

MIL-C-9963F
 15 October 1976

 SUPERSEDING
 MIL-C-9963E
 12 May 1970

MILITARY SPECIFICATION
 CARTRIDGE, 5.56MM, BALL, M193

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

1. SCOPE

1.1 This specification covers Cartridge, 5.56MM, Ball, M193 for use in the 5.56MM weapons.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bid or request for proposal, form's part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-I-45607 - Inspection Equipment, Acquisition,
 Maintenance and Disposition of

STANDARDS

Military

MIL-STD-105 - Sampling Procedures and Tables for
 Inspection by Attributes
 MIL-STD-109 - Quality Assurance Terms and Definitions
 MIL-STD-636 - Visual Inspection Standards for Small
 Arms Ammunition through Caliber .50
 MIL-STD-644 - Visual Inspection Standards and Inspection
 Procedures for Inspection of Packaging,
 Packing and Marking of Small Arms Ammunition
 MIL-STD-1168 - Lot Numbering of Ammunition

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Frankford Arsenal, ATTN: SARFA-MDM, Phila., PA 19137, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1462) appearing at the end of this document or by letter.

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DRAWINGS

Armament Command

D10523632	- Cartridge, 5.56mm, Ball, M193
C7643674	- Classification of Cartridge Case Defects
F10535858	- Packing and Marking, Cartridges, 5.56mm; Cartons; Box, Ammunition, M2A1; Box, Wirebound
F10534605	- Packing and Marking, Cartridges, 5.56mm; Cartons; Bandoleers; Box, Ammunition, M2A1; Box, Wirebound
F10542258	- Packing and Marking, Cartridges, 5.56mm; 10 Rd. Clips; Cartons; Bandoleers; Box, Ammunition, M2A1; Box, Wirebound
F11735709	- Packing and Marking, Cartridges, 5.56mm; 10 Rd. Clips; Cartons; Bandoleer M8; Box, Ammunition, M2A1; Box, Wirebound
LI10523632	Index of Inspection Equipment List for Cartridge, 5.56mm, Ball, M193

PUBLICATIONS

SCATP-5.56	- Ammunition Ballistic Acceptance Test Methods, Test Procedures for 5.56mm Cartridges
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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.-The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bid or request for proposal shall apply.

ASTM Method E 92	- Method of test for Vickers Hardness of Metallic Materials
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(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

3. REQUIREMENTS

3.1 General. - The cartridge shall comply with Drawing D10523632, referenced specifications and the following:

3.2 Bullet extraction. -The force required to extract the bullet from the cartridge case shall be not less than 35 pounds.

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3.3 Residual stress. -The cartridge case shall not split when subjected to a 1% mercurous nitrate solution for 15 minutes.

3.4 Waterproof. -The cartridge shall not release more than one bubble of air when subjected to an internal pressure differential of 7½ pounds per square inch (psi) for 30 seconds.

3.5 Accuracy. -The average of the mean radii of all targets of the sample cartridges, fired at 200 yards, shall not exceed 2.0 inches.

3.6 Velocity. -The average velocity of the sample cartridges, conditioned at $70^{\circ} \pm 2^{\circ}$ Fahrenheit (F), shall be 3165 feet per second (ft/sec) plus or minus 40 ft/sec, at 78 feet from the muzzle of the weapon. The standard deviation of the velocities shall not exceed 40 ft/sec.

3.7 Chamber pressure.

3.7.1 Measurement by copper-crush cylinder. -The average chamber pressure of the sample cartridges, conditioned at $70^{\circ} \pm 2^{\circ}$ F, shall not exceed 52,000 pounds per square inch (PSI). The average chamber pressure plus three standard deviations of chamber pressure shall not exceed 58,000 PSI.

3.7.2 Measurement by piezoelectric transducer. -The average chamber pressure of the sample cartridges, conditioned at $70^{\circ} \pm 2^{\circ}$ F, shall not exceed 55,000 PSI. The average chamber pressure plus three standard deviations of chamber pressure shall not exceed 61,000 PSI.

