

INCH-POUND
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MIL-DTL-10176K

20 May 2005

SUPERSEDING

MIL-C-10176J

6 January 1989

## DETAIL SPECIFICATION

## CLOTH, GABARDINE: WOOL, POLYESTER AND WOOL

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

## 1. SCOPE

1.1 Scope. This specification covers wool, polyester and wool gabardine cloths.

1.2 Classification. The cloth should be of the following types and classes as specified in 6.2.

## Type I - Wool

- Class 3 - 7.0 ounce (see 6.8)
- Class 5 - 9.3 ounce (see 6.8)
- Class 7 - 10.3 ounce (see 6.8)
- Class 8 - 8.35 ounce (see 6.8)

## Type II - Polyester and wool blend

- Class 1 - 6.75 ounce (see 6.8)
- Class 8 - 6.0 ounce (see 6.8)
- Class 9 - 6.95 ounce (see 6.8)
- Class 10 - 8.35 ounce (see 6.8)
- Class 11 - 7.2 ounce (see 6.8)
- Class 12 - 6.8 ounce (see 6.8)
- Class 13 - 6.8 ounce, Water Repellent Treated (see 6.8)

<p>Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center Philadelphia, Clothing and Textiles Directorate, Attn: DSCP-CRDD, (Bldg 6D), 700 Robbins Ave., Philadelphia, PA 19111-5092 or emailed to <a href="mailto:bernice.klucznik@dla.mil">bernice.klucznik@dla.mil</a>. Since contact information can change, you may want to verify the currency of this address information using Acquisition Streamlining and Standardization Information System (ASSIST) Online database at <a href="http://www.assist.daps.dla.mil">www.assist.daps.dla.mil</a>.</p>
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## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

## DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-43665 - Cloth, Wool: Mothproofing Treatment of

## DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-655 - Provisions for Evaluating Quality of Cloth, Wool, Worsted  
and Wool Blends

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## FEDERAL TRADE COMMISSION

Rules and Regulations Under the Wool Products Labeling

(Copies are available online at [www.ftc.gov](http://www.ftc.gov) or from the Federal Trade Commission, 600 Pennsylvania Avenue, N.W., Washington, DC 20580-0001.)

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## U.S. DEPARTMENT OF AGRICULTURE

## Methods of Test for Grades of Wool Top

(Copies are available online at [www.usda.gov](http://www.usda.gov) or from the U.S. Department of Agriculture, Agricultural Marketing Service, Washington, DC 20402.)

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

2.3 Non-Government standards and other publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract (see 6.2).

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC – 8 - Colorfastness to Crocking: AATCC Crockmeter Method
- AATCC – 15 - Colorfastness to Perspiration
- AATCC – 16 - Colorfastness to Light
- AATCC – 20A - Fiber Analysis: Quantitative
- AATCC – 22 - Water Repellency: Spray Test
- AATCC – 81 - pH of the Water Extract from Wet Processing Textiles
- AATCC – 99 - Dimensional Change on Woven or Knitted Textiles:  
Relaxation, Consolidation and Felting
- AATCC – 132 - Colorfastness to Drycleaning
- AATCC – 158 - Dimensional Changes on Drycleaning in  
Perchloroethylene: Machine Method
- AATCC Evaluation Procedure 1, Gray Scale for Color Change
- AATCC Evaluation Procedure 2, Gray Scale for Staining
- AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale
- AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles

(Copies of documents are available on line at [www.aatcc.org](http://www.aatcc.org) or from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

## ASTM INTERNATIONAL

- ASTM-D-3511 - Pilling Resistance and Other Related Surfaces Changes  
Fabrics – Brush Pilling Tester Method
- ASTM-D-3775 - Fabric Count of Woven Fabric
- ASTM-D-3776 - Mass per Unit Area (Weight) of Fabric
- ASTM-D-5034 - Breaking Force and Elongation of Textile Fabrics (Grab Test)

(Copies of documents are available on line at [www.astm.org](http://www.astm.org) or from the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19426-2959.)

