

INCH-POUND

MIL-C-10859J
24 September 1990
SUPERSEDING
MIL-C-10859H
6 March 1984

MILITARY SPECIFICATION

CLOTH, OXFORD, COTTON, (PERMEABLE)

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

1. SCOPE

1.1 Scope. This specification covers the requirements for permeable cotton cloth.

1.2 Classification. The cloth shall be of the following types and classes as specified (see 6.2):

Type I - 5.2 ounces

Class 1 - Dyed

Class 2 - Natural, flame resistant and mildew resistant treated.

Class 3 - Bleached white

Type II - 6.0 ounces

Class 1 - Dyed

Class 3 - Bleached white

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be used in improving this document should be addressed to:
U.S. Army Natick Research, Development, and Engineering Center, Natick, MA
01760-5014 by using the Standardization Document Improvement Proposal
(DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 8305

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

A-A-50199 - Thread, Polyester Core, Cotton- or Polyester-Covered
 PPP-P-1134 - Packaging of Cotton and Cotton-Synthetic Fiber
 Blend Fabrics (Excluding Duck Fabrics)

STANDARDS

FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections
 FED-STD-191 - Textile Test Methods

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, 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.

FEDERAL TRADE COMMISSION

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies may be obtained from the Federal Trade Commission, Pennsylvania Avenue at Sixth Street, N.W., Washington, DC 20580-0001.)

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 6.2).

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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

Chromatic Transference Scale

(Application for copies should be addressed to the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 1424 - Tear Resistance of Woven Fabrics by Falling-Pendulum
(Elmendorf) Apparatus

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that 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 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 6.3), in accordance with 4.3.

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 Material. The material shall be cotton which has been carded, drawn and spun into single yarn. It is encouraged that recycled material be used when practical as long as it meets the requirements of this specification.

3.4 Color.

3.4.1 Types I and II, class 1. When dyed cloth is specified, the color of the types I and II, class 1 cloth shall be as specified (see 6.2), and shall match the standard sample (see 6.4). The use of dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid is prohibited. The dyestuff shall be chosen and applied so that the dyed and finished cloth shall contain no more labile sulfur than shown by the standard sample when tested as specified in 4.4.3. When a standard sample is not available, the dyed and finished cloth shall show no

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more than a slight trace of labile sulfur as defined in the test method when tested as specified in 4.4.3.

3.4.1.1 Types I and II, class 3 bleached white cloth. When bleached white cloth is specified, the cloth shall be fully bleached and may be supplemented with fluorescent optical brighteners which fluoresce to the blue region. The bleach cloth shall not discolor to a degree greater than that shown by the standard sample when tested as specified in 4.4.3. When no standard sample is available, the discoloration shall be no lower than the rating of "fair" when tested as specified in 4.4.3.

3.4.2 Type I, class 2. The type I, class 2 finished cloth shall be the natural shade imparted to the undyed unbleached cloth, resulting from the treatment.

3.4.3 Matching. The color of the dyed cloth shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and that have a correlated color temperature of $7500 \pm 200\text{K}$, with illumination of 100 ± 20 foot candles, and shall be a good match under incandescent lamplight at $2300 \pm 200\text{K}$.

3.4.4 Colorfastness. The types I and II, class 1 dyed cloth shall show fastness to laundering (after 3 cycles), perspiration and light (after 40 hours), equal to or better than the standard sample or equal to or better than a rating of "good". The dyed cloth shall show fastness to crocking equal to or better than the standard sample or shall have an AATCC Chromatic Transference Scale rating of not lower than 3.5. Testing shall be as specified in 4.4.3.

3.5 Physical requirements. The physical requirements of the finished cloth shall be as specified in table I when tested as specified in 4.4.3.

TABLE I. Physical requirements

Characteristic	Type I		Type II
	Classes 1 and 3	Class 2	Classes 1 and 3
Weight, oz./sq. yd.	5.3 (min)	7.0 (max)	6.0 (min)
Yarns per inch			
Warp	124	122	115
Filling	42	40	44
Breaking strength, lbs. (min.)			
Warp	75	75	100
Filling	60	60	65

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TABLE I. Physical requirements (cont'd)

Characteristic	Type I		Type II
	Classes 1 and 3	Class 2	Classes 1 and 3
Tearing strength, lbs. (min)			
Warp	--	3	--
Filling	--	3	--
Air permeability, ft. ³ /min./ft. ² (min)	20	20	20
Seam efficiency percent (min)	90	80	90

3.5.1 Width. The width of the cloth shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of the selvage when fly shuttle looms or shuttleless looms with tuck-in selvage are used. For all other shuttleless looms the width measurement shall be made between the last warp yarn on each side excluding the protruding frings(s) (see 6.5).

