

MIL-D-50030H(EA)

11 December 1986

SUPERSEDING

MIL-D-50030G(EA)

2 June 1986

## MILITARY SPECIFICATION

## DECONTAMINATING AGENT, DS2

This specification is approved for use within the Chemical Research, Development and Engineering Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers a solution type decontaminating agent hereinafter referred to as DS2.

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications. The following specifications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

## SPECIFICATIONS

## FEDERAL

O-D-1271 - Diethylenetriamine, Technical  
O-E-780 - Ethylene Glycol Monomethyl Ether, Technical

## MILITARY

MIL-P-51529 - Packaging of Decontaminating Agent, DS2 in 1-1/3 Quart Can and 5-Gallon Pail

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: Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Chemical Research, Development and Engineering Center ATTN: SMCCR-SPT-S, Aberdeen Proving Ground, MD 21010-5423 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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AMSC N/A

FSC 6850

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2.1.2 Publications. The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

## PUBLICATIONS

U.S. ARMY ARMAMENT, MUNITIONS AND CHEMICAL COMMAND

CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

## PURCHASE DESCRIPTIONS

EA-N-1334 - Nitrogen, Technical (High Purity)

(Copies of specifications and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-government documents which is current on the date of the solicitation.

## ASTM STANDARDS

- D 93 - Flash Point by Pensky-Martens Closed Tester (DOD Adopted)
- D 268 - Sampling and Testing Volatile Solvents and Chemical Intermediates (DOD Adopted)
- D 445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosities) (DOD Adopted)
- D 891 - Specific Gravity of Industrial Aromatic Hydrocarbons and Related Materials (DOD Adopted)
- D 1193 - Reagent Water (DOD Adopted)
- E 300 - Sampling Industrial Chemicals

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which 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 (except for associated detail specifications, specification sheets or MS standards), the text of this

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specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Composition. DS2 shall be a homogeneous mixture of the materials specified in table I in the proportions specified when tested as specified therein.

TABLE I. Composition

Material	Percent by weight	Test paragraph
Diethylenetriamine conforming to O-D-1271	69.0 to 71.0	4.4.4.1
Sodium hydroxide, ACS grade except that sodium carbonate content shall be no greater than 0.5 percent by weight	1.90 to 2.10	4.4.4.2
Ethylene glycol monomethyl ether conforming to O-E-780	Remainder	-----

3.2 Chemical and physical characteristics. DS2 shall conform to the chemical and physical characteristics of table II when tested as specified therein.

TABLE II. Chemical and physical characteristics

Characteristic	Requirement	Test paragraph
Specific gravity at 25°C/25°C	0.970 to 0.980	4.4.4.3
Viscosity, cps at -30°C, maximum	420	4.4.4.4
Flash point, °F, minimum	168	4.4.4.5
Reactivity, mg of chloroform, minimum	350	4.4.4.6
Suspended matter, percent by volume, maximum:		
Before heating	0.15	4.4.4.7(a)
After heating	0.20	4.4.4.7(b)

3.3 Nitrogen blanket. All DS2 mixing, filling, storing, and handling operations shall be performed using clean equipment in a closed system under a blanket of dry nitrogen conforming to EA-N-1334 to avoid contact with carbon dioxide and moisture. The contractor shall certify that this requirement has been met.

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3.4 First article. The contractor shall furnish samples for first article inspection and approval in accordance with 4.3.

4. QUALITY ASSURANCE PROVISIONS

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 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 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 of assuring that all products or supplies submitted to the Government for acceptance comply with all 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 acceptance of defective material.

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

- (a) First article inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.3 First article inspection.

4.3.1 Lotting. First article items shall be produced using the same methods, materials, equipment, and processes of manufacture as will be used during regular production.

4.3.2 Sampling. The first article shall consist of 3 filled and closed containers.

4.3.3 Inspection procedure (see 6.4). The first article samples shall be submitted in accordance with 3.4. A representative specimen of approximately 1 liter shall be taken from each of the three filled containers. Each specimen shall be tested as specified in 4.4.4. Failure of any DS2 specimen to pass any examination or test shall be cause for rejection of the first article.

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4.4 Quality conformance inspection.