3.8 port pressure.

3.8.1 Measurement by copper-crush cylinder. -The average port pressure of the sample cartridges, conditioned at $70^{\circ} \pm 2^{\circ}$ F, shall be 15,000 PSI \pm 2000 PSI,

3.8.2 Measurement by piezoelectric transducer. -The average pore pressure of the sample cartridges, conditioned at $70^{\circ} \pm 2^{\circ}$ F, shall be 14,400 PSI \pm 2000 PSI.

3.9 Temperature stability. -When the sample cartridges are subjected to the following storage conditions, the average velocity shall not decrease by more than 250 ft/sec and the average chamber pressure by either method used in 3.7 shall not increase by more than 5000 PSI. Also, the average port pressure by either method used in 3.8 shall neither increase nor decrease by more than 2000 PSI with respect to the average velocity, chamber pressure and port pressure of the sample cartridges of the same lot, conditioned at $70^{\circ} \pm 2^{\circ}$ F for a minimum of twenty minutes. Any increases in velocity and decreases in chamber pressure of the sample cartridges under these temperature conditions are acceptable.

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3.9 (Cont'd)

Stored at $125^{\circ} \pm 2^{\circ}\text{F}$ for not less than one hour and fired at that temperature.

Stored at $-65^{\circ} \pm 5^{\circ}\text{F}$ for not less than one hour and fired at that temperature.

3.10 Function and casualty. -The cartridge shall function without casualty at ambient temperature and under the conditions specified in 3.9.

3.11 Stripping. -The jacket of the bullet, or any part thereof, shall not separate from the slug when the cartridge is fired.

3.12 Fouling. -The fouling accumulated in the weapon during the firing of 1000 sample cartridges shall not cause failure of the weapon to function.

3.13 Workmanship. -The requirements for workmanship are as specified on the applicable drawings, referenced specifications and the following:

3.13.1 Metal defects. -The cartridge shall be free of folds, wrinkles, deep draw scratches, scaly metal, dents and other defects.

3.13.2 Foreign matter. -The cartridge shall be free of corrosion, stains, discolorations, dirt, oil, and smears of lacquer.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. -Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 the prescribed requirements.

4.1.1 Quality assurance terms and definitions. -Reference shall be made to MIL-STD-109 for definitions of quality assurance terms.

4.2 First article sample.

4.2.1 Initial production sample. -At the beginning of regular production, a sample of 3500 cartridges shall be submitted in accordance with contract requirements. In addition, 100 bullets shall be submitted for visual and dimensional examinations. The sample shall be manufactured using the same materials, equipment, processes and procedures as will be used in regular production. All parts and materials, including packaging and packing,

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4.2.1 (Cont'd)

shall be the same as used for regular production and shall be obtained from the same source of supply.

4.2.1.1 Examination and test. -After inspection and provisional acceptance at source, the sample shall be inspected for all requirements of the drawings and specifications at a Government laboratory or such other facility specified in the contract.

4.2.1.2 Initial production sample failure. -Failure of the sample to comply with requirements of the drawings and specifications shall result in sample disapproval. Determination as to acceptability of any initial production sample shall be based upon results of initial tests only, and no second tests shall be permitted on that initial production sample.

4.3 Inspection provisions.4.3.1 Lot.

4.3.1.1 Submission of product. -The product shall be submitted in accordance with MIL-STD-105.

4.3.1.2 Lot identification. -Each lot of ammunition shall be identified as to type, caliber and model, as well as with a lot number in accordance with MIL-STD-1168. Each lot shall be further identified by a Federal Stock Number assigned by the procuring activity.

