored in this manner, the concentrated material will have an

indefinite shelf life. However, the blended material is subject to selective evaporation. Carrier solvents may evaporate, increasing tricresyl phosphate concentration, the tricresyl phosphate being non-volatile. A loss of 4 percent by volume by evaporation may cause analysis to indicate a concentration beyond specification limits. For this reason, quality surveillance samples should be withdrawn within 6 months of date of manufacture, and stock levels should be held to a minimum in order to prohibit longer than 18 months storage life, wherever practicable.

5.32 Name. TRIPHENYL PHOSPHATE, TECHNICAL $(C_6H_5O)_3PO$ FW 326.29
(HAZARDOUS)

5.32.1 Specifications. TT-T-662, Triphenyl Phosphate (For use in organic coatings).

5.32.2 Technical description. Triphenyl phosphate is supplied in the form of white flakes having a faintly aromatic, characteristic odor. It is a nonflammable material and insoluble in water. It is soluble in benzene, chloroform, ether, and acetone, and is moderately soluble in alcohol. It is also soluble in most lacquers, thinners, and oils. In addition to the requirements listed in Table XXXIII, it shall be free from oxidizable substances when tested with potassium permanganate solution.

Table XXXIII - Chemical and physical requirements of triphenyl phosphate, technical

| Property | Requirement |
|---|-------------|
| Acidity (mg KOH per gm sample, max) | 0.10 |
| Ester content as triphenyl phosphate (pct by wt, min) | 99 |
| Free phenols (pct by wt, max) | 0.15 |
| Melting point ($^{\circ}C$, min) | 48.5 |
| Nonvolatile matter (pct by wt, min) | 99.8 |

5.32.3 Use data. Triphenyl phosphate, technical, is intended for military use in the manufacture of organic coatings. Typical commercial applications include use as a plasticizer in lacquers and varnishes; as a noncombustible substitute for camphor in celluloid; to render cellulose esters and air-plane dope stable and fireproof; for impregnating roofing paper; and as a lubricant.

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5.32.4 Packaging data and labeling. For military use, triphenyl phosphate, technical is packaged in 1 kilogram unit quantity amber colored bottles provided with a screw cap. The bottles shall be sealed with a secondary closure of pressure sensitive tape and shall be enclosed in a telescoping-type, water-resistant, fiber can cushioned with either vermiculate or shredded asbestos not less than three-fourths inch thick. Each container shall bear the following label:

TRIPHENYL PHOSPHATE
CAUTION! EMITS HIGHLY TOXIC
FUMES WHEN HEATED TO
DECOMPOSITION.

Do not take internally.
Do not breathe dust or vapor.

5.32.5 Storage data. Keep in tightly sealed containers out of direct light and away from definite fire hazards. If stored under these conditions the shelf life of this material should be indefinite.

5.33 Name. ZINC STEARATE, TECHNICAL $Zn(C_{18}H_{35}O_2)_2$ FW 632.33
(HAZARDOUS)

5.33.1 Specifications. None.

5.33.2 Technical description. Zinc stearate is a mixture of the zinc salts of stearic and palmitic acids and usually with some excess of zinc oxide. Theoretically, pure zinc stearate is expressed as the formula shown in paragraph 5.33 above. This material is a white, fine, soft, bulky powder with a slight characteristic odor. It repels water; therefore it is insoluble in water, alcohol and ether. It is soluble in benzene and decomposes in dilute acids. It melts at approximately 120°C.

5.33.3 Use data. Zinc stearate, technical is intended for military use as an ingredient in paints, varnishes and lacquers. Typical commercial applications include use in tablet manufacture; in cosmetic and pharmaceutical powders and ointments; as a flattening agent in lacquers; as a drying lubricant and dusting agent for rubber; as a plastic-mold releasing agent; and as a waterproofing agent for concrete, rock wool, paper and textiles.

5.33.4 Packaging data and labeling. For military use, zinc stearate, technical is packaged in 25 pound unit quantity bags.

5.33.5 Storage data. Store in a cool place away from definite fire hazards and powerful oxidizing agents. If stored as recommended this material will 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.

Assignee activity: GS Preparing activity: Army - MU

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

Review activities: Army - MI, MU, WC

User activities: Navy - AS, CG, MC, SH

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