4.4.1 Lotting. A lot shall consist of the DS2 produced by one manufacturer, at one plant, from the same materials, and which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

4.4.2 Sampling. Sampling shall be conducted in accordance with table III. A representative specimen of approximately 1 liter shall be removed from each sample container and placed in a suitable clean, dry, glass container labeled to identify the lot and container from which it was taken. When the lot consists of 1-1/3 quart containers, each container shall constitute a specimen.

TABLE III. Sampling for DS2 test

: Number of containers in batch or lot	: Number of sample containers
: 2 to 25	: 2
: 26 to 150	: 3
: 151 to 1,200	: 5
: 1,201 to 7,000	: 8
: 7,001 to 20,000	: 10
: Over 20,000	: 20
:	:

4.4.3 Inspection procedure. Each sample specimen taken in 4.4.2 shall be tested as specified in 4.4.4. Failure of any test by any specimen shall be cause for rejection of the lot represented.

4.4.4 Tests (see 6.4). Water in accordance with ASTM D 1193 and reagent grade chemicals shall be used throughout the tests. Where applicable, blank determinations shall be run and corrections applied where significant. Tests shall be conducted as follows:

4.4.4.1 Diethylenetriamine. Determine diethylenetriamine content in accordance with the purity test of O-D-1271 except use a 175 to 225 milligram (mg) specimen and calculate the percent by weight diethylenetriamine as follows:

$$\text{Percent diethylenetriamine} = \frac{515.8AB}{WP} - 1.29C$$

where: A = Milliliters of hydrochloric acid,  
 B = Normality of hydrochloric acid,  
 C = Percent by weight sodium hydroxide determined in 4.4.4.2,  
 W = Weight in grams of specimen, and  
 P = Purity, in percent, of the diethylenetriamine used.

4.4.4.2 Sodium hydroxide. Determine percent sodium hydroxide by procedure A or procedure B.

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(a) Procedure A. Tare a platinum evaporating dish that has been heated to constant weight in a muffle furnace at 700° to 800°C. Weigh 10 grams (g) of the specimen to the nearest 0.1 mg into the evaporating dish. Heat slowly to dryness, being careful to avoid loss by spattering. Add 3.0 milliliters (mL) of water and 2 drops of methyl red indicator solution to the dish. Then add 1 to 1 sulfuric acid to the solution dropwise, until 1 drop of acid is in excess. Evaporate slowly to dryness, being careful to avoid loss by spattering. Add 5.0 g of powdered ammonium carbonate to the dish. Then heat until it disappears. Repeat this treatment. Ignite the dish in the blue flame of a Meeker-type burner until all remaining carbonaceous matter is burned off, or ignite in a muffle furnace at 700° to 800°C for 1/2 hour. Heat to constant weight. From the weight of residue, calculate the percent by weight of sodium hydroxide in the specimen.

$$\text{Percent sodium hydroxide} = \frac{56.32A}{W}$$

where: A = Weight in grams of residue, and  
W = Weight in grams of specimen.

(b) Procedure B.

(1) Form a stock sodium solution by preparing 2.542 g of sodium chloride dried at 140°C. Dissolve the 2.542 g of sodium chloride in distilled water, quantitatively transfer to a 1-liter volumetric flask and dilute to the mark. Mix well. This makes a solution containing 1.00 mg of sodium per 1.00 mL.

(2) Prepare standard solution No. 1 (2 mg by weight/liter) by pipetting 2 mL of stock solution into a 1,000 mL volumetric flask, dilute to the mark, and mix well.

(3) Prepare standard solution No. 2 (5 mg by weight/liter) by pipetting 5 mL of stock solution into a 1,000 mL volumetric flask, dilute to the mark, and mix well.

(4) Prepare standard solution No. 3 (10 mg by weight/liter) by pipetting 10 mL of stock solution into a 1,000 mL volumetric flask, dilute to the mark, and mix well.