4.3.2 Examination. - One hundred percent examination shall be performed for all critical defects. Examination for major and minor defects shall be performed on a class basis in accordance with the classification of defects, Table I, using applicable sampling plans and acceptance criteria of MIL-STD-105. The Acceptable Quality Level (AQL) for the major class shall be 0.25 percent and the AQL for the minor class shall be 1.50 percent. All non-conforming cartridges shall be rejected.

4.3.2.1 Classification of defects. -The classification of defects shall be as specified in Table I.

TABLE I

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
	Visual 1/ Cartridge				
1	Discolored, dirty, oily, smeared				X

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4.3.2.1 (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
2	Corroded or stained, if etched		X		
Case					
4	Round Head		X		
5	Dent				X
6	Split case				
	in K, L, or M location	X			
	in I, S, or J location		X		
7	Perforated case	X			
8	Draw scratch				X
9	Scratch			X	
10	Beveled underside of head		X		
11	Case mouth not crimped in cannellure		X		
12	Scaly metal				X
13	No chamfer on head (rim)		X		
14	Fold			X	
15	Wrinkle			X	
16	Buckle			X	
17	Bulge			X	
18	Illegible or missing head stamp			X	
19	Defective head			X	
20	Defective mouth			X	
21	No visible evidence of mouth anneal		X		
Bullet					
22	Dent			X	
23	Scratch			X	
24	Split bullet jacket		X		
25	Loose bullet		X		
26	Missing cannellure		X		
27	Scaly metal (bullet)				X
28	Upset (crooked) point,			X	
29	Exposed steel (clad jacket)			X	
30	Blunt point			X	
31	Defective cannellure			X	
Primer					
32	No primer	X			
33	Cocked primer	X			
34	Inverted primer	X			
35	Loose primer		X		
36	Nicked or dented primer			X	

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4.3.2.1 (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
37	No waterproofing material (primer pocket joint)				X
38	Defective crimp				x
Gaging					
39	Total length		x		
40	Cartridge profile and alignment failure		x		
41	Diameter of extractor groove, max.		x		
42	Diameter of extractor groove, min.				X
43	Diameter of head		x		
44	Thickness of head		x		
45	Length to shoulder datum		x		
46	Depth of primer		x		
Weighing					
47	Weight, min. <u>2/</u>	X			

1/ Refer to MIL-STD-636 (NATO caliber 7.62mm section) for visual defect standards for defects 1 through 38.

2/ Each lightweight cartridge shall be disassembled and the propellant weighed. Each such cartridge found to contain 10 grains or more of propellant shall be classed as a major defect. Any cartridge containing less than 10 grains of propellant shall be classed as a critical defect.

4.3.3 Tests.-The tests listed in Table II shall be conducted in accordance with the methods and procedures specified in 4.4.

4.3.3.1 Test samples.-The quantities for the various tests shall be as specified in Table II. Only cartridges having met the visual, dimensional and weight requirements shall be used in the ballistic tests, and shall have been selected in such a manner that the sample is representative of the entire lot. The cartridges shall be thoroughly mixed before being divided into samples for the various tests.

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4.3.3.1 (Cont'd)

TABLE II

Test	Number of Cartridges				Requirement Para.
	Ambient Temp.	<u>70° ± 2°F</u>	Low Temp. (4.4.8.1)	High Temp. (4.4.8.2)	
Bullet extraction <u>1/</u>	25				3.2
Residual stress (Mercurous Nitrate) <u>1/</u>	50				3.3
Waterproof <u>2/</u>	50				3.4
Accuracy <u>3/</u>	90				3.5
Velocity <u>4/</u>		20	20	20	3.6 & 3.9
Chamber pressure <u>4/</u>		20	20	20	3.7 & 3.9
Port pressure <u>4/</u>					3.8 & 3.9
Function & Casualty <u>5/</u>					
Rifle, M16 or M16A1	480		480	480	3.9 & 3.10
Stripping <u>6/</u>	1 00				3.11
Fouling <u>7/</u>	1000				3.12
Hardness					
Head <u>8/</u>	10				Drawing
Sidewall <u>3/</u>	10				Drawing

1/ Failure of two or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. If one cartridge fails in the first test, a second sample consisting of double the number of cartridges in the first sample may be tested. If any failing cartridges are found in the second sample, the lot shall be rejected.

