

INCH-POUND

MIL-PRF-32380

3 May 2011

## PERFORMANCE SPECIFICATION

## BAGS – UNIT PACK BARRIER, CHEMICAL, BIOLOGICAL PROTECTIVE CLOTHING AND ACCESSORIES

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

## 1. SCOPE

1.1 Scope. This specification covers the performance criteria for barrier materials made into flexible, heat and vacuum sealed unit pack bags, for packaging or protective individual item storage of chemical biological protective clothing and accessories.

1.2 Classification. The unit pack barrier bags for packaging or protective individual item storage of protective clothing and accessories will be one of the following types, as specified in the acquisition requirements (see 6.2).

Type I – For protective clothing

Type II – For protective clothing accessories

## 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 documents cited in sections, 3, 4, or 5 of this specification, whether or not they are listed.

Comments, suggestions or questions on this document should be addressed to: Joint Project Manager, Protection (JPM-P), 50 Tech Parkway, Suite 301; Stafford, VA 22556; Attention: Individual Protective Equipment Product Manager. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

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### 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.

#### FEDERAL STANDARDS

FED-STD-595	Colors used in Government Procurement
FED-STD-595/16350	Gray, Gloss
FED-STD-595/30313	Brown, Flat or Lusterless
FED-STD-595/34089	Green, Flat or Lusterless
FED-STD-595/34090	Green, Flat or Lusterless

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

#### DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129 - Military Marking for Shipment and Storage

(Copies of these documents are available online at <https://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, 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 of these documents are those cited in the solicitation or contract.

#### DEPARTMENT OF THE ARMY

DTC TOP 8-2-501 Permeation and Penetration Testing of Air Permeable, Semi-permeable and Impermeable Materials with Chemical Agents

(Copies of these documents are available at <http://www.dtc.army.mil/publications/topsindex.aspx> or from the Defense Technical Information Center, 8725 John J. Kingman Road, Ft. Belvoir, VA 22060-6218.)

2.3 Non-Government publications. The following 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.

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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC Test Method 169 – Weather Resistance of Textiles: Xenon Lamp Exposure

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AMERICAN SOCIETY FOR QUALITY (ASQ)

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

(Copies are available online at <http://www.asq.org> or from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM D 882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting

ASTM D 1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

ASTM D 1922 - Standard Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method

ASTM F 88 - Standard Test Method for Seal Strength of Flexible Barrier Materials

ASTM F 392 - Standard Test Method for Flex Durability of Flexible Barrier Materials

ASTM F 1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film And Sheeting Using a Modulated Infrared Sensor

ASTM F 1927 - Standard Test Method for Determination of Oxygen Gas Transmission Rate, Permeability and Permeance at Controlled Relative Humidity Through Barrier Materials Using a Coulometric Detector

(Copies of documents are available online at <http://www.astm.org> or from the ASTM INTERNATIONAL, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 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 the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

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3.2 Performance characteristics.

3.2.1 Unit pack barrier bag material. The unit pack barrier bag material shall meet the requirements for performance characteristics specified in 3.2.1.1 thru 3.2.1.8 and shall be capable of meeting the sealing requirements of 3.2.3.

3.2.1.1 Oxygen transmission rate (O<sub>2</sub>GTR). The oxygen transmission rate of the unit pack barrier bag material shall not exceed 0.05 cc/m<sup>2</sup>.day when tested in accordance with 4.3.1.

3.2.1.2 Water vapor transmission rate (WVTR). The water vapor transmission rate of the unit pack barrier bag material shall not exceed 0.3 gm/m<sup>2</sup>/24 hrs when evaluated initially, after ultraviolet radiation, and after flexural durability when tested in accordance with 4.3.2, 4.3.3 and 4.3.4.

3.2.1.3 Ultraviolet (UV) radiation resistance. The unit pack barrier bag material shall not have detrimental degradation such as alligating after UV exposure when tested in accordance with 4.3.3.

3.2.1.4 Tensile strength. The tensile strength of the unit pack barrier bag material shall be a minimum of 20 MPa (machine direction) and 16 MPa (cross-machine direction) when evaluated initially, and a minimum of 11 MPa (machine direction) and 9 MPa (cross-machine direction) after ultraviolet radiation exposure, when tested in accordance with 4.3.3 and 4.3.5.

3.2.1.5 Tear strength. The unit pack barrier bag material shall have initial minimum tear strength of 280 grams in the machine, and transverse directions, and shall have minimum tear strength of 190 grams in both the machine, and transverse directions after ultraviolet radiation exposure, when tested in accordance with 4.3.3 and 4.3.6.

3.2.1.6 Falling dart impact resistance. The falling dart impact resistance of the unit pack barrier bag material shall be greater than 800 grams when tested in accordance with 4.3.7.

3.2.1.7 Color. The color of the unit pack barrier bag material shall approximate Green 34089, Green 34090, Brown 30313 or Gray 16350 of FED-STD 595, as specified in the acquisition requirements (see 6.2).

