INCH-POUND

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SUPERSEDING
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MILITARY SPECIFICATION

LUBRICANT, CETYL ALCOHOL, 1-HEXADECANOL, APPLICATION TO FASTENERS

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for flake or granular cetyl alcohol, the solvent for dissolving the cetyl alcohol, preparation and application requirements for use of cetyl alcohol as an installation lubricant on mechanical fasteners—such as pins, bolts, nuts, washers, and threaded or nonthreaded fastening devices—and inspection criteria for coated parts

1.2 Classification. The lubricant shall be classified in one type with grades as specified herein (see 6.1)

1.2.1 Type and grades

Type III – Water base solvent

Grade A	10 to 30 grams (0 08 to 0 25 pound per gallon) cetyl alcohol per liter of deionized water
Grade B	30 to 60 grams (0 25 to 0.50 pound per gallon) cetyl alcohol per liter of deionized water
Grade C	60 to 100 grams (0 50 to 0.83 pound per gallon) cetyl alcohol per liter of deionized water

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENSI, 2335 Seventh Street, Suite 6, Wright-Patterson AFB OH 45433-7809 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A FSC 9150

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the *Department of Defense Index of Specifications and Standards* (*DoDISS*) and supplement thereto, cited in the solicitation (see 6 3)

STANDARDS

FEDERAL

FED–STD–313	Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
FED–STD–791	Lubricants, Liquid Fuels, and Related Products, Methods of Testing

MILITARY

MIL–STD–105	Sampling Procedures and Tables for Inspection by Attributes
MIL–STD–290	Packaging of Petroleum and Related Products

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Department of Defense Single Stock Point, Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia PA 19111–5094)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein Unless otherwise specified, the issues are those cited in the solicitation

PUBLICATIONS

CODE OF FEDERAL REGULATIONS

Title 49 CFR 171–178	Subchapter C – Hazardous Materials Regulations

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington DC 20402)

DEPARTMENT OF LABOR (DOL)

OSHA 29 CFR 1910 1200	Federal Register, Part IV, Department of Labor, OSHA Hazard Communication. Final Rule

(Guideline CPL 2–2 38 may be obtained from OSHA Publication Office, Room S–4203, 200 Constitution Avenue NW, Washington DC 20210)

2.2 Non–Government publications. The following documents form a part of this document to the extent specified herein Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the *DoDISS* cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the *DoDISS* are the issues of the documents cited in the solicitation (see 6 3)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1957	Standard Test Method for Hydroxyl Value of Fatty Oils and Acids
ASTM D1959	Standard Test Method for Iodine Value of Drying Oils and Fatty Acids (DoD adopted)
ASTM D1962	Standard Test Method for Saponification Value of Drying Oils, Fatty Acids, and Polymerized Fatty Acids (DoD adopted)
ASTM D1963	Standard Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25 Degrees C
ASTM D1980	Standard Test Method for Acid Value of Fatty Acids and Polymerized Fatty Acids
ASTM D1983	Standard Test Method for Fatty Acid Composition by Gas–Liquid Chromatography of Methyl Esters (DoD adopted)
ASTM E324	Standard Test Method for Relative Initial and Final Melting Points and the Melting Range of Organic Chemicals (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103–1137.)

(Non–Government standards and other publications are normally available from the organizations which prepare or distribute the documents These documents also may be available in or through libraries or other informational services)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this document takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Properties. The lubricant shall be cetyl alcohol, normally obtained by the user in flake or granular form, and mixed with the appropriate solvent prior to use, as specified herein

3.1.1 Cetyl alcohol. Cetyl alcohol shall be National Formulary Grade, (CH3 (CH2) 150H), in flake or granular form, in accordance with table I.

3.1.2 Water base solvent. Water base solvent shall be nonflammable, deionized water with a 1 meg–ohm minimum resistivity modified with cetyl alcohol

TABLE I. Properties of cetyl alcohol.

