

INCH-POUND

MIL-DTL-32249 (AR)
w/AMENDMENT 1
30 March 2012
SUPERSEDING
MIL-DTL-32249 (AR)
14 April 2008

DETAIL SPECIFICATION

CARTRIDGE, IGNITION: M752A1 FOR ILLUMINATION AND SMOKE CARTRIDGES FOR THE 81MM MORTAR

This specification is approved for use by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements, examinations and tests for the parts and Loading, Assembling and Packing (LAP) of M752A1 Ignition Cartridges for the 81mm M853A1 Illumination (Visible), M816 Illumination (Infrared) and M819 Smoke Cartridges for the 81mm Mortar.

Comments, suggestions, or questions on this document should be addressed to the Commander, U.S. Army ARDEC, ATTN: AMSRD-AIS-SS , Picatinny, NJ 07806-5000 or emailed to ardecstdzn@conus.army.mil. 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>.

AMSC N/A

FSC 1315

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are needed to meet the requirements specified in sections 3 and 4 of this detail specification. This section does not include documents in other sections of this detail 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 requirements, documents cited in sections 3 and 4 of this detail 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-P-00223 – Powder, Black

MIL-P-60398 – Propellant M9, Flake for use in ignition cartridges

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-1916 DoD Preferred Methods for Acceptance of Product

MIL-STD-1168 Ammunition Lot Numbering and Ammunition Data Card

(Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch/> or from the Standardization Documents Order Desk, 700 Robbins Avenue, Bldg. 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 are those cited in the solicitation.

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC) DRAWINGS

9293427	Head
9294752	Cartridge, Ignition, M752A1
9294753	Tube Assembly
9294754	Tube
9294755	Body
9294756	Cap
9294757	Flash Tube Assembly
9294758	Tube, Flash
9297909	Pin

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9345250	Tubing, Heat Shrinkable
9345251	Tubing, Heat Shrinkable
12630551	Assembly, Body
13028855	Primer, Fed 150D
13000746	O-ring Plug, Firing
13000797	Plug, Firing M752A1
13000847	Pellet
13012620	Head Assembly
12977160	Drop Test fixture

(Copies of these drawings maybe requested online at pica.drawing.request@conus.army.mil or from US Army ARDEC, ATTN: RDAR-EIS-PE, Picatinny Arsenal, NJ 07806-5000)

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.

ASTM International

ASTM B117 - Standard Test Method of Salt Spray (Fog) Apparatus

(Copies of ASTM standards are available online from <http://www.astm.org>)

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 in accordance with 4.2.

3.2 Corrosion resistance (salt spray). Parts subjected to the salt spray test shall show no evidence of pitting or mottling.

3.3 Components and assemblies.

3.3.1 Pellet. The pellet shall conform to drawing 13000847.

3.3.2 O-ring Plug, Firing. The O-ring shall conform to drawing 13000746.

3.3.3 Plug, Firing M752A1. The firing plug shall conform to drawing 13000797.

3.3.4 Head. The head shall conform to drawing 9293427.

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- 3.3.5 Head Assembly. The head assembly shall conform to drawing 13012620.
- 3.3.6 Tube. The paper tube shall conform to drawing 9294754.
- 3.3.7 Body. The body shall conform to drawing 9294755.
- 3.3.8 Cap. The cap shall conform to drawing 9294756.
- 3.3.9 Tube, Flash. The flash tube shall conform to drawing 9294758.
- 3.3.10 Pin. The pin shall conform to drawing 9297909.
- 3.3.11 Flash Tube Assembly. The flash tube assembly shall conform to drawing 9294757.
- 3.3.12 Tube Assembly. The tube assembly shall conform to drawing 9294753.
- 3.3.13 Assembly, Body. The body assembly shall conform to drawing 12630551.
- 3.3.14 Cartridge, Ignition, M752A1. The M752A1 ignition cartridge shall conform to drawing 9294752.
- 3.3.15 Primer, Fed 150D. The Fed 150D primer shall conform to drawing 13028855.
- 3.4 Moisture content of black powder. The moisture content of the black powder pellets used in loading the ignition cartridge shall not exceed 0.50 percent at the time of loading.
- 3.5 Primer testing.
- 3.5.1 Non-functioning sensitivity. The primer shall not function under an applied energy value of 8.85 inch ounces minimum (min.) using a 2.95 pound ball.
- 3.5.2 Functioning sensitivity. The primer shall be accepted if the following requirement is satisfied:
- H bar + 3 s times the nominal weight (7.8 lbs) is less than or equal to 70 inch-ounce
H bar – 2 s times the nominal weight (7.8 lbs) is greater than or equal to 16 inch-ounce
- Where:
H bar = the calculated average critical height
s = dispersion of the of the critical height
- 3.5.3 Ignition Cartridge function with primer (safety drop test). The primer shall not function as a result of the 1.5 meter (m) cartridge drop.

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3.6 Incomplete Seal (Leak test). After the primer is loaded and the lacquer cured, each body assembly, as well as each loaded ignition cartridge, shall satisfactorily pass the leak test.

3.7 Velocity, functioning and security (proving ground test). The rounds shall be fired from a M252 81mm mortar, on a hard mount, at an elevation of 45 degrees (800 mils) to minimize ballistic differences in ammunition performance imposed by various soil conditions. at an elevation of 800 mils.

3.7.1 Misfires. The ignition cartridges shall function on the first attempt.

3.7.2 Velocity and functioning (proving ground). The cartridge assemblies shall function and shall impart a corrected mean muzzle velocity as specified in Table I. In addition, the velocity standard deviation of the lot shall be not greater than 0.9 mps.