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## AMERICAN SOCIETY FOR QUALITY

## ANSI/ASCQ Z1.4 – Sampling Procedures and Tables for Inspection of Attributes

(Copies of documents are available on line at [www.asq.org](http://www.asq.org) or from the American Society for Quality, 600 Plankinton Avenue, Milwaukee, WI 53203.)

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

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 4.2).

3.2 Standard sample. The finished cloth shall match the standard sample for shade and appearance and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.4).

3.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

#### 3.4 Material.

##### 3.4.1 Stock.

3.4.1.1 Grade. The wool for the cloth shall be not lower in grade than the U.S. Standard grades specified below for the applicable class, when tested as specified in 4.3.1.1.

Classes 1, 3 and 7 - 62's U.S. Standard

Classes 5, 8, 9, 10, 11, 12 and 13 - 64's U.S. Standard

3.4.1.2 Wool. The wool top for Type I cloth shall be fleece or pulled wool, or both, not lower in grade than that specified for the applicable class (see 1.2 and 3.4.1.1). The use of wool top made from laps, noils, or any other wool manufacturing by-products is prohibited (see 4.3.2).

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3.4.1.3 Polyester. The polyester fiber shall be semi-dull polyester fiber made from polyethylene glycol terephthalate either homopolymer or modified polymer as appropriate. The minimum average fiber length shall be 3 inches and shall be a suitable denier to blend adequately with the specified wool grade. The use of polyester fiber waste is prohibited. Testing shall be as specified in 4.3.4.

### 3.4.2 Yarn.

3.4.2.1 Wool yarn for Type I cloth. The wool shall be spun from combed top on either the Bradford, French or American system. The yarn shall be spun into 2-ply and shall contain not less than 95 percent wool based on the dry weight of the specimen when tested as specified in 4.3.4.

3.4.2.2 Polyester/wool blend yarn for Type II cloth. The polyester fiber and wool fiber shall be blended and spun into 2-ply for both the warp and filling. The use of wool top produced from laps, noils, or any other wool manufacturing by-product is prohibited. The finished cloth shall consist of the following fiber percentages based on dry weight of the specimen when tested as specified in 4.3.4.

<u>Fiber</u>	<u>Percentage</u>	
	<u>Minimum</u>	<u>Maximum</u>
Polyester	55	60
Wool	40	--

3.5 Color. The color shall be as specified (see 6.2) and shall match the standard sample. The color for Type I cloth shall be obtained by blending stock or top dyed wools; the color for Type II cloth shall be obtained by blending top dyed wool with stock, top, or tow dyed polyester fibers, with the wool and polyester fibers dyed separately and then blended.

3.5.1 Mothproofing. Mothproofing of the wool material, in accordance with MIL-C-43665, shall be accomplished during stock or top dyeing as applicable.

3.5.2 Visual shade matching (all types and classes). The color and shade of the finished cloth shall match the standard sample when viewed using AATCC Evaluation Procedure 9, Option A, under filtered tungsten lamps that approximate artificial daylight D75 illuminant with a color temperature of  $7500 \pm 200$  K, with illumination of  $100 \pm 20$  foot candles and shall be a good match to the standard sample under horizon lamplight at  $2300 \pm 200$  K.

3.5.3 Colorfastness (all types and classes). The finished cloth shall conform to the colorfastness requirements in below in Table I when tested as specified in 4.3.4.

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TABLE I. Colorfastness requirements (all types and classes)

Colors Evaluation	Light (40 hrs or 170 KJ) <u>2/</u> (min.)	Wet Dry-cleaning (1 cycle) <u>1/</u> (min.)	Perspiration (acid & alkali) <u>1/</u> (min.)	Crocking <u>3/</u> (min.)
All colors	3-4	3-4	3-4	
All colors except Black 357				3.5
Black				3.0

1/ Rated using the AATCC Gray Scale for Color Change and AATCC Gray Scale for Staining.

2/ Rated using the AATCC Gray Scale for Color Change

3/ Rated using the AATCC 9-Step Chromatic Transference Scale

3.6 Physical requirements. The finished cloth shall conform to the requirements listed below, in Tables IIa. and b., when tested as specified in 4.3.4.