3.5.2 Weave. The weave shall be oxford, plain weave (two ends weaving as one).

3.6 Cloth preparation.

3.6.1 Types I and II, classes 1 and 3. The types I and II, classes 1 and 3 cloth shall be closely singed, desized and mercerized. The starch and protein content including chloroform-soluble and water-soluble material of the finished cloth shall not exceed 2.0 percent when tested as specified in 4.4.3.

3.6.2 Type I, class 2. The type I, class 2 cloth shall be desized. The starch and protein content including chloroform-soluble and water-soluble material of the cloth prior to flame resistant and mildew resistant treatments shall not exceed 2.0 percent when tested as specified in 4.4.3.

3.7 Finishing, type I, class 2 cloth. The cloth shall be treated with an approved durable flame resistant treatment (see 6.6) and mildew resistant treatment. The finished cloth shall be thoroughly plant-washed to remove any residues from the curing process. The water-soluble material of the finished cloth shall not exceed 6.0 percent when tested as specified in 4.4.3.

3.7.1 Flame resistance. The finished cloth shall have an average time of after-flame of not more than 2.0 seconds and an average length of char of not more than 5.0 inches initially and after laundering (3 cycles), when tested as specified in 4.4.3.

3.7.2 Flexibility. The finished cloth shall have a flex stiffness for both warp and filling of not more than 0.001 inch-pounds initially and not more than 0.0035 inch-pounds after being subjected to a temperature of $-25^{\circ}\text{F} \pm 2^{\circ}\text{F}$ for a period of 1 hour. Testing shall be as specified in 4.4.3.

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3.7.3 Mildew resistance. The cloth shall be treated with solubilized copper-8-quinolinolate applied from an aqueous or solvent base. The finished cloth shall have a copper content of not less than 0.18 percent and not greater than 0.27 percent as metal from copper-8-quinolinolate when tested as specified in 4.4.3.

3.8 pH. The pH value of water extract of finished cloth shall be no less than 5.0 nor more than 8.5 when tested as specified in 4.4.3.

3.9 Shrinkage. Types I and II, classes 1 and 3 cloth shall be preshrunk and shall not shrink more than 1.0 percent in either the warp or filling direction. Type I, class 2, cloth shall be preshrunk and shall not shrink more than 3.0 percent in either the warp or filling direction. Testing shall be as specified in 4.4.3. The preshrinking process shall not be identified by name or trademark either on the cloth or on the ticket or package.

3.10 Length and put-up. Unless otherwise specified (see 6.2), the finished cloth shall be furnished in continuous lengths, each not less than 40 yards. Each length shall be put-up on full width rolls as specified in 5.1.

3.11 Face identification. The face side of the cloth shall be identified by applying a stamping on that side of the cloth with the word "Face" at each end of the roll.

3.12 Fiber identification. Each roll shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act.

3.13 Workmanship. The finished cloth shall conform to the quality of product established by this specification. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the applicable established maximum point values.

4. QUALITY ASSURANCE PROVISION

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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies

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submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

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. When a first article is required (see 3.1 and 6.2), it shall be examined for the defects specified in 4.4.2.1 and 4.4.2.4 and tested as specified in 4.4.3.

4.4 Quality conformance inspection.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.2 End item examination.

4.4.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects, as defined in Section I of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.4.2.1.1 except that only those slubs and knots which exceed the limits shown on Sears Fabric Defect Scales (see 6.7), G or 1 as applicable for slubs and "E" for knots, shall be scored. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll within the sample shall be penalized more than four points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds 40 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 60 points. If one roll exceeds 60 points per 100 square yards, a second sample of 20 rolls shall be examined only for individual roll quality. The lot shall be unacceptable if one or more rolls in the second sample exceeds 60 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

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<u>Total points scored in sample x 3600</u>	= Points per 100
Contracted width of cloth (inches) x Total yards inspected	square yards