Table I. Mean velocity Requirements

Cartridge	Cartridge Weight	Velocity (max) (Para 3.7.2)	Velocity (min) (Para 3.7.2)	Uniformity Velocity (Para 3.8)
M819	10.35 ± 0.02 lbs	59.0 mps	57.0 mps	58.0 mps
M853A1/M816	8.9 ± 0.02 lbs	65.0 mps	63.0 mps	64.0 mps

3.7.3 Metal part security. There shall be no evidence of rupture or metal parts separation in the gun bore or in flight.

3.8 Propellant charge uniformity. The M9 propellant lots shall achieve a velocity as specified in Table I. This test shall be required for each M9 propellant lot and when a lapse of two years or more occurs between propellant acceptance and LAP initiation.

3.9 Propellant and assembly weights.

3.9.1 Propellant weight. The propellant weight shall comply with the weight specified in the loading authorization within plus or minus 1.0 grain.

3.9.2 Assembly weight. The weight of the ignition cartridge after assembly of the cap and immediately prior to pack-out will not differ by more than 10 grains from the total amount specified in the loading authorization plus actual weight of the ignition cartridge prior to filling with propellant plus the average weight of the RTV sealant around the cap plus the average or actual weight of the cap.

3.10 Excessive pressure on fin boom (static pressure). The average internal pressure of the ignition cartridges plus three standard deviations shall not exceed 23,000 psi.

3.11 Bursting strength. The tube shall not burst at a compression load of 57 pounds, minimum, but shall burst at a compression load of 192 pounds, maximum.

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3.12 Check for deterioration of ignition cartridge. If the total elapsed time between original acceptance of the ignition cartridge lot and assembly of that lot into the complete round exceeds two years, or if the ignition cartridges were subjected to adverse conditions for any period of time since previous tests, the ignition cartridges shall be subjected to, and must satisfactorily comply with the test as specified in 4.5.10 before the ignition cartridges are assembled into complete rounds.

3.13 Workmanship. All parts and assemblies shall be fabricated and loaded in a thorough workmanlike manner. They shall be free of burrs, sharp edges, cracks, dirt, rust and other foreign matter. The cleaning method used shall not be injurious to any part nor shall parts be contaminated by the cleaning agent. All required markings should be neat and sharply defined.

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4. VERIFICATION

TABLE II. Requirements/verification cross reference matrix

METHOD OF VERIFICATION				CLASSES OF VERIFICATION				
1-Analysis 2-Demonstration 3-Examination 4-Test				A- First Article B- Conformance				
Section Requirement	Description	Verification Method				Verification Class		Section 4 Verification
		1	2	3	4	A	B	
3.1	First Article			X	X	X		4.2
3.2	Corrosion resistance			X		X	X	4.5.9
3.3.1	Pellet			X	X	X	X	4.4.2.1
3.3.2	O-ring Plug, Firing			X		X	X	4.4.2.2
3.3.3	Plug, Firing M752A1			X		X	X	4.4.2.3
3.3.4	Head			X		X	X	4.4.2.4
3.3.5	Head Assembly			X		X	X	4.4.2.5
3.3.6	Tube			X		X	X	4.4.2.6
3.3.7	Body			X		X	X	4.4.2.7
3.3.8	Cap			X		X	X	4.4.2.8
3.3.9	Tube, Flash			X		X	X	4.4.2.9
3.3.10	Pin			X		X	X	4.4.2.10
3.3.11	Flash Tube Assembly			X		X	X	4.4.2.11
3.3.12	Tube Assembly			X		X	X	4.4.2.12
3.3.13	Assembly, Body			X		X	X	4.4.2.13
3.3.14	Cartridge, Ignition Prior to Filling with Propellant			X		X	X	4.4.2.14
3.3.14	Cartridge, Ignition, Prior to Assembly of Cap			X		X	X	4.4.2.15
3.3.14	Cartridge, Ignition, After Assembly of Cap			X		X	X	4.4.2.16
3.3.15	Primer, Fed 150D			X		X	X	4.4.2.17
3.4	Moisture content of black powder			X	X	X	X	4.5.1
3.5	Primer testing			X	X	X	X	4.5.2
3.5.1	Non-functioning Sensitivity			X	X	X	X	4.5.2.1

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TABLE II. Requirements/verification cross reference matrix - Continued

METHOD OF VERIFICATION				CLASSES OF VERIFICATION				
1-Analysis 2-Demonstration 3-Examination 4-Test				A- First Article B- Conformance				
Section Requirement	Description	Verification Method				Verification Class		Section 4 Verification
		1	2	3	4	A	B	
3.5.2	Functioning Sensitivity			X	X	X	X	4.5.2.2
3.5.3	Ignition cartridge function with primer (safety drop test)			X	X	X	X	4.5.2.3
3.6	Incomplete Seal (Leak test)			X	X	X	X	4.5.3
3.7	Velocity, functioning and security (proving ground test)			X	X	X	X	4.5.5
3.7.1	Misfire			X	X	X	X	4.5.5
3.7.2	Velocity and functioning (proving ground)			X	X	X	X	4.5.5
3.7.3	Metal part security			X	X	X	X	4.5.5
3.8	Propellant charge uniformity				X			4.5.6
3.9.1	Propellant Weight			X	X	X	X	4.5.4.1
3.9.2	Assembly Weight			X	X	X	X	4.5.4.2-4.5.4.4
3.10	Excessive pressure on fin boom (Static pressure)			X	X	X	X	4.5.7
3.11	Bursting strength			X	X	X	X	4.5.8
3.12	Check test for deterioration of ignition cartridge			X	X		X	4.5.10
3.13	Workmanship			X	X	X	X	4.4.2.1-4.4.2.17

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.4).