Property	Requirement
Carbon Content, %	
C_{16}	95 min
C_{14}	1 nom
C_{18}	3 nom
Hydroxyl value	218 – 238
Acid value, max	2 0
Saponification	3.0
Iodine value, max	3 0
Melting point	45°C – 51°C (113°F – 124°F)
Specific gravity	0 815
Color	White

3.2 Application solution

3.2.1 Composition and preparation

3.2.1.1 Type III, water base. Water base, type III, shall be prepared by heating deionized water up to 71°C (160°F) and adding the appropriate amount of cetyl alcohol flakes or granules for the grade solution being prepared in accordance with table II. The solution shall be stirred until the cetyl alcohol particles are completely dissolved. Dispersing agents and corrosion inhibitors are allowed

NOTE: Care should be taken to reduce the possibility of freezing, or shock from organic solvents or hard water

3.3 Properties of mixed solutions

3.3.1 As mixed. As mixed solutions shall be as specified in table II

3.3.2 Storage life in closed containers. Mixed solutions shall meet the requirements of table II when tested at any time up to 36 months after mixing, when stored in closed, noncontaminating containers at ambient temperatures

3.3.3 Working life in application tank or container

3.3.3.1 Coatability after cycling. Solutions shall maintain coatability after cycling from ambient temperature to application temperature specified in table II until replenishment is necessary as required by 3.3.3 2 or replacement is required as specified in 3.3.3.3 Flotation control devices may be used to reduce solvent evaporation, provided there is no contamination of parts or solutions

3.3.3.2 Maintain solution concentrations. Solutions shall be maintained within the concentrations specified in table II by a suitable method, such as gravimetric, evaporations, or specific gravity The appropriate amounts of either cetyl alcohol or solvent shall be added as necessary, generally at the beginning of each work period or shift

3.3.3.3 Contamination of solution. Solutions shall be replaced when contamination of the solution is indicated by poor coating of parts or parts become contaminated from the solution This is evident by spotty coating or application on parts, and the solution becomes cloudy, dark, or includes foreign particles Type III should be a white, opaque emulsion

TABLE II. Properties of mixed lubricant solutions.

PROPERTY	TYPE III		
	GRADE A	GRADE B	GRADE C
Cetyl Alcohol g/L solvent (lb/gal solvent)	10–30 (0 08–0 25)	30–60 (0 25–0.50)	60–100 (0 50–0.83)
Solvent Base	water	water	water
Specific Gravity at Application Temperature	TBD[1]	TBD[1]	TBD[1]
Application Temperature	71°C max (160°F)	71°C max (160°F)	71°C max (160°F)

[1] To be determined and reported in quality conformance data

3.4 Safety considerations

3.4.1 Cetyl alcohol toxicity. Cetyl alcohol flakes and granules are nontoxic, noncorrosive, and practically odorless; however, safety and health information or precautionary labels applied to containers or packages by the manufacturer should be read and understood by all supervisory personnel and employees before handling the material

3.5 Properties of coated parts

3.5.1 Physical properties. The physical properties of the cetyl alcohol coated parts shall be as follow

a. Parts shall be uniformly coated and free from coating nodules and localized buildup on pin and bolt shanks, in locking grooves, and in threads

b Parts shall be slippery to the touch

c Parts may exhibit a white or slightly colored film or frosty appearance, which does not affect the performance of the coating and shall not be the cause for rejection

3.5.2 Physical inspection criteria. Useful inspection criteria to indicate the presence of coating on parts include.

a Slippery feeling to the touch.

b Presence of white surface film or frosty appearance

c Nonwetting of surface when dipped in water

d Coating shall be thin and uniform in appearance.

3.6 Coating equipment

3.6.1 Application tank. The application tank shall be any suitable tank or container into which racked or basketed parts can be immersed The tank or container should contain provisions for, or be capable of maintaining the coating solution within the application temperature range for the applicable solution specified in table II The tank lining shall be made from noncontaminating materials

3.6.2 Racks and baskets. Racks and baskets shall be made from, or coated with noncontaminating materials. There shall be free movement of solution around and through the parts The position of parts in the racks or baskets shall promote thorough draining and drying of parts after removal from immersion

4. QUALITY ASSURANCE REQUIREMENTS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3 and 5 The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility to assure all products or supplies submitted to the Government for acceptance comply with all the requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material

4.2 Classification of inspection. The inspection requirements specified herein are classified as follow

a First article testing (see 4 3)

b. Quality conformance inspection (see 4 4).