Take the test specimen in accordance with ASTM D 268 and E 300. Shake the specimen bottle thoroughly to insure good mixing of the specimen. While wearing weighing gloves, fill and weigh to the nearest milligram the 1-cubic centimeter syringe with specimen to be tested. Transfer the sample to a 1-liter volumetric flask. Determine the amount of specimen used to the nearest milligram by reweighing the now empty syringe. Dilute to the mark with distilled water and mix well. Prepare an atomic absorption/emission spectrophotometer for sodium by referring to the operator's manual of the spectrophotometer. Measure the emission of the 10 mg/liter standard and record. Measure the emission of a distilled water blank and record. Determine the concentration of

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sodium by using the method of least squares by using the concentration of the known standards versus emission for these standards and using the emission of the unknown sample, solving for the concentration. Calculate the percent sodium hydroxide as follows:

$$\text{Percent sodium hydroxide} = \frac{0.174A}{W}$$

where: A = Concentration of sodium in milligrams per liter, and  
W = Weight of specimen in grams.

4.4.4.3 Specific gravity. Determine the specific gravity at 25°/25°C in accordance with ASTM D 891.

4.4.4.4 Viscosity. Determine the viscosity in accordance with ASTM D 445. Convert the kinematic viscosity to absolute viscosity by multiplying the kinematic viscosity at minus 30°C by the specific gravity determined in 4.4.4.3. In all viscosity determinations, the solution in the viscosimeter shall be protected from carbon dioxide and moisture by use of "Ascarite" desiccant tubes on both viscosimeter openings.

4.4.4.5 Flash point. Determine the flash point in accordance with ASTM D 93.

4.4.4.6 Reactivity. Pipet 20 mL of specimen into a 250-mL Erlenmeyer flask fitted with a ground glass stopper. Pull 0.5 to 0.6 mL of chloroform into a syringe. Inject the chloroform into the 250-mL Erlenmeyer flask by removing the ground glass stopper, starting the stir plate (thus the reaction), and starting the lab timer. At the end of 5 minutes, add 50 mL of water to the flask to stop the reaction. Wash the mixture into a 100-mL volumetric flask with water. Dilute to the mark, and mix well by shaking. Pipet a 10-mL aliquot of this solution into a flask and dilute to 50 mL with water. Titrate the chlorides by the Volhardt method, using approximately 0.025N silver nitrate solution. Calculate the chloroform decomposed as follows:

$$\text{Chloroform decomposed (mg)} = 399AN$$

where: A = Milliliters of silver nitrate solution used and  
N = Normality of the silver nitrate solution.

4.4.4.7 Suspended matter.

(a) Before heating. Stir the specimen until the particulates are in homogeneous suspension. Fill a centrifuge tube having a calibrated capillary tip with the suspension and centrifuge it for 30 minutes at a minimum force of 1600 times gravity. (Centrifuge tubes having a capacity of 6.5 mL or 10 mL have been found to be satisfactory for this test.) Calculate the percent by volume suspended matter.



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(b) After heating. Heat 15 mL of the specimen in a sealed glass ampule by placing the ampule in bath of boiling water for 2 hours. Cool and transfer all the contents into a test tube. Stir the solution until all the particulates are in homogeneous suspension and then use the procedure in (a).

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-P-51529.

## 6. NOTES

6.1 Intended use. DS2 is intended for use as a decontaminating agent for rendering persistent chemical agents harmless.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Unit quantity required (see 5.1).

6.3 Mixing operations. The production of satisfactory DS2 is facilitated by the addition of a small quantity (1 percent) of the diethylenetriamine to the ethylene glycol monomethyl ether prior to the mixing in of the sodium hydroxide. The temperature of the batch should not exceed 105°F during this operation and the subsequent mixing operation.

6.4 Sampling and testing precautions. DS2 is toxic and corrosive (alkaline) and should be handled with corrosive-resistant gloves, boots, and apron; an industrial faceshield or splash-proof goggles; and full facepiece respirator with amine cartridge. For further information, see safety precautions on the DS2 container.

6.5 Significant places. For the purpose of determining conformance with this specification, an observed or calculated value should be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of ASTM E 29.

6.6 Subject term (key word) listing.

Chemical agent  
Decontaminating agent  
Decontaminating solution  
Solution

Custodian:

Army - EA

Preparing activity:

Army - EA

Project No. 6850-A824



PREVIOUS EDITION IS OBSOLETE.