4.2 First article. When specified, a sample shall be subjected to first article verification in accordance with Table III.

4.2.1 First article quantity. First article inspection shall be performed on the quantities listed in Table III.

4.2.2 Verification to be performed. The first article inspection shall be performed in accordance with Table III.

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TABLE III. First Article inspection

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	<u>Pellet (Dwg. 13000847)</u> Examination for defects	25	3.3.1	4.4.2.1
	<u>O-ring Plug, Firing (Dwg. 13000746)</u> Examination for defects	25	3.3.2	4.4.2.2
	<u>Plug, Firing M752A1 (Dwg. 13000797)</u> Examination for defects	25	3.3.3	4.4.2.3
	<u>Head (Dwg. 9293427)</u> Examination for defects	25	3.3.4	4.4.2.4
	<u>Head Assembly (Dwg. 13012620)</u> Examination of defects	25	3.3.5	4.4.2.5
	<u>Tube (Dwg. 9294754)</u> Examination for defects Bursting strength	25 <u>1/</u> 25 <u>1/</u>	3.3.6 3.11	4.4.2.6 4.5.8
	<u>Body (Dwg. 9294755)</u> Examination for defects Salt spray test	25 25	3.3.7 3.2	4.4.2.7 4.5.9
	<u>Cap (Dwg. 9294756)</u> Examination for defects Salt spray test	25 25	3.3.8 3.2	4.4.2.8 4.5.9
	<u>Tube, Flash (Dwg. 9294758)</u> Examination for defects Salt spray test	25 25	3.3.9 3.2	4.4.2.9 4.5.9
	<u>Pin (Dwg. 9297909)</u> Examination for defects	25	3.3.10	4.4.2.10
	<u>Flash Tube Assembly (Dwg. 9294757)</u> Examination for defects	25	3.3.11	4.4.2.11
	<u>Tube Assembly (Dwg. 9294753)</u> Examination for defects	25	3.3.12	4.4.2.12

Notes: 1/ The same samples submitted for examination shall be used for the burst test.

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TABLE III. First Article inspection – Continued

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	<u>Assembly, Body (Dwg. 12630551)</u> Examination for defects	25	3.3.13	4.4.2.13
	<u>Cartridge, Ignition Prior to Filling with Propellant (Dwg. 9294752)</u> Examination for defects	25	3.3.14	4.4.2.14
	Moisture content	10	3.4	4.5.1
	Non-functioning sensitivity	200	3.5.1	4.5.2.1
	Functioning sensitivity	500	3.5.2	4.5.2.2
	Ignition cartridge function with primer	25	3.5.3	4.5.2.3
	<u>Cartridge, Ignition, Prior to Assembly of Cap (Dwg. 9294752)</u> Examination of defects	25	3.3.14	4.4.2.15
	<u>Cartridge, Ignition, After Assembly of Cap (Dwg. 9294752)</u> Examination for defects	25	3.3.14	4.4.2.16
	Incomplete seal (Leak Test)	50	3.6	4.5.3
	Excessive pressure on fin boom	25 <u>2</u> /	3.10	4.5.7
	Proving ground test	50	3.7	4.5.5
	<u>Primer, Fed 150D (Dwg. 13028855)</u> Examination for defects	25	3.3.15	4.4.2.17
NOTES:	<u>2</u> / Static pressure test is required for each propellant lot.			

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4.3 First article rejection. If any assembly, component or test specimen fails to comply with Table III requirements, the first article sample shall be rejected. The first article ballistic test shall be:

- a. Rejected if the mean velocity exceeds the uniformity velocity by ± 3 mps.
- b. Referred if the mean velocity exceeds the uniformity velocity by ± 1 mps to ± 3 mps
- c. Rejected if the velocity standard deviation exceeds the requirement.
- d. Rejected if one or more misfires attributable to the ignition cartridge occur.
- e. Rejected if one or more metal part separations attributable to the ignition cartridge occur.

4.4 Conformance inspection.

4.4.1 Inspection lot formation. Lot formation shall be in accordance with paragraph 4.2.2 of MIL-STD-1916. Lot numbering shall be in accordance with MIL-STD-1168. In addition, each inspection lot of ignition cartridges shall be produced with components complying with the following constraints:

- a. Metal parts from one lot interfix, from one manufacturer.
- b. Black powder pellets from one lot interfix, from one manufacturer.
- c. M9 propellant from not more than one lot number and from one manufacturer.
- d. Fed 150D primers from not more than one lot number and from one manufacturer.
- e. Heat shrinkable tubing from not more than one manufacturer.
- f. Adhesive sealant from not more than one manufacturer.

4.4.2 Classification of characteristics.

a. Sampling requirements. Inspection sampling requirements for critical, major and minor characteristics are defined in MIL-STD-1916. Unless specified otherwise, Inspection Level IV shall be used for all characteristics defined as Majors and Inspection Level II for all Minor characteristics; Critical characteristics shall be addressed in accordance with MIL-STD-1916 (see 6.9).

b. Conformance inspection. Conformance inspection shall be performed in accordance with paragraph 4.4.2.1 through 4.4.2.17. For all conformance inspections the same sample specimen may be used for all non-destructive examinations or tests.