4.3 First article testing. First article testing shall include all tests to determine conformance to all technical requirements as specified in section 3 and in tables I and II

4.4 Quality conformance inspection

4.4.1 Routine acceptance tests. Tests on each lot of cetyl alcohol, solvent, or coated parts shall consist of the tests specified in table III Samples shall be labelled completely with information which identifies the purpose of the sample, name of the product, specification number, type, lot, batch number, date of sampling, and contract number Unless otherwise specified, sampling of the lubricant shall be in accordance with *MIL–STD–105*

4.4.2 Bulk lot. A bulk lot (batch) is an indefinite quantity of homogeneous mixture of material offered for acceptance in a single, isolated container; or manufactured in a single plant run (not to exceed 24 hours) through the same processing equipment, with no change in ingredient material

4.4.3 Packaged lot. A packaged lot is an indefinite number of 55–gallon drums or smaller unit containers of identical size and type, offered for acceptance, and filled with a homogeneous mixture of material from one isolated container; or filled with a homogeneous mixture of material manufactured in a single plant run (not to exceed 24 hours) through the same processing equipment, with no change in ingredient material

4.4.4 Submission of Material Safety Data Sheets. The contractor shall furnish to the Contracting Activity the toxicological data and formulations required to evaluate the safety of the material for the proposed use through the submission of the Material Safety Data Sheet detailed in *FED–STD–313*

TABLE III. Test methods for lubricant properties.

Tests and Inspections	Paragraph Requirements	Test Method
Cetyl alcohol: Inspection unit = 22.7 kg (50 lb)		
Carbon content, C_{16}	3.1 1	*ASTM D1983*
Specific gravity	3.1.1	*ASTM D1963*
Color	3.1.1	Visual
Hydroxyl value	3 1.1	*ASTM D1957*
Acid value	3.1 1	*ASTM D1980*
Saponification value	3.1 1	*ASTM D1962*
Iodine value	3.1.1	*ASTM D1959*
Melting point	3 1.1	*ASTM E324*
Cetyl alcohol coated parts Inspection unit = As specified on the applicable part standard or on the purchase order.		
Coating uniformity	3 5 1	Visual
Surface	3 5.1	Touch
Color	3.5.1	Visual

4.5 Method of inspection and test

4.5.1 Inspection. Inspection shall be in accordance with Method 9601b of *FED–STD–791* and 4 5 2 of this specification.

4.5.2 Tests. The lubricant properties shall be determined in accordance with the applicable methods specified in table III and 4 5 4 Physical and chemical values specified in section 3 apply to the average of the determinations made on the samples.

4.5.3 Quality conformance data. Test reports and statements of conformance, signed by a responsible officer of the supplier involved, shall be supplied with each production lot and shall include results of tests to determine lot acceptance or a statement that the lot conforms

4.5.4 Sampling of cetyl alcohol coated parts. Sampling of cetyl alcohol coated parts shall be in accordance with the sampling plan specified for the quality conformance inspection for the parts, such as on the applicable parts standards document

4.5.4.1 Sample preparation

4.5.4.1.1 Application of cetyl alcohol coating to parts

4.5.4.1.1.1 Cleaning. Clean parts to remove all foreign material and surface contamination Solvent clean or vapor degrease parts immediately prior to first lubricant application with a suitable hydrocarbon solvent

4.5.4.1.1.2 Application process. Immerse the parts racked in wire supports or perforated baskets into the lubricant solution maintained at the application (operating) temperature specified in table II Allow the parts to soak in the solution temperature Agitate the basket or rack several times to ensure adequate circulation of solution into part recesses When specified by purchaser, parts may be immersed in lubricant solution maintained at ambient temperature for not less than 5 minutes. Users of room temperature solutions are cautioned that coating adhesion will be inferior to that produced by the warmed solution. Remove the rack or baskets from the solution, allow the excess solution to drip into the tank, and allow the parts to dry before handling A centrifuge or stream of warm, dry air at a temperature no higher than 38°C (100°F) may be used to facilitate drying Some parts may require turning to prevent coating buildup on the surface

NOTE: Collect or disperse evaporated solvent in accordance with applicable air quality regulations (See 6 5)