3.2.1.8 Chemical agent protection. The unit pack barrier bag material shall provide 24 hours of continuous protection against a 10 g/m<sup>2</sup> challenge level of the chemical agent HD. The initial penetration of HD shall be <0.5 µg/cm<sup>2</sup>, and the penetration after treatment with household bleach titrated to a minimum of 5.25% free chlorine and after treatment with JP-8 shall be <2 µg/cm<sup>2</sup> when tested in accordance with 4.3.8.

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3.2.2 Unit pack barrier bag configuration.3.2.2.1 Type I (for protective clothing).

3.2.2.1.1 Type I (for protective clothing) unit pack barrier bag dimension. The finished unit pack barrier bag shall meet the dimensional requirements specified in the acquisition documentation (see 6.2) when sealed in accordance with 3.2.3.1.

3.2.2.1.2 Type I (for protective clothing) unit pack barrier bag marking. The finished unit pack barrier bag shall be marked in accordance with MIL-STD-129 with descriptive information as specified in the acquisition documentation (see 6.2). All markings shall be legible.

3.2.2.2 Type II (for protective clothing accessories).

3.2.2.2.1 Type II (for protective clothing accessories) unit pack barrier bag dimension. The finished unit pack barrier bag shall meet the dimensional requirements specified in the acquisition requirements (see 6.2) when sealed in accordance with 3.2.3.2.

3.2.2.2.2 Type II (for protective clothing accessories) unit pack barrier bag marking. The finished unit pack barrier bag shall be marked in accordance with MIL-STD-129 with descriptive information as specified in the acquisition documentation (see 6.2). All markings shall be legible.

3.2.3 Unit pack barrier bag sealing.

3.2.3.1 Type I (for protective clothing). The Type I unit pack barrier bag shall be heat sealed on three (3) edges (two long sides and the bottom) with an approximately 1/2 inch seal. The seal strength shall be a minimum of 10 lbf/in when tested in accordance with 4.3.9. The bags shall have a tear, nick, or "V" notch, one-eighth (1/8) inch deep in at least one edge, approximately 2 inches, from the end of the bag. The material shall show no evidence of delamination, degradation, or foreign odor when sealed or fabricated into bags, when examined in accordance with 4.2.

3.2.3.2 Type II (for protective clothing accessories). The Type II unit pack barrier bag shall be heat sealed on three sides with a 1/8 or 1/2-inch wide seal, as specified in the acquisition documentation (see 6.2). The seal strength shall be a minimum of 6 lbf/inch for the bags with the narrower (approximately 1/8 inch) seal and a minimum of 7 lbf/inch for the bags with the wider (approximately 1/2 inch) seal, when tested in accordance with 4.3.9. Unit pack barrier bags shall have a tear, nick, or "V" notch, one-eighth (1/8)-inch deep on one or more edges of the bag, 1 to 2-inches from the end of the bag. The material shall show no evidence of delamination, degradation, or foreign odor when heat sealed or fabricated into bags, when examined in accordance with 4.2.

3.2.3.3 Sealed unit pack barrier bag defects. Sealed bags shall be free of damage (tears, cuts, holes, abrasions) through one or more layers in the material, when examined in accordance with 4.2.

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## 4. VERIFICATION

4.1 Conformance inspection. Conformance inspection shall include the examinations of 4.2 and the tests of 4.1.1, and 4.3.1 through 4.3.9, performed on specified samples as defined in the contract or acquisition documents. (see 6.2).

4.1.1. Unit pack barrier material testing. The unit pack barrier material shall be tested for the characteristics listed in Table I.

TABLE I. Unit pack barrier material tests

Characteristic	Requirement paragraph	Verification
Oxygen transmission rate	3.2.1.1	4.3.1
Water vapor transmission rate		
Initial	3.2.1.2	4.3.2
After ultraviolet exposure	3.2.1.2	4.3.2 and 4.3.3
After flexural durability test	3.2.1.2	4.3.2 and 4.3.4
Ultraviolet (UV) Radiation Resistance	3.2.1.3	4.3.3
Tensile Strength		
Initial	3.2.1.4	4.3.5
After ultraviolet exposure	3.2.1.4	4.3.3 and 4.3.5
Tear Strength		
Initial	3.2.1.5	4.3.6
After ultraviolet exposure	3.2.1.5	4.3.3 and 4.3.6
Falling Dart Impact Resistance	3.2.1.6	4.3.7
Chemical Agent Resistance		
Initial	3.2.1.8	4.3.8
After treatment with bleach	3.2.1.8	4.3.8
After treatment with JP-8	3.2.1.8	4.3.8

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4.2 Examination of unit pack barrier bag.

4.2.1 Visual examination. After fabrication, the unit pack barrier bags shall be visually examined for compliance with the dimensional requirements specified in 3.2.2 and for the defects listed in Table II.