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.1	TITLE Pellet	SHEET 1 OF 1		DRAWING NUMBER 13000847
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	Weight of pellet	VL-IV	3.3.1	Balance
102	Outside diameter	VL-IV	3.3.1	Gage
103	Inside diameter	VL-IV	3.3.1	Gage
104	Length	VL-IV	3.3.1	Gage
105	Pellet chipped or cracked	VL-IV	3.3.1	Visual
<u>Minor</u>				
201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

PARAGRAPH 4.4.2.2	TITLE O-Ring Plug, Firing	SHEET 1 OF 1		DRAWING NUMBER 13000746
				NEXT HIGHER ASSEMBLY 13012620
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	Inner Diameter	VL-IV	3.3.2	Gage
102	Cross-sectional diameter	VL-IV	3.3.2	Gage
103	Composition	1/	3.3.2	Analysis
104	Presence of flash or cracks	VL-IV	3.3.2	Visual
<u>Minor</u>				
201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes: 1/ The supplier (s) shall provide the material certification with each delivered lot.				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.3	TITLE Plug, Firing M752A1	SHEET 1 OF 1		DRAWING NUMBER 13000797
				NEXT HIGHER ASSEMBLY 13012620
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	Length of tip to second largest diameter	VL-IV	3.3.3	Gage
102	Total length including tip	VL-IV	3.3.3	Gage
103	Length of tip	VL-IV	3.3.3	Gage
104	Radius improper	VL-IV	3.3.3	Gage
105	Large diameter	VL-IV	3.3.3	Gage
106	Small diameter	VL-IV	3.3.3	Gage
107	Protective finish missing	VL-IV	3.3.3	Visual
108	Chamfer missing or incorrect	VL-IV	3.3.3	Visual
109	True position of tip with large outside diameter	VL-IV	3.3.3	Gage
110	Shoulder length from the second largest diameter to o-ring diameter	VL-IV	3.3.3	Gage
111	Width of groove for o-ring	VL-IV	3.3.3	Gage
112	Diameter of o-ring groove (smallest diameter)	VL-IV	3.3.3	Gage
<u>Minor</u>				
201	Surface finish improper	VL-II	3.3.3	Visual
202	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.4	TITLE Head	SHEET 1 OF 1		DRAWING NUMBER 9293427
				NEXT HIGHER ASSEMBLY 13012620
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	Pitch diameter of internal threads	VL-IV	3.3.4	Gage
102	Minor diameter of internal threads	VL-IV	3.3.4	Gage
103	Pitch diameter of external threads	VL-IV	3.3.4	Gage
104	Major diameter of external threads	VL-IV	3.3.4	Gage
105	Length of internal thread, min.	VL-IV	3.3.4	Gage
106	Overall length	VL-IV	3.3.4	Gage
107	Length of large internal diameter	VL-IV	3.3.4	Gage
108	Diameter of firing plug hole	VL-IV	3.3.4	Gage
109	Large outside diameter	VL-IV	3.3.4	Gage
110	Small outside diameter	VL-IV	3.3.4	Gage
111	Large inside diameter	VL-IV	3.3.4	Gage
112	True position of large inside diameter with P.D. of external thread	VL-IV	3.3.4	Gage
113	True position of firing plug hole with P.D. of external thread	VL-IV	3.3.4	Gage
114	True position of internal threads with external threads	VL-IV	3.3.4	Gage
115	Length from shoulder to beginning of external threads	VL-IV	3.3.4	Gage
116	Protective finish missing	VL-IV	3.3.4	Visual
<u>Minor</u>				
201	Surface finish improper	VL-II	3.3.4	Visual
202	Diameter of spanner holes	VL-II	3.3.4	Gage
203	Depth of spanner holes	VL-II	3.3.4	Gage
204	Location of spanner holes	VL-II	3.3.4	Gage
205	Distance from front face to shoulder	VL-II	3.3.4	Gage
206	Length of thread undercut	VL-II	3.3.4	Gage
207	Chamfer missing or incorrect	VL-II	3.3.4	Visual
208	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

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PARAGRAPH 4.4.2.5	TITLE Head Assembly	SHEET 1 OF 1		DRAWING NUMBER 13012620
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	O-ring missing or not fully seated	VL-IV <u>2/</u>	3.3.5	Visual
102	O-ring not lubricated	VL-IV <u>2/</u>	3.3.5	Visual
103	Firing plug not fully seated	100% <u>1/</u>	3.3.5	Gage
<u>Minor</u>				
201	Evidence of Poor workmanship	VL-II	3.13	Visual
Notes: <u>1/</u> Firing plug with o-ring must be seated flush to the head with o-ring properly seated in the groove after assembly <u>2/</u> Inspections shall be performed prior to insertion into the head.				