5. PACKAGING

5.1 Packaging requirements. Unless otherwise specified in the contract (see 6 3), preservation, packaging, packing, and marking shall be in accordance with *MIL-STD-290* for levels A and B and commercial packaging

5.1.1 Packaging of coated parts. Packaging of cetyl alcohol coated parts shall be in accordance with the applicable parts standard

5.2 Hazardous material. Each container of hazardous material shall be conspicuously marked to identify the hazard and provide safe handling and storage instructions in accordance with *MIL-STD-290* and *Code of Federal Regulations Title 49 subchapter c* and any other special markings specified by the Acquiring Activity All unit and intermediate packs of toxic and hazardous chemicals and materials shall also be labelled in accordance with the applicable laws, statues, regulations, or ordinances—including federal, state, and municipal requirements In addition, unit and intermediate containers, including unit containers which serve as shipping containers, such as pails and drums, shall be marked with the applicable precautionary information detailed in *OSHA 29 CFR 1910.1200*

6. NOTES

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

6.1 Intended use. Cetyl alcohol, also called hexadecanol, is intended for use as a lubricating coating to promote the installation of fasteners as follows (see 1 2)

Type III.

Grade A	Collars, nuts, and washers
Grade B	Pins, bolts, externally threaded parts, and noninterference fit fasteners
Grade C	Interference fit fasteners, internally threaded parts, and parts requiring heavy lubricant coating.

6.2 Application of cetyl alcohol to parts. Application of cetyl alcohol to parts is usually specified on the respective part drawing, standard, or applicable specification Cetyl alcohol may also be used as an additional, supplementary lubricant as allowed by an applicable process specification, installation drawing, or appropriate technical order.

6.3 Acquisition requirements. Acquisition documents should specify not less than the following:

a Title, number, and date of this specification.

b. Issue of the *DoDISS* to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2 1 1 and 2.2).

c. Type and grade, as applicable, of lubricant coating desired

d Size of package or container desired

e Quantity of lubricant desired.

f. Level of packaging desired (see 5.1).

6.4 Material Safety Data Sheet. Appropriate instructions from the Material Safety Data Sheet (*FED-STD-313*) shall be in or attached to each exterior container.

6.5 Air quality regulations. Examples of applicable air quality regulations for geographical areas are the *Los Angeles County Air Pollution Control District Rule 442* (formerly *Rule 66*) and the *San Francisco Bay Area Air Pollution Control District Regulation 3.*

6.6 Definition

6.6.1 Cetyl alcohol. Cetyl alcohol is white, crystalline, odorless, and noncorrosive (DOT) and is compatible with fats, fatty acids, waxes, and petroleum oils It is soluble in light petroleum base solvents, fluorocarbon solvents, and water Cetyl alcohol is a nontoxic, nonirritating, and otherwise innocuous material

6.7 Storage requirements. Type III should be stored at temperatures between 0°C to 38°C (32°F to 100°F)

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

6.9 Subject term (keyword) listing

butoxyethanol
butyl cellosolve
installation lubricant
melting point
water base solvent

Custodians
Army – AT
Navy – AS
Air Force – 11
DLA – GS

Review activities
Army – AR, AV
Air Force – 68

Preparing activity:
Air Force – 11

(Project 9150–1133)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1 The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given

2. The submitter of this form must complete blocks 4, 5, 6, and 7

3. The preparing activity must provide a reply within 30 days from receipt of the form

NOTE: This form may not be used to request copies of documents, not to request waivers, or clarification of requirements on current contracts Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements

I RECOMMEND A CHANGE:	1 DOCUMENT NUMBER MIL-L-87132B	2 DOCUMENT DATE (YYMMDD) 941215

3 DOCUMENT TITLE
LUBRICANT, CETYL ALCOHOL, 1-HEXADECANOL, APPLICATION TO FASTENERS

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

5 REASON FOR RECOMMENDATION

6. SUBMITTER

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

8 PREPARING ACTIVITY

A NAME ASC/ENSI AF CODE 11	B TELEPHONE *(Include Area Code)* (1) Commercial (513) 255-6281 (2) DSN *(If applicable)* 785-6281
C ADDRESS *(Include Zip Code)* 2335 SEVENTH STREET, SUITE 6 WRIGHT-PATTERSON AFB OH 45433-7809	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340