

DOD-B-82669(OS)  
 19 January 1979  
 SUPERSEDING  
 WS 2101  
 30 July 1965

## MILITARY SPECIFICATION

### BUTYL SEBACATE, DI-NORMAL

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers the requirements for one type of di-n-butyl sebacate suitable for use in the manufacture of propellants.

#### 2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

#### STANDARDS

##### MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-1218	ACS Chemicals

#### PUBLICATIONS

##### NAVAL SEA SYSTEMS COMMAND (CODE IDENT 10001)

OD 43852	Determination of Sodium in Propylene Glycol Dinitrate by the Atomic Absorption Method
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(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station, Standardization/Documentation Division (501), Indian Head, MD 20640, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or requests for proposals shall apply.

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Associations, Attn: Traffic Department, 1616 P Street, Washington, DC 20036).

Uniform Classification Committee, Agent

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-270 Sampling Petroleum and Petroleum Products

ASTM D-1209 Color of Clear Liquids (Platinum-Cobalt Scale)

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

### 3. REQUIREMENTS

3.1 Physical and chemical requirements. The physical and chemical properties of the di-n-butyl sebacate shall conform to the limits specified in TABLE I when tested as specified herein. If the individual or composite specimens (see 4.2.3) fail to conform to any of the requirements specified, the lot shall be rejected.

TABLE I. Physical and chemical requirements

Property	Requirements		Test Method
	Minimum	Maximum	
Color (Pt-Co Scale)	-	10	4.3.2.1
Acidity (as acetic acid) (% by wt)	-	0.05	4.3.2.2
Saponification number	350	360	4.3.2.3
Refractive index ( $n_D^{25^\circ C}$ )	1.4385	1.4405	4.3.2.4
Moisture (% by wt)	-	0.15	4.3.2.5
Sodium (ppm)	-	1.0	4.3.2.6

3.2 Workmanship. The di-n-butyl sebacate shall be a water white, homogeneous liquid, free from dirt, sediment, and other suspended foreign matter when examined visually by transmitted light.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

#### 4.2 Inspection provisions.

4.2.1 Lot formation. If the process is a batch operation, each batch shall be a lot (see 6.3). If the butyl sebacate is produced in a continuous process, a lot shall consist of material produced by one plant of one manufacturer, with no change in the process, materials or conditions and offered for acceptance at one time.

4.2.2 Sampling. Sampling from tank cars shall be conducted in accordance with ASTM D-270. Sampling from smaller containers shall be conducted as follows: A random sample shall be taken from each lot, in accordance with MIL-STD-105, Inspection Level S-2, acceptance number zero. If there are fewer than three containers in a lot, each container shall be sampled. In all other cases, no fewer than three containers shall be selected. A 500 milliliter (mL) specimen shall be removed from each container in the sample and placed in a clean, dry container (nonreactive with di-n-butyl sebacate) with a tight fitting closure. The container shall be labeled to identify the lot and container from which it was taken.

4.2.3 Test specimens. A composite specimen shall be made with equal portions from each specimen and the composite shall be tested as specified in 4.3. If there are fewer than three specimens, each one shall be tested as specified in 4.3.

4.3 Quality conformance inspection. The material shall be subjected to all the following inspections and tests for acceptance. When specified in the contract (see 6.2), the supplier shall submit a report giving the results obtained for all inspections and tests performed and a certified statement that the lot meets all the requirements of this specification. Unless otherwise specified, all chemicals shall be ACS grade in accordance with MIL-STD-1218 and distilled water shall be used. Where applicable, blank determinations shall be run and corrections applied where significant.

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4.3.1 Visual inspection. All samples shall be visually inspected to determine conformance to the workmanship requirements of 3.2.

4.3.2 Test methods and procedures.

4.3.2.1 Determination of color. The color of di-n-butyl sebacate shall be determined in accordance with ASTM D-1209, platinum cobalt scale.

4.3.2.2 Determination of acidity. Measure 100 mL of ethyl alcohol into a flask, add three drops of phenolphthalein indicator, and titrate the alcohol to a faint pink color with 0.1N sodium hydroxide solution. Add an accurately weighed 30 to 40 gram (g) portion of the sample to the alcoholic solution. Titrate the mixture with 0.1N sodium hydroxide. Calculate the percentage of acidity as acetic acid as follows:

$$\text{Percent by wt acetic acid} = \frac{6.005 \text{ VN}}{G}$$

where:

V = sodium hydroxide required for titration of sample, mL

N = normality of sodium hydroxide solution

G = weight of sample, g

4.3.2.3 Determination of saponification number. Transfer 0.8 g weighed to  $\pm 0.1$  milligram (mg) of the sample to an appropriate size flask, and add 50 mL of 0.5N alcoholic potassium hydroxide by means of a calibrated burette or pipette. (0.5N alcoholic potassium hydroxide is prepared by adding 28 g of potassium hydroxide to 1 liter of 95-percent ethyl alcohol). Fit the flask to a reflux condenser by means of ground joints and heat on a water bath until the precipitation appears to be complete. Add approximately 15 mL of water to dissolve the potassium sebacate and reflux on a water bath for not less than 60 minutes with occasional whirling of the flask. Wash down the sides of the reflux condenser and the ground joints with approximately 25 mL of the water. Cool the solution to 25°C and titrate with standard 0.5N hydrochloric acid using phenolphthalein indicator. Protect sample solution from carbon dioxide during heating and cooling with an ascarite guard tube. At the same time, conduct a blank determination on 50 mL of alcoholic potassium hydroxide which has been carried through the complete process. Calculate the saponification number as follows:

$$\text{Saponification number (mg potassium hydroxide per g)} = \frac{(V_1 - V_2) \times N \times 56.1}{W}$$

where:

V<sub>1</sub> = volume of hydrochloric acid solution required for blank titration, (mL)

V<sub>2</sub> = volume of hydrochloric acid solution required for the sample titration, (mL)

N = normality of the hydrochloric acid solution

W = weight of sample, (g)

4.3.2.4 Determination of refractive index. The following procedure shall be used for the determination of refractive index using a Bausch and Lomb Abbe refractometer or equivalent:

a. Wipe with caution to preclude scratching the prism surface of the refractometer with a tissue wet with methanol or xylene, and then with a dry tissue. Adjust the temperature of the water bath and the velocity of the circulating fluid so that the thermometer reads  $25.0^{\circ} \pm 0.1^{\circ}\text{C}$ .

b. Rotate the body of the instrument and the moving arm away from the operator until the interface between the prisms is horizontal. Loosen the prism clamp and drop the lower prism. With a glass stirring rod, add a few drops of the sample liquid to be tested to the lower prism. Bring the prism faces together and lock the prism clamp. Rotate the instrument to the normal viewing position. Adjust the mirror to reflect light into the telescope.

c. Unclamp the index arm and move it to the far end of the scale. Focus the telescope eyepiece sharply on the crosshairs. Bring the divided field into view by moving the index arm forward. The field may have a colored border, which can be achromatized by use of the compensators rotated by a pinion. The field will be sharpest when the edge is just turning blue. Bring the field almost into coincidence with the crosshairs by moving the index arm. Adjust the mirror for the maximum illumination of the field. Obtain the final adjustment of the field line to the crosshairs by means of the fine adjustment screw.

d. Focus the magnifier on the scale and rotate it so that the scale is well illuminated. Read the scale directly to three decimal places and estimate the figure in the fourth decimal place.

e. If the index reading does not remain constant within one unit in the fourth decimal place for 1 minute, it may indicate diffusion of solvent remaining on the prisms or insufficient time for thermal equilibrium. Place a new sample of the liquid to be tested on the prism taking care that the prism is clean and dry. Sufficient time should elapse after placement of the drop to insure that the liquid film is at the prism temperature.

f. Report the reading obtained as  $n_D^{25^{\circ}\text{C}}$ .

4.3.2.5 Determination of moisture. To the titration flask add 75 to 100 mL of methanol. Titrate the methanol to a potentiometric end point with stabilized Karl Fischer reagent. Transfer an accurately weighed sample of di-n-butyl sebacate (5 to 15 g) to the titration flask. Titrate the sample to a potentiometric end point. Calculate the moisture content as follows:

$$\text{Percent moisture} = \frac{100(KF)}{W}$$

where:

K = Karl Fischer reagent used in titration, mL  
 F = reagent factor, g of water per mL of reagent  
 W = weight of di-n-butyl sebacate, g

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4.3.2.6 Determination of sodium. The sodium shall be determined in accordance with OD 43852 except that a factor of 1.17 shall be used.

4.3.3 Rejection criteria. Failure of any sample to meet any requirement of this specification shall be cause for rejecting the lot or batch.

## 5. PACKAGING

### 5.1 Packaging.

5.1.1 Level C. The di-n-butyl sebacate shall be packaged in uniform quantities for shipment in accordance with the manufacturer's commercial practice. Packages shall be of uniform size, shape, and material.

### 5.2 Packing.

5.2.1 Level C. The di-n-butyl sebacate shall be packed in uniform quantities in such a manner as to assure carrier acceptance and afford protection against damage during direct shipment from the supply source to the first receiving activity. Containers used shall comply with the Uniform Freight Classification, National Motor Freight Classification, or other carrier regulations applicable to the mode of transportation. Containers shall be of uniform size, shape, and material.

5.3 Marking. In addition to any special marking required by the contract, unit packages and shipping containers shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The di-n-butyl sebacate covered by this specification is intended for use in the manufacture of propellant.

6.2 Ordering data. Procurement documents should specify the following:

### 6.2.1 Procurement requirements.

- a. Title, number, and date of this specification
- b. Whether tank cars or containers are to be used for shipment
- c. Size of containers required
- d. Whether a certified analysis and/or test report is required

6.2.2 Contract data requirements. The items of deliverable data which may be required by this specification are cited in 4.3.

### Data Requirement

### Applicable DID\*

Test Report  
Certified Analysis

DI-T-2072

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\*DIDs (Data Item Descriptions/DD Form 1664) for the above data requirements are documented in the applicable ADL (Authorized Data List). Such data will be delivered as identified on completed (numbered) DIDs when specified on DD Forms 1423 (Contract Data Requirements Lists) and incorporated into applicable contracts.

6.3 Batch. A batch is defined as that quantity of di-n-butyl sebacate that has been subjected to the same unit chemical or physical process intended to make the final product homogeneous.

Custodian:  
NAVY - OS

Preparing Activity:  
NAVY - OS

Project Number:  
6810-NA44

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL		OMB Approval No. 22-R255
<p><b>INSTRUCTIONS:</b> The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. 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. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.</p>		
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NAME OF ORGANIZATION AND ADDRESS	CONTRACT NUMBER	
	MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT	
<p>1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.</p> <p>B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES</p>		
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DD FORM 1426  
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