PARAGRAPH 4.4.2.6	TITLE Tube	SHEET 1 OF 1		DRAWING NUMBER 9294754
				NEXT HIGHER ASSEMBLY 9294753
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u>				
101	Thickness	VL-IV	3.3.6	Gage
102	Length	VL-IV	3.3.6	Gage
103	Inside diameter	VL-IV	3.3.6	Gage
104	Tube not spiral wound	5	3.3.6	Visual
105	Burst strength	25	3.11	4.5.8
<u>Minor</u>				
201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.7	TITLE Body	SHEET 1 OF 2		DRAWING NUMBER 9294755
				NEXT HIGHER ASSEMBLY 12630551
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u> 1	Flash hole missing or obstructed	100%	3.3.7	Gage
<u>Major</u> 101	Pitch diameter of threads, min.	VL-IV	3.3.7	Gage
102	Major diameter of threads, min.	VL-IV	3.3.7	Gage
103	Diameter of primer cavity	VL-IV	3.3.7	Gage
104	Depth of primer cavity	VL-IV	3.3.7	Gage
105	Depth of flash tube cavity	VL-IV	3.3.7	Gage
106	Diameter of flash tube cavity	VL-IV	3.3.7	Gage
107	Diameter of flash hole rear of pellet cavity	VL-IV	3.3.7	Gage
108	Large outside diameter	VL-IV	3.3.7	Gage
109	Diameter of pellet cavity	VL-IV	3.3.7	Gage
110	Depth to bottom of pellet cavity	VL-IV	3.3.7	Gage
111	Length overall	VL-IV	3.3.7	Gage
112	True position of primer cavity	VL-IV	3.3.7	Gage
113	Width of groove	VL-IV	3.3.7	Gage
114	Depth of groove	VL-IV	3.3.7	Gage
115	Small outside diameter	VL-IV	3.3.7	Gage
116	Diameter of countersink at base of primer cavity, max.	VL-IV	3.3.7	Gage
117	Length from rear face to large outside diameter	VL-IV	3.3.7	Gage
118	Outside diameter forward and rear of groove	VL-IV	3.3.7	Gage
119	Length from large diameter to end of external thread	VL-IV	3.3.7	Gage
120	Length from large diameter to beginning of thread	VL-IV	3.3.7	Gage
121	Diameter of thread undercut	VL-IV	3.3.7	Gage
122	Length of large diameter section	VL-IV	3.3.7	Gage
123	Length from front face to groove	VL-IV	3.3.7	Gage
124	Protective finish missing or inadequate	VL-IV	3.3.7	Visual
125	True position of forward outside diameter with P.D. of thread	VL-IV	3.3.7	Gage
126	Salt spray test	25	3.2	4.5.9
127	Inside chamfer at entrance of primer cavity incorrect	VL-IV	3.3.7	Gage
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.7	TITLE Body (continued)	SHEET 2 OF 2		DRAWING NUMBER 9294755
				NEXT HIGHER ASSEMBLY 12630551
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Minor</u> 201 202 203	Radii or chamfers missing or incorrect Surface finish improper Evidence of poor workmanship	VL-II VL-II VL-II	3.3.7 3.3.7 3.13	Visual Visual Visual
Notes:				

PARAGRAPH 4.4.2.8	TITLE Cap	SHEET 1 OF 1		DRAWING NUMBER 9294756
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101 102 103 104 105 106 107 108 109 110 111	Forward outside diameter (OD) Total length Rear OD Distance from rear face to shoulder Diameter of cavity Depth of cavity True position of cavity with rear OD Protective finish missing or inadequate True position of forward OD with rear OD Radius at bottom of cavity over maximum Salt Spray Test	VL-IV VL-IV VL-IV VL-IV VL-IV VL-IV VL-IV VL-IV VL-IV VL-IV 25	3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.3.8 3.2	Gage Gage Gage Gage Gage Gage Gage Gage Gage Gage 4.5.9
<u>Minor</u> 201 202 203	Radii or chamfers missing or improper Surface finish improper Evidence of poor workmanship	VL-II VL-II VL-II	3.3.8 3.3.8 3.13	Visual Visual Visual
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.9	TITLE Tube, Flash	SHEET 1 OF 1		DRAWING NUMBER 9294758
				NEXT HIGHER ASSEMBLY 9294757
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>				
1	Longitudinal flash hole missing or obstructed	100%	3.3.9	Gage
2	Flash hole(s) missing or excessive in number or obstructed	100%	3.3.9	Gage-Visual
<u>Major</u>				
101	True position of flash holes to forward outside diameter and rear face	VL-IV	3.3.9	Gage
102	Diameter of flash holes	VL-IV	3.3.9	Gage
103	Overall length	VL-IV	3.3.9	Gage
104	Forward outside diameter	VL-IV	3.3.9	Gage
105	Rear outside diameter	VL-IV	3.3.9	Gage
106	Length of rear outside diameter	VL-IV	3.3.9	Gage
107	Large inside diameter	VL-IV	3.3.9	Gage
108	Length of large inside diameter	VL-IV	3.3.9	Gage
109	Protective finish missing or inadequate	VL-IV	3.3.9	Visual
110	Small inside diameter	VL-IV	3.3.9	Gage
111	Salt spray test	25	3.2	4.5.9
<u>Minor</u>				
201	Surface finish improper	VL-II	3.3.9	Visual
202	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.10	TITLE Pin	SHEET 1 OF 1		DRAWING NUMBER 9297909
				NEXT HIGHER ASSEMBLY 9294757
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
<u>Major</u> 101	Length	VL-IV	3.3.10	Gage
102	Outside Diameter	VL-IV	3.3.10	Gage
<u>Minor</u> 201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.11	TITLE Flash Tube Assembly	SHEET 1 OF 1		DRAWING NUMBER 9294757
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u> 1	Heat shrinkable tubing missing, loose, or does not completely cover all flash holes	100%	3.3.11	Visual
2	Pin missing	100%	3.3.11	Gage
<u>Major</u> 101	Length, max.	VL-IV	3.3.11	Gage
<u>Minor</u> 201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.12	TITLE Tube Assembly	SHEET 1 OF 1		DRAWING NUMBER 9294753
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101	Outside diameter, max.	VL-IV	3.3.12	Gage
102	Length of tube fold-in	VL-IV	3.3.12	Gage
103	Tubing missing, loose, wrinkled, separating or inadequately covering external surface	VL-IV	3.3.12	Visual-Manual
<u>Minor</u> 201	Evidence of poor workmanship	VL-II	3.13	Visual