4.4.2.1.1 Demerit points. Demerit points shall be assigned as follows:

For defects up to 3 inches in any dimension	- one point
For defects exceeding 3 inches but not exceeding 6 inches in any dimension	- two points
For defects exceeding 6 inches but not exceeding 9 inches in any dimension	- three points
For defects exceeding 9 inches in any dimension	- four points

The following defects, when present shall be scored four points for each yard in which they occur:

Hole, tear, or cut
 Slack or tight selvages ^{1/}
 Width less than specified.
 Baggy, ridgy, or wavy cloth.
 Objectionable odor.
 Poor dye penetration, mottled, streaky, or cloudy.
 Treating compound uneven.
 Not closely singed (classes 1 and 3 only).

^{1/} To determine the presence of unacceptable selvage conditions, the following procedure shall be observed: During the visual examination, the perch shall be stopped a minimum of three times for each roll in the sample, the tension removed and the finished cloth examined for the selvage conditions. Suspect rolls should be removed from the perch and unrolled on the floor or a table and further examined for the condition. A waviness in the selvage or significant ripples diagonally across the width of the fabric is an indication of slack or tight selvages.

4.4.2.2 Length examination.

4.4.2.2.1 Individual rolls. During the yard-by-yard examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified or more than 2 yards less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if two or more rolls in the sample are defective in respect to length.

4.4.2.2.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the tickets.

4.4.2.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. If any roll in the sample is off shade, shaded side to side, side to center, or end to end, or if any roll does not have the same appearance as the standard sample, the lot represented by the sample shall be rejected.

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4.4.2.4 Roll identification examination. During the yard-by-yard examination, each roll in the sample shall be examined for defects listed below. The lot shall be unacceptable if two or more of the following defects are present in the sample:

- Face identification missing from either or both ends.
- Face identification on wrong side.
- Preshrinkage process identified by name or trademark on cloth or ticket.
- Not labeled or ticketed in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act.

4.4.3 End item testing. The cloth shall be tested for the characteristics listed in table II. The methods of testing specified in FED-STD-191 wherever applicable and as listed in table II shall be followed. The physical and chemical values specified in section 3 apply to the results of the determinations made on a sample unit for test purposes as specified in the applicable test method. The sample unit for classes 1 and 3 cloth shall be 4 continuous yards full width of the finished cloth. The sample unit for class 2 cloth shall be 1/2 yard full width of the cloth prior to flame resistant and mildew resistant treatments to determine weight and starch and protein content, including chloroform-soluble and water-soluble material; and 4 continuous yards full width of the finished cloth. All test reports shall contain the individual values utilized in expressing the final results. The lot shall be unacceptable if one or more sample units fail to meet any requirement specified. The sample size shall be in accordance with the following:

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

TABLE II. End item tests

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Labile sulfur content	3.4.1	2020
Discoloration (types I and II, class 3)	3.4.1.1	5660 <u>1/ 2/</u>
Colorfastness to: (types I and II, class 1)		
Laundering (after 3 cycles)	3.4.4	5610 <u>3/ 4/</u>
Perspiration	3.4.4	5680
Light (after 40 standard fading hours)	3.4.4	5660
Crocking	3.4.4	5651

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TABLE II. End item tests (cont'd)

Characteristic	Requirement paragraph	Test method
Weight	3.5	5041
Yarns per inch	3.5	5050
Breaking strength	3.5	5100
Tearing strength	3.5	ASTM D 1424
Air permeability	3.5	5450
Seam efficiency	3.5	5110 <u>5/</u>
Weave	3.5.2	Visual <u>1/</u>
Mercerization (types I and II, classes 1 and 3)	3.6.1	Microscopic examination for swelling of cotton fiber <u>1/</u>
Starch and protein content including chloroform-soluble and water-soluble material	3.6.1 and 3.6.2	2611
Water-soluble material (type I, class 2)	3.7	2611 <u>6/</u>
Flame resistance (type I, class 2):		
Initial	3.7.1	5903
After three launderings	3.7.1	5556 and 5903
Flexibility (type I, class 2):		
Initial	3.7.2	5206
At $-25^{\circ}\text{F} \pm 2^{\circ}\text{F}$	3.7.2	5206
Mildew resistance:		
Total copper analysis	3.7.3	2050 or 2051
Fungicide	3.7.3	2060
pH	3.8	2811
Shrinkage:		
(types I and II, class 1 and 3)	3.9	5550
(type I, class 2)	3.9	5556

- 1/ One determination shall be made from each sample unit and the result reported as "pass" or "fail".
- 2/ Method 5660 shall be used, except that exposure of the specimen and standard shall be for 20 standard hours. Any specimen showing discoloration less than or equal to that of the standard sample shall be rated "pass". Any specimen showing discoloration greater than that of the standard sample shall be rated "fail". When no standard sample is available, the discoloration shall be considered satisfactory if it is not worse than the rating of "fair" indicated in Method 5660.
- 3/ The specimens must be dried after each of the 3 laundering cycles.

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- 4/ On the color transfer cloth evaluation, only the stain on the cotton fibers of the color transfer cloth shall be evaluated.
- 5/ The needle shall measure 0.040 + 0.001 inch across the blade at the eye. The thread for all classes shall be polyester/cotton or rayon covered in accordance with A-A-50199, ticket No. 50, 2 or 3 ply for the needle and ticket No. 70, 2 or 3 ply for the looper.
- 6/ Testing shall be performed in accordance with the "water-soluble material" paragraph of Method 2611, the chloroform extract procedure shall be omitted.

4.4.4 Packaging inspection. The inspection shall be in accordance with the quality assurance provisions of PPP-P-1134.

5. PACKAGING

5.1 Put-up and preservation. Put-up and preservation shall be level A or Commercial as specified (see 6.2).

5.1.1 Levels A and Commercial. The cloth shall be put-up and preserved in accordance with the applicable requirements of PPP-P-1134.

5.2 Packing. Packing shall be level A, B or Commercial as specified (see 6.2).

5.2.1 Levels A, B and Commercial. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1134.

5.3 Marking. In addition to any special marking required by the contract or purchase order, shipping containers shall be marked in accordance with PPP-P-1134.

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 types I and II, classes 1 and 3 cloths are intended for use in clothing and mittens. Type I, class 2 cloth is intended for use in tent liners.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type and class required (see 1.2).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. When a first article is required (see 3.1, 4.3, and 6.3).

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- e. Color required (see 3.4.1).
- f. Width required (see 3.5.1).
- g. Length of roll if other than specified (see 3.11).
- h. Levels of preservation and packing (see 5.1 and 5.2).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Sample. For access to standard samples, address the contracting activity issuing the invitation for bids or request for proposal.

6.5 Preferred width for type I, class 2 cloth. The preferred width of type I, class 2 cloth is $45 + 1/2$ inches.

6.6 Approved flame resistant treatment. Approval of the flame resistant treatment is the responsibility of U.S. Army Natick Research, Development and Engineering Center, Natick MA 01760, and is based on extensive tests including those for toxicity which are not set forth in this specification. Because of the time required to evaluate and approve new treatments (approximately 6 months) only those chemical treatments already approved will be considered acceptable for the related procurement. Information pertaining to the approval of new treatments should be obtained from the U.S. Army Natick Research, Development and Engineering Center. The list of approved treatments may be obtained from the contracting activity.

6.7 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

6.8 Subject term (key word) listing.

Extended cold weather clothing system (ECWCS)
 Fabric
 Uniform

6.9 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.

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MILITARY INTERESTS:

Custodians:

Army - GL
Navy - NU
Air Force - 99

Review activities:

Army - MD
Air Force - 82
DLA - CT

User activity:

Navy - MC

PREPARING ACTIVITY:

Army - GL
(Project 8305-0353)

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, nor 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

1. RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-10859J	2. DOCUMENT DATE (YYMMDD) 1990 September 24
3. DOCUMENT TITLE CLOTH, OXFORD, COTTON, (PERMEABLE)		
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) AUTOVON (if applicable)	e. DATE SUBMITTED (YYMMDD)
7. PREPARING ACTIVITY		
a. NAME U.S. Army Natick RD&E Center	b. TELEPHONE (Include Area Code) (1) Commercial 508-651-5221 (2) AUTOVON 256-5221	
c. ADDRESS (Include Zip Code) Commander, U.S. Army Natick RD&E Center ATTN STRNC-ES Natick, MA 01760-5014	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 AUTOVON 289-2340	