2/ Failure of ten or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. If more than three but less than ten cartridges fail in the first test, a second sample consisting of double the number, of cartridges in the first sample shall be tested. The lot shall be rejected if in the combined first and second sample, ten or more cartridges fail to comply with the applicable requirement.

3/ Failure of the cartridges to comply with the applicable requirement shall be cause for rejection of the lot subject to testing of a second sample consisting of double the quantity of cartridges used in the first test. Failure of the cartridges in the second sample to comply with the applicable requirement shall be cause for rejection of the lot.

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4.3.3.1 (Cont'd)

- 4/ Failure of the cartridges in any sample to comply with the applicable requirement shall be cause for rejection of the lot subject to testing of a second sample consisting of double the quantity of cartridges used in the first test for the temperature or temperatures at which the failure occurred. Failure of the cartridges of the second sample to comply with the applicable requirement shall be cause for rejection of the lot. Chamber pressure and port pressure tests shall be conducted simultaneously.
- 5/ The lot shall be rejected when function and casualty defects plus firing defects observed in all other firing tests exceed the acceptance number for the cumulative sample of Table III. If the number of defects found in the first tests exceeds the acceptance number for the first sample, but is equal to or less than the acceptance number for the cumulative sample, a second sample, consisting of double the quantities specified under function and casualty test, shall be fired in the service weapon specified therefor. This procedure shall apply regardless of the weapon or weapons in which the firing defects occurred in the first test. If the total number of defects in the combined first and second sample exceeds the acceptance number for the cumulative sample, the lot shall be rejected. If, in testing a second sample, defects other than those for which the second sample is being tested should occur to the extent that they exceed the acceptance number for the cumulative sample, the lot shall be rejected.
- 6/ Any evidence of stripping, as indicated by any irregular perforations on the paper screens, shall be cause for rejection of the lot subject to testing of a second sample consisting of double the quantity of cartridges used in the first test. Any evidence of stripping in the second sample shall be cause for rejection of the lot.
- 7/ The test shall be conducted on the initial production sample only.
- 8/ Failure of one or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. No second sample permitted.

4.3.3.2 Firing defects. -Firing defects and acceptance numbers shall be as specified in Table III.

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4.3.3.2 (Cont'd)

TABLE III

	<u>Defects</u>	<u>Acceptance</u>	
		First Sample	Cumulative (1st & 2nd Sample)
1.	Misfire <u>6/</u>		
	a. No vent hole	0	--
	b. Other	1	2
2.	Bullet remaining in bore <u>1/</u>	0	--
3.	Primer leak:		
	a. Perforation in firing pin indent in primer cup (Rifle M16 or M16A1 only) <u>2/</u>	0	--
	b. Escape of gas through primer cup other than 3a. above	<u>1</u>	2
	c. Escape of gas around primer cup <u>5/</u>	<u>44</u>	105
	d. Loose primer <u>7/</u>	<u>1</u>	2
	e. Blown primer <u>7/</u>	<u>0</u>	1
	f. Dropped primer <u>7/</u>	<u>0</u>	1
4.	Case casualties		
	a. Longitudinal split <u>3/</u>		
	(1) Neck and shoulder (I or S)	28	66
	(2) Body (J)	2	4
	(3) Body (K)	0	1
	(4) To head (L)	0	1
	(5) Through head (M)	0	1
	b. Circumferential rupture <u>3/</u>		
	(1) Partial, shoulder or body (J & S)	1	2
	(2) Partial, body (K)	0	1
	(3) Partial, head (L)	0	1
	(4) Complete	0	1
5.	Failure to extract	0	1
6.	Weapons stoppage <u>4/</u>	0	1

1/ No second sample permitted. Lot shall be rejected.