PARAGRAPH 4.4.2.13	TITLE Assembly, Body	SHEET 1 OF 1		DRAWING NUMBER 12630551
				NEXT HIGHER ASSEMBLY 9294752
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101	Primer missing or inverted	100%	3.3.13	Visual
102	Primer above flush or more than .015 in. below flush	100%	3.3.13	Gage
103	Lacquer seal missing or inadequate	100%	3.3.13	4.5.3.1
104	Presence of any adhesive or sealant on face of primer	100%	3.3.13	Visual
105	Staking process inadequate	1/ 100%	3.3.13	4.4.3.1
106	Primer bulged after staking	2/ 100%	3.3.13	Visual
107	One or more stakes missing or not full	3/ 100%	3.3.13	Visual
<u>Minor</u> 201	Evidence of poor workmanship	VL-II	3.13	Visual

Notes:

1/ See 4.4.3.1 for conformance criteria.

2/ Standards shall be established by the contractor during First Article Testing

3/ Inspect the tool or one body at the start of each day's production and each hour thereafter. A missing or broken tooth shall be cause for rejection of all parts staked since the last successful inspection.

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.14	TITLE Cartridge, Ignition Prior to Filling with Propellant	SHEET 1 OF 1		DRAWING NUMBER 9294752
		NEXT HIGHER ASSEMBLY		
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>				
1	Nonfunctioning sensitivity	200/125 <u>1/</u>	3.5.1	4.5.2.1
2	Ignition cartridge function with primer	25 <u>2/</u>	3.5.3	4.5.2.3
3	Firing plug above flush with head surface	100%	3.3.14	Gage
<u>Major</u>				
101	Body not fully assembled to head	VL-IV	3.3.14	Visual
102	Body and head improperly staked (2 places)	VL-IV	3.3.14	Visual
103	Pellet missing, broken or chipped	100% <u>3/</u>	3.3.14	Visual
104	Presence of adhesive for 360 degrees in body groove prior to assembling to tube assembly	VL-IV	3.3.14	Visual
105	Tube assembly improperly seated on body	VL-IV	3.3.14	Visual
106	Functioning sensitivity	500	3.5.2	4.5.2.2
107	Flash tube assembly missing	100%	3.3.14	Visual
108	Pellet moisture content	25/shift	3.4	4.5.1
<u>Minor</u>				
201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes: <u>1/</u> 200 Samples for First 3 consecutive lots, and 125 samples each additional lot (See 4.5.2.1 for details) <u>2/</u> Ignition Cartridge function with Primer will be conducted using a Safety drop test and will be performed per primer lot <u>3/</u> Standards shall be established by the contractor during first article				

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Conformance inspection by classification of characteristics

PARAGRAPH 4.4.2.15	TITLE Cartridge, Ignition, Prior to Assembly of Cap	SHEET 1 OF 1		DRAWING NUMBER 9294752
		NEXT HIGHER ASSEMBLY		
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u> 1	Flash tube assembly missing Propellant weight greater than 10 grains below lower limit or above upper limit (after loading)	100%	3.3.14	Gage
2		100% <u>1/</u>	3.9.1	4.5.4.1/4.5.4.2
<u>Major</u> 101	Propellant weight 1 to 10 grains below lower limit or above upper limit (after loading)	100% <u>1/</u>	3.9.1	4.5.4.1/4.5.4.2
102	Environmental conditions inadequate	<u>2/</u>	3.3.14	Gage
<u>Minor</u> 201	Foreign matter in propellant	VL-II	3.3.14	Visual
202	Evidence of poor workmanship	VL-II	3.13	Visual

Notes:
1/ Same sample used for both inspections.
2/ Temperature and humidity shall be checked at the beginning and end of each shift. If conditions are not proper at either time, the quantity of product represented by the conditioning shall be rejected.

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PARAGRAPH 4.4.2.16	TITLE Cartridge, Ignition, After Assembly of Cap	SHEET 1 OF 1		DRAWING NUMBER 9294752
		NEXT HIGHER ASSEMBLY		
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>				
1	Propellant Weight	315	3.9.1	4.5.4.3
2	Excessive pressure on fin boom	25 <u>2/</u>	3.10	4.5.7
3	Assembly improper or damaged to the extent that propellant can escape	100%	3.3	Visual-Manual
4	Teardown inspection	4.4.3.2 <u>3/</u>	3.3	4.5.11
5	Gross Weight (Propellant missing)	100% <u>1/</u>	3.9.2	4.5.4.4
<u>Major</u>				
101	Gross Weight (Propellant missing)	100% <u>1/</u>	3.9.2	4.5.4.4
102	Channel not completely filled with RTV sealant	VL-IV	3.3.14	Visual
103	Cap cocked or not completely seated	VL-IV	3.3.14	Visual
104	Distance from shoulder to front of cap, max	VL-IV	3.3.14	Gage
105	True position of outside diameter with major diameter of head thread	VL-IV	3.3.14	Gage
106	Incomplete seal (leak test)	100%	3.6	4.5.3.2
107	Environmental conditions inadequate	<u>4/</u>	3.3.14	Gage
108	Presence of excessive sealant	VL-IV	3.3.14	Visual
109	Pellet missing or broken	100%	3.3	4.5.12/4.5.13
110	Firing plug missing	100%	3.3	4.5.12/4.5.13
111	Primer missing	100%	3.3	4.5.12/4.5.13
112	Pellet missing	100%	3.3	4.5.12/4.5.13
<u>Minor</u>				
201	Marking missing, misleading or unidentifiable	VL-II	3.3.14	Visual
202	Evidence of poor workmanship	VL-II	3.13	Visual
	<u>Proving ground test</u>			
	Initial production	50	3.7.2	4.5.5
	Subsequent production	50/35	3.7.2	

Notes:

1/ 1/ The rejected ignition cartridge shall be disassembled to verify the propellant weight. If the weight of the propellant is within critical tolerance, it will be classified as a Major, if not it will be classified as a Critical.