TABLE IIa. Physical requirements (Type I)

Characteristic	Class 3	Class 5	Class 7	Class 8
Weight, oz./sq.yd. Minimum	7.0	9.3	10.3	8.35
Yarns per inch, (min.)				
Warp	86	112	120	98
Filling	48	56	60	52
Breaking strength, lbs., (min.)				
Warp	80	115	120	130
Filling	42	65	55	55
Tearing strength, lbs, (min.)				
Warp	4.0	6.0	4.0	5.0
Filling	3.0	3.0	3.0	3.0

TABLE IIb. Physical requirements (Type II)

Characteristic	Class 1	Class 8	Class 9	Class 10	Class 11	Class 12 & 13
Weight, oz./sq.yd., (min.)	7.0	9.3	10.3	8.35	7.2	6.8
Yarns per inch, (min.)						
Warp	86	112	120	98	90	108
Filling	48	56	60	52	53	58
Breaking strength, lbs., (min.)						
Warp	80	115	120	130	120	3.0
Filling	42	65	55	55	70	1.0
Shrinkage percent, (min.)						
Warp	4.0	6.0	4.0	5.0	3.0	3.0
Filling	3.0	3.0	3.0	3.0	1.0	2.0

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3.6.1 Weave. The weave for the types and classes shall be as follows:

<u>Type</u>	<u>Class</u>	<u>Weave</u>
I	3	2/1 right twill
I	5, 7 & 8	2/2 right twill
II	1, 10 & 11	2/1 right twill
II	8, 9, 12 & 13	2/2 right twill

3.6.2 Width. Unless otherwise specified, the width of the finished cloth for all types and classes shall be a minimum of 60 inches exclusive of the selvage.

3.7 Finish. The cloth shall be scoured, brushed, sheared, pressed, and decated so as to provide a finish equal to that of the standard sample.

3.7.1 Pilling. The Type II cloth shall be processed to show no more pilling than the standard sample. When no standard sample is available the cloth shall show a rating of 4 using the ASTM Photograph Rating Standard (see 6.4). Testing shall be as specified in 4.3.4.

3.7.2 Water repellency. When specified, the cloth shall be given a fluorocarbon (Quarapel Type) water repellent treatment and shall conform to the requirements specified below, in Table III, when tested as specified in 4.3.4.

TABLE III. Water repellency

	<u>Spray rating <sup>1/</sup></u>
Initial	90, 90, 80
After 1 dry-cleaning	80, 80, 70

<sup>1/</sup> The results of the three individual determinations on the sample unit for spray rating shall be equal to or better than the specified ratings when tested as specified in 4.4.3.

3.7.3 pH. The pH value of the water extract of the finished cloth shall be not lower than 5.5 or higher than 8.5 when tested as specified in 4.3.4.

3.8 Length and put-up. For Government procurement only, unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 50 yards. The cloth shall be put up on full width rolls as specified in 5.1.

3.9 Wool content label. The cloth shall be labeled in accordance with the Wool Products Labeling Act (see 2.2.2).

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3.10 Marking. The back of the cloth shall be marked "Back" at both ends of each roll with letters not less than 1/2 inch in height (see 4.3.3.3). The marking shall be clearly legible in any indelible marking medium used commercially.

3.11 Workmanship. The finished cloth shall conform to the quality established by this document. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the established maximum point value.

3.12 Toxicity. The finished fabric shall not present a health hazard when used as intended and tested as specified in 4.3.5.

#### 4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. A first article, submitted in accordance with 3.1, shall be inspected, examined for color, shade and defects and tested for the characteristics as specified in Table IV.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.3.1, through 4.3.3 and the tests in Table IV as applicable. Sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4 and with quality acceptance levels as specified in the contract and/or order, except where otherwise indicated.

4.3.1 Material inspection. In accordance with 4.1 above, the material shall be inspected in accordance with all the requirements of referenced documents, unless otherwise excluded, amended, modified or qualified in this specification or applicable procurement documents.