2/ If one or more defects are found in the first sample, a second sample consisting of double the quantity of cartridges specified under Function and Casualty of Table II shall be fired. Prior to the testing of the second sample, the firing pin of the specific rifle(s) in which the defect originally occurred shall be replaced with a new firing pin. If an additional primer perforation is found in the second sample, the lot shall be rejected.

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4.3.3.2 (Cont'd)

3/ For location of defects indicated by letters in parentheses, see Drawing C7643674.

4/ All stoppages attributable to the ammunition, with the exception of misfire, complete rupture or failure to extract, observed in all tests shall be included.

5/ Of the cartridges in which this defect occurs, nor more than 14 in the first sample nor more than 30 in the cumulative sample shall exhibit escape of gas around 50% or more than 50% of the periphery.

6/ Each cartridge that misfires shall be disassembled and examined for presence of vent hole in primer pocket. If vent hole is missing, the lot shall be rejected with no second sample permitted.

7/ Loose primer.- Looseness, but not so as to permit the fired primer to fall from the primer pocket.

Blown primer.- A primer which, when the cartridge is fired, is separated completely from the head of the cartridge case, and both the head of the case and the primer pocket are grossly distorted and deformed. The severity of this condition is such that it is readily detectable with the naked eye.

Dropped primer.- A primer which falls from the primer pocket after the cartridge is fired.

4.3.4 Packaging, packing and marking inspection. -During or immediately prior to the packaging operation, 100% examination of the cartridges shall be performed to ascertain that the cartridge type conforms to the drawing. Occurrence of a high pressure test, dummy or blank cartridge shall be classed as a critical defect. Occurrence of any type other than those listed shall be classed as a major defect. All nonconforming cartridges shall be rejected. Inspection for packaging, packing and marking shall be in accordance with MIL-STD-644 as applicable to the drawing.

4.3.5 Inspection equipment. -The examinations and tests shall be made using the equipment prescribed in Equipment Lists listed on LI-10523632. Unless otherwise specified, acquisition, maintenance and disposition of inspection equipment shall be in accordance with MIL-I-45607. Simulated assessment of reference cartridge shall be in accordance with SCATP-5.56

4.4 Test methods and procedures.

4.4.1 Bullet extraction. -The test shall be conducted in accordance with SCATP-5.56. The rate of travel of the test head shall be not less than three nor more than six inches per minute.

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4.4.2 Residual stress Mercurous nitrate .-The test shall be conducted in accordance with SCATP-5.56.

4.4.3 Waterproof. -The test shall be conducted in accordance with SCATP-5.56.

4.4.4. Accuracy. -The test shall be conducted in accordance with SCATP-5.56, except that the Mean Radius shall be recorded to the nearest one-tenth of an inch.

4.4.5 Velocity. -The test shall be conducted in accordance with SCATP-5.56 ' 8 .

4.4.6 Chamber pressure. -The test shall be conducted in accordance with SCATP-5.56 and 4.4.8 simultaneously with the port pressure tests.

4.4.7 Port pressure. -The tests shall be conducted in accordance with SCATP-5.56 and 4.4.8 simultaneously, with the chamber pressure tests.

4.4.8 Temperature. -The test shall be conducted in accordance with SCATP-5.56. The weapon in which these tests are fired shall be at room temperature. Velocity and pressure differences shall be determined by firing twenty cartridges, conditioned at 68° to 72°F for a minimum of 20 minutes, from the same lot of ammunition, immediately prior to firing the cartridges conditioned as specified below.

4.4.8.1 Low temperature test. -The test sample shall be stored at minus 65 degrees F, plus or minus 5 degrees, for not less than 1 hour and shall be fired at that temperature.