2/ Excessive Pressure on Fin Boom will be verified using a static pressure test fixture and should be conducted per propellant lot

3/ Category is Critical or Major dependent upon the inspection performed (see 4.5.11)

4/ Temperature and humidity shall be checked at the beginning and end of each shift. If conditions are not proper at either time, the quantity of product represented by the conditioning shall be rejected.

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PARAGRAPH 4.4.2.17	TITLE Primer, FED 150D	SHEET 1 OF 1		DRAWING NUMBER 13028855
				NEXT HIGHER ASSEMBLY 12630551
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101	Height	100%	3.3.15	Gage
<u>Minor</u> 201	Evidence of poor workmanship	VL-II	3.13	Visual
Notes:				

4.4.3 Testing and sampling.

4.4.3.1 Staking process (primer security). Each hour, and on the last units staked before a scheduled staking tool change, five (5) primed bodies shall be inspected before and after staking, using any method that can verify that the primer cups have been pushed down as a result of the staking operation. If none of the primer cups have been pushed down, all units loaded since the last successful inspection shall be rejected. If one or more primer cups have been pushed down by any amount, the process may continue unchanged at the discretion of the contractor.

4.4.3.2 Teardown Inspection. Three (3) complete assembled ignition cartridges shall be randomly selected from each day's production beginning with the first day of production and continuing until three consecutive days have complied with applicable requirements (see 4.5.11). After three consecutive days have met the requirements, one sample shall be randomly selected.

4.4.4 Inspection equipment. The inspection equipment required to perform the inspections specified herein is identified in the "Inspection Method Reference" column of the Classification of Characteristics listings from 4.4.2.1 to 4.4.2.17. Designs which provide variable measurements instead of attributes data are preferred in order to facilitate the use of statistical process control. Inspection equipment used for acceptance of product shall be capable of repeatable measurements, by various experienced inspection/test personnel, to an accuracy of 10% or better of the total tolerance of the characteristic being inspected. See 6.3 herein.

4.4.5 Automatic Inspection Equipment. Automatic test and inspection equipment, when utilized by the Contractor, shall be subjected to periodic verification and calibration check during production. Calibration and verification standards are required and shall initially be supplied by the equipment manufacturer as part of the equipment. Replacement standards will be fabricated and certified using designs and procedures provided by the equipment manufacturer

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and approved by the government. All standards or test samples required for such calibration/verification shall be furnished by the equipment manufacturer as part of the equipment. Procedures for verification shall include, as a minimum: frequency, method of verification and the method of retrieval of items produced between verification/calibration. These procedures shall be included in the operation/calibration procedures as required by the above paragraph. In addition, the equipment shall be subjected to periodic maintenance by the manufacturer or other qualified personnel in accordance with approved maintenance procedures.

4.5 Methods of inspection.

4.5.1 Moisture content of black powder. The procedures used for determining the moisture content of the black powder pellets shall be equivalent to that specified in MIL-P-00223. A sample of 5 each black powder pellets shall be selected prior to and after each production shift along with a sample of 15 black powder pellets selected randomly throughout each production shift. If any sample fails to comply with the requirement cited in paragraph 3.4, all pellets in the production shift represented by this sample shall be rejected. If loading with propellant has begun, ignition cartridges loaded with the non-conforming black powder pellets shall be rejected.

4.5.2 Primer testing.

4.5.2.1 Non-functioning sensitivity.

4.5.2.1.1 Initial production. Beginning with the first lot produced and continuing until three consecutive lots have complied with the acceptance criteria specified, 200 primed head assemblies (consisting of the firing plug Dwg. 13000797, head Dwg. 9293427 and body assembly Dwg. 12630551) shall be randomly selected from each lot for this test. If one or more assemblies fail to comply with the specified requirement, the lot shall be rejected.

4.5.2.1.2 Consecutive production. After three consecutive lots have met the criteria of 4.5.2.1.1, 125 samples shall be tested using the same acceptance criteria. If a lot is rejected, revert to sampling plan per 4.5.2.1.1. The test shall be performed as specified in 4.5.2.1.3.

4.5.2.1.3 Test. The primed head assemblies shall be assembled to a suitable fixture. The firing pin of the test fixture shall be adjusted so that impact will be on the center of the firing plug of the assembly. A 2.95 pound steel ball shall be dropped onto the firing pin from a height of 3/16 inch producing 8.85 inch ounces of energy (min.). The height of drop shall be measured as the height from the top of the firing pin to the bottom of the weight. Any primed head assemblies that functions shall be classified defective. Samples used in this test shall not be returned to the lot.

4.5.2.2 Functioning sensitivity.

4.5.2.2.1 Sampling plan. A random sample of five hundred (500) primed head assemblies (consisting of the firing plug Dwg. 13000797, head Dwg. 9293427 and body assembly Dwg. 12630551) shall be selected from each lot for this test. The test shall be

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performed as specified in 4.5.2.2.2 using the Government's design test equipment or an approved alternate (See 4.4.4).

4.5.2.2.2 Test. The primed head assemblies shall be divided into ten (10) groups of fifty (50) each. When assembled in the Drop Test Fixture (12977160). A 7.8 pound steel weight shall be dropped on to the firing pin starting from a height of 0.2 inches. The height of the drop shall be increased by 0.05 inches after each group of fifty primers is tested until the all fire height is reached. The "fire" and "no fire" events shall be recorded for each group (most lots do not require all ten (10) groups to reach all function height). An H bar and s shall be calculated (See 6.11). The lot shall be rejected if the H bar + 3s and H bar – 2s do not meet the requirements of 3.5.2, or if an all fire height is not reached after all 500 primed head assemblies have been tested.

4.5.2.3 Ignition Cartridge function with Primer (safety drop test).

4.5.2.3.1 Sampling plan. Twenty-five ignition cartridge assemblies (without flash tubes, black powder pellets or propellant) in accordance with Dwg. 9294752 shall be selected for first article testing. This test shall be performed only upon initial use of each primer lot. If one or more of the test samples function, the lot shall be rejected.

4.5.2.3.2 Test. The test assemblies shall be assembled into inert-loaded, standard 81mm cartridges (Weighed to 10.35 ± 0.02 lbs. for M819). Each cartridge shall be dropped twice from a height of 1.5m on a steel surface. For the first drop, the cartridge shall be in the base (fin) down orientation. For the second drop, the cartridge shall be in the nose (fuze) down orientation. The drop height shall be measured from the lowest point of the cartridge orientation to the top of the steel surface. Any test assembly which functions as a result of the drop shall be classed defective. All questionable test assemblies shall be downloaded to verify primer functioning or nonfunctioning. This test shall be performed only upon initial use of each primer lot. All components used for this test shall not be returned to their respective lots.

4.5.3 Leak tests.

4.5.3.1 Body assembly. After the lacquer has cured, each primed body assembly shall be tested for leakage around the primer. The pressure differential and duration of the test shall be as specified for the leak test of the fully assembled ignition cartridge (see 4.5.3.2). Any body assembly which fails the test shall be classified defective and removed from the lot.

4.5.3.2 Ignition cartridge. The ignition cartridges shall be subjected to a pressure of 3 ± 1 psi for duration of five (5) seconds minimum. Any ignition cartridge with a leak rate of 1.5 CC per minute or greater shall be rejected and removed from the lot. The test equipment shall be calibrated at the start of each day's operation and prior to production restarts. A restart results from any break in continuous production whether it is due to equipment stoppage/failure or operator breaks. Both accept and reject standards shall be used during each calibration. If the equipment is found to be out of calibration, the ignition cartridges tested since the last successful calibration shall be retested after adjustment of the equipment. Equipment design shall be submitted for approval (see 4.4.4).

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4.5.4 Weight of propellant.

4.5.4.1 Propellant Weight. Prior to filling the ignition cartridge, the propellant shall be weighted or volumetrically dispensed and then check-weighted on a different scale. If performed manually, the check-weigh will be performed by another operator. Any propellant sample propellant failing to meet the applicable requirements shall be classified defective and removed from the lot.

4.5.4.1.1 Automated method. An automated operation method can be performed using the 100 percent check-weighing operation with automated equipment and mandatory process controls. In such cases, process control plans in accordance with data item description DI-P1604 must be submitted to the technical agency for approval of the automated operations.

4.5.4.2 Ignition Cartridge Assembly Weight (prior to assembling the cap). The actual weight of the ignition cartridge assembly (without the cap) will be recorded (weight #1). The ignition cartridge assembly, immediately after the propellant is loaded and prior to the assembly of the cap, will be weighted and recorded (weight #2). The weight of the propellant shall be determined by subtracting the tare weight of the ignition cartridge assembly (weight #1) from the loaded ignition cartridge assembly weight (weight #2). Any propellant sample propellant failing to meet the applicable requirements shall be classified defective and removed from the lot.

4.5.4.3 Ignition Cartridge Assembly Weight (after assembly of cap). Critical defect: More than 10 grains above assessed maximum weight. Critical defect: More than 10 grains below assessed minimum weight. Major defect: 1 to 10 grains above assessed maximum weight. Major defect: 1 to 10 grains below assessed minimum weight. **315** sample ignition cartridge assemblies shall be randomly selected from each lot for this test. If any sample exceeds the assessed maximum weight by more than 10 grains or if two or more samples exceed the assessed maximum weight by 1 to 10 grains, the lot shall be rejected. If any sample is under the assessed minimum weight by more than 10 grains or if two or more samples are under the assessed minimum weight by 1 to 10 grains, the lot shall be rejected. The propellant shall be removed from each ignition cartridge sample, placed on the pan of a precision or analytic balance and weighed. Alternatively, the ignition cartridge assembly may be weighed and reweighed after removal of the propellant: The weight of the propellant charge shall be determined by subtracting the weight of the empty ignition cartridge from the loaded (gross) weight. The weight of the propellant in each sample shall be determined to the nearest 1 grain.

4.5.4.4 Gross Weight. The intent of this inspection is to verify presence of propellant in the ignition cartridge. The assembled ignition cartridge shall be weighed 100% prior to pack out. The mean gross weight shall be the average weight calculated by the contractor using a consecutive sample of 125 ignition cartridges, selected from a normal production run. The contractor shall submit the data used to calculate the mean gross weight to the responsible technical agency for approval prior