TABLE II. Sealed unit pack barrier bag defects

Defect	Category		
	<u>Critical</u>	<u>Major</u>	<u>Minor</u>
<b>1. Unit Pack Barrier Bag</b>			
a. Seal width not as specified.	1		
b. Seal not continuous.	2		
c. Tear, cut, hole or open seal	3		
d. Marking:			
1) Omitted	4		
2) Incorrect		101	
3) Illegible		102	
4) Improper font size		103	
5) Improper location		104	
6) Improper sequence		105	
7) Improper application		106	
e. Tear notch or serration missing			201
f. Color does not approximate specified shade			202

4.2.2 Sampling for visual examination. Sampling for visual examination shall be in accordance with ANSI/ASQ Z1.4.

4.3 Tests.

4.3.1 Oxygen transmission rate (O<sub>2</sub>GTR) test. The oxygen transmission rate of the material shall be determined in accordance with ASTM F 1927, at 23°C and 90 % relative humidity (RH).

4.3.2 Water vapor transmission rate (WVTR) test. The water vapor transmission rate of the material shall be determined in accordance with ASTM F 1249, at 100°F and 90 % RH.

4.3.3 Ultraviolet (UV) radiation resistance test. The barrier material shall be exposed for 100 hours to ultraviolet radiation exposure in accordance with AATCC Method 169, cycle option 1, except that the following deviations shall apply: The irradiance level shall be 0.55 W/m<sup>2</sup>/nm at 340 nanometers; the relative humidity shall be set at 95% for the 30 minutes light and water spray cycle; the test cycles should be repeated until the total exposure time of 100 hours is reached.

4.3.4 Flexural durability test. The flexural durability (Gelbo Flex) of the material shall be tested in accordance with ASTM F 392 except the test condition will be full flex for 100 cycles.

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4.3.5 Tensile strength test. The tensile strength of the material shall be determined in accordance with ASTM D 882 at 2-inch gauge length, and 2-inch/minute.

4.3.6 Tear strength test. The tear strength of the material shall be determined in accordance with ASTM D 1922.

4.3.7 Falling dart impact resistance test. The falling dart impact resistance shall be evaluated in accordance with ASTM D 1709.

4.3.8 Chemical agent resistance test. Chemical agent resistance shall be evaluated in accordance with the US Army Test and Evaluation Command, Test Operating Procedures (TOP) 8-2-501, static flow test method, at 90 ( $\pm 2$ ) °F and 80% ( $\pm 5\%$ ) relative humidity.

4.3.9 Seal strength test. The seal strength of the flat bag shall be determined in accordance with ASTM F 88. The two sealed sides and bottom of the bag shall be evaluated.

## 5. PACKAGING

This section is not applicable to this specification.

## 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 barrier bags covered by this performance specification will be vacuum sealed and used to package or protect chemical protective clothing and accessories (see 1.2).

a. Protective clothing. Each protective clothing item will be completely folded (including an extra polyethylene re-usable barrier bag placed between the fold) and placed in the unit pack barrier bag which will then be heat sealed under vacuum. Closures may be made by dielectric, impulse, or ultrasonic process.

b. Protective clothing accessories. Each accessory will be placed in a separate unit pack barrier bag which will be heat sealed under vacuum. Closures may be made by dielectric, impulse, or ultrasonic process and must be uniform and smooth.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this Specification.
- b. Type required (see 1.2).
- c. Bag color (see 3.2.1.7)
- d. Bag dimension (see 3.2.2.1.1 and 3.2.2.2.1)
- e. Marking information and size prediction charts (if applicable)  
(see 3.2.2.1.2 and 3.2.2.2.2)
- f. Seal width (Type II bag only) (see 3.2.3.2)
- g. Conformance inspection sampling (see 4.1)



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6.3 Unit pack barrier bag material. The following unit pack barrier bag material constructions have been found to meet the performance requirements of this specification:

a. A colored flexible multi-layer formable foil, with an opaque finish, with a material structure consisting of 0.0012 inch Oriented Polypropylene, adhesive layer, 0.00175 inch Aluminum Foil, adhesive layer, 0.003 inch Cast Polypropylene.

b. A colored flexible multi-layer nylon foil film, with an opaque finish, with a material structure consisting of 60g Nylon, 0.0005 inch Polyethylene, 0.00035 inch Aluminum Foil, 0.004 inch Polyolefin Coextrusion.

6.4 Sources of supply for unit pack barrier bag foil material. It has been determined that the following suppliers are capable of meeting the foil film requirements:

Cadillac Products, Inc.  
5800 Crooks Road  
Troy, MI 48098-2830  
(248) 879-5000  
[www.cadprod.com](http://www.cadprod.com)

Lakeland Packaging  
219 Village Landing  
Fairport, NY 14450-1805  
(585) 425-3490  
[www.lakelandpkg.com](http://www.lakelandpkg.com)

6.6 Source of chemical agent testing. A list of Government approved laboratories for chemical agent testing is available from the contracting officer.

6.7 Subject term (key word) listing

Agent HD  
Coverall  
Neck Dam  
Nylon foil  
Nylon foil laminate  
Combat Vehicle Crewmen  
JC3  
Joint Service Lightweight Integrated Suit Technology  
JSLIST  
Aircrew Ensemble  
JPACE  
Repair kit

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## MILITARY INTERESTS

Custodians:

Army – GL  
Air Force – 11  
Navy - NU

Preparing activity:

DLA - CT

Project Number: 8105-2011-001

Review activities:

Army - MD, QM  
Navy – MC

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