4.4.8.2 High temperature test. -The test sample shall be stored at 125 degrees F, plus or minus 2 degrees, for not less than 1 hour and shall be fired at that temperature.

4.4.9 Function and casualty. -The test shall be conducted in accordance with SCATP-5.56 and 4.4.8. Two rifles shall be used and the following number of cartridges shall be fired in each:

	<u>First Sample</u>	<u>Second Sample (if required)</u>
Ambient temperature	240	490
Low temperature	240	480
High temperature	240	480

4.4.10 Stripping. -The test shall be conducted in accordance with SCATP-5.56 and the following: Five magazines, 20 cartridges each, shall be fired alternately, i.e. full automatic, semi-automatic, full automatic, etc. After firing each magazine, the paper screen shall be inspected, and

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4,4.10 (Cont'd)

if necessary, be replaced, to assure observations. Test weapons shall be cooled to ambient temperature after firing 60 cartridges. Cooling cycle shall be the same for retests.

4.4.11 Fouling. -The test shall be conducted in accordance with SCATP-5.56.

4.4.12 Hardness testing. -The bullets shall be extracted, the propellant removed and the primers extracted. Each cartridge case of the sample shall be prepared and placed on the appropriate test fixture for testing in accordance with ASTM Method E 92.

4.4.12.1 Case sidewall. -The average of the hardness values of the sample cases for each prescribed point along the sidewall exterior surface shall be computed and charted in accordance with the drawing requirements.

4.4.12.2 Case head. -The individual hardness value for each prescribed point on the head section of each sample case shall be recorded. Any value failing to meet the drawing requirement at a prescribed point(s) shall be cause for measurement of hardness at the corresponding point(s) on the opposite side of the primer pocket of the same head section from which the initial value was obtained. The higher of the two measurements shall be recorded as the value of record for determination of conformance to drawing requirements.

4.4.13 Defect penalty. -In any ballistic test, except function and casualty, in which the occurrence of a firing defect prevents the obtaining of a reliable result for the characteristic being tested, an additional shot shall be fired. That particular test shall not be penalized, but the acceptance or initial production sample shall be penalized for such defects in accordance with Table III.

5. PREPARATION FOR DELIVERY

5.1 Packing - Level A (Worldwide shipment) .-The cartridges shall be packed in accordance with Drawing F10535858, F10534605, F10542258 or F11735709.

5.2 Marking and labeling. -Packing boxes shall be marked and labeled in accordance with applicable drawing cited in 5.1.

6. NOTES

6.1 Ordering data. -Invitation for bids and contracts or orders will specify the following:

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6.1.1 Title, number and date of this specification.

6.1.2 Type and level of packing.

6.1.3 Provisions for the supply, maintenance and disposition of mandatory ballastic test equipment for acceptance inspection purposes.

6.1.4 Provisions for the submission of acceptance inspection reports containing final inspection results for each lot on ammunition presented to the Government.

6.1.5 Requirement for contractor to provide and maintain an inspection system in accordance with MIL-I-45208, Inspection System Requirement.

6.2 Hazard notice. The cartridge described herein and certain of its components are flammable and /or explosive and consequently present hazards in manufacture, handling, storage and shipment. The contractor should recognize these hazards and take appropriate measures to guard and protect against fire, explosion, adverse environment, corrosive atmosphere, rough handling, and electrically induced incidents.

Custodian:

Army -MU

Air Force - 99

Review activities:

Air Force - 99

User activity:

Navy - OS, MC

Preparing activity:

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Project Mo. 1305-0800

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DEPARTMENT OF THE ARMY



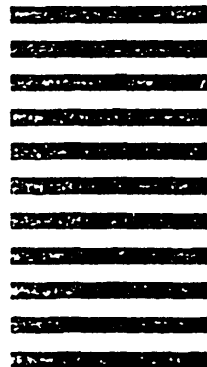
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(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

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3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

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7a. NAME OF SUBMITTER (Last, First, MI) - Optional

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