4.4 Wool grade examination. The wool shall be examined for grade (see 3.4.1.1) in the undyed top form by comparison with the applicable U.S. Standard (see 2.2.2). In the event of a dispute, the wool grade shall be determined by the width method (wedge). The sample unit shall be 1 yard or top, prior to dyeing and to blending with polyester fibers. The sample size (number of sample units) shall be as listed below. The lot size shall be expressed in units of one pound and the results from each sample unit shall be reported separately. The lot shall be unacceptable if a single sample unit fails to meet the required grade.



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<u>Lot size (pounds)</u>	<u>Sample size (sample units)</u>
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

4.3.2 In-process inspection. Inspection shall be made at any point or during any phase of the manufacturing process to assure that no laps, noils, or any other wool manufacturing by-products are used (see 3.4.1.2), and that the dyeing requirements have been adhered to (see 3.4). The Government reserves the right to exclude from consideration for acceptance any material for which in-process inspection has indicated nonconformance.

4.3.3 End item examination.

4.3.3.1 Yard-by-yard examination. The yard-by-yard examination shall be as specified in MIL-STD-655. The fabric quality for all shades except Tan 3729 shall be Quality Level 10. For Tan 3729 the fabric quality shall be Quality Level 12.

4.3.3.1.1 Limits of slubs and knots. Only slubs and knots which exceed "D" or 3-1/2 as applicable, for slubs and "C" for knots on the Sears Fabric Defect Scale shall be scored (see 6.5).

4.3.3.2 Length examination. The length examination shall be as specified in MIL-STD-655.

4.3.3.3 Examination for back marking and compliance with the Wool Products Labeling Act. The examination for back marking and compliance with the Wool Products Labeling Act shall be as specified in MIL-STD-655.

4.3.3.4 Examination for shade and appearance. A sample from each roll in the lot shall be examined visually for shade (see 3.5.2). The sample shall be a 4-inch by 20-inch swatch of the cloth. A sample shall be drawn from each roll in the lot. A roll shall be unacceptable if the sample fails to meet the requirements for shade.

4.3.3.5 Examination for defect marking. The examination for defect marking (stringing of defects) shall be as specified in MIL-STD-655.

4.3.4 End item testing. The cloth shall be tested for the characteristics listed in Table IV. The methods of testing specified wherever applicable and as listed in Table IV shall be followed. All test reports shall contain the individual values utilized in expressing the final results. The sample unit shall be 5 continuous yards full width of the finished cloth for all physical and chemical tests. The lot shall be unacceptable if one or more sample units fail to meet any test requirement specified. The sample size shall be in accordance with the following:

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Lot size (yards)Sample size (sample units)

800 or less

2

801 up to and including 22,000

3

22,001 and over

5

TABLE IV. End item tests

Characteristic	Requirement paragraph	Test method
<u>Material</u>		
Polyester:		
Fiber Identification	3.4.1.1	<u>1</u> /
Yarn Ply:		
Type I	3.4.2.1	Visual <u>2</u> /
Type II	3.4.2.2	Visual <u>2</u> /
Fiber Percentage:		
Type I	3.4.2.1	AATCC-20A
Type II	3.4.2.2	AATCC-20A
Mothproofing content	3.5.1	<u>3</u> /
Visual shade matching	3.5.2	AATCC Evaluation Procedure 9, Opt A
Colorfastness:		
Light (after 40 hrs or 170 kilojoules)	3.5.3	AATCC-16 Opt 1 or 3
Wet dry-cleaning (1 cycle)	3.5.3	AATCC-132
Perspiration (acid & alkaline)	3.5.3	AATCC-15
Crocking	3.5.3	AATCC-8
Weight	3.6	ASTM-D-3776, Opt C
Yarns per inch	3.6	ASTM-D-3775
Breaking Strength	3.6	ASTM-D-5034, G-E or G-T
Shrinkage	3.6	AATCC-99
Weave	3.6.1	Visual <u>2</u> /
Water repellent treatment (Class 13) <u>4</u> /:		
Spray rating:		
Initial	3.7.2	AATCC-22
After 1 dry-cleaning	3.7.2	AATCC-158and AATCC-22
pH	3.7.3	AATCC-81
Toxicity	3.12	4.2.5

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- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and acceptable for the stated requirement (see 6.6).
- 2/ One determination shall be made from each sample unit and the result reported as "pass or fail".
- 3/ As specified in MIL-C-43665.
- 4/ The contractor shall report the approved water repellent used, and certify that no other material (except the specified buffer and acetic acid) has been added.

4.2.5 Toxicity test. The contractor must furnish information, which certifies that the finished product is composed of materials, which have been safely used commercially or provide sufficient toxicity data to show compatibility with prolonged, direct skin contact. At a minimum, toxicity data should include results from a primary dermal irritation study in laboratory animals and a repeated insult human patch test (Modified Draize Procedure). The latter must be conducted under the supervision of a qualified dermatologist using at least 100 free-living individuals.

4.2.5.1 Toxicity documents. All finishes/chemicals used to process the garment shall be identified and accompanied by the appropriate Material Safety Data Sheet (MSDS) information. The use of chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens is prohibited.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Department or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. The cloth is intended for use in the manufacture of dress clothing and uniforms for personnel of the Department of Defense.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type and class of cloth required (see 1.2).
- c. ASSIST will be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
- d. When first article is required (see 3.1 and 4.2).
- e. Color required (see 3.5).
- f. Width required if other than 60 inches (see 3.6.2).
- g. When water repellent treatment is required (see 3.7.2).
- h. Length required if other than specified (see 3.8).
- i. Packaging (see 5.1).

6.3 Standard sample. For access to samples, address the contracting activity issuing the invitation for bids or request for proposal.

6.4 Photograph Rating Standard. The Photograph Rating Standards are available from ASTM International 100 Barr Harbor Drive, West Conshohocken, PA. 19426-2959.

6.5 Fabric defect scales. Fabric Defect Replica Kits are available from Sears Roebuck and Company, Department 817, (ATTN: BSC 23-29), Sears Tower, Chicago, IL 60684.

6.6 Certificate of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

6.7 Subject term (key word) listing.

Clothing  
Dress Uniforms  
Mothproofing

6.8 Superseding data. The weight; ounces per linear yard based on 56 inch width in revision “J” have been converted to ounces per square yard (oz/yd<sup>2</sup>) in revision “K” as follows:

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MIL-C-10176 “J”

Type I - Wool  
 Class 3 - 11.0 ounce  
 Class 5 - 14.5 ounce  
 Class 7 - 16.0 ounce  
 Class 8 - 13.0 ounce

Type II - Polyester/wool blend  
 Class 1 - 10.5 ounce  
 Class 8 - 9.5 ounce  
 Class 9 - 10.8 ounce  
 Class 10 - 13.0 ounce  
 Class 11 - 11.2 ounce  
 Class 12 - 10.6 ounce

MIL-C-10176 “K”

Type I - Wool  
 Class 3 - 7.1 oz/yd<sup>2</sup>  
 Class 5 - 9.3 oz/yd<sup>2</sup>  
 Class 7 - 10.3 oz/yd<sup>2</sup>  
 Class 8 - 8.4 oz/yd<sup>2</sup>

Type II - Polyester/wool blend  
 Class 3 - 6.75 oz/yd<sup>2</sup>  
 Class 8 - 6.0 oz/yd<sup>2</sup>  
 Class 9 - 6.95 oz/yd<sup>2</sup>  
 Class 10 - 8.35 oz/yd<sup>2</sup>  
 Class 11 - 7.2 oz/yd<sup>2</sup>  
 Class 12 - 6.8 oz/yd<sup>2</sup>  
 Class 13 - 6.8 oz/yd<sup>2</sup>, Water Repellent Treated

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

## Custodians:

Army - GL  
 Navy - NU  
 Air Force - 11

## Preparing activity:

DLA - CT  
 Project No. 8305-0850

## Review activities:

Navy - MC  
 Air Force - 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using ASSIST Online database at [www.assist.daps.dla.mil](http://www.assist.daps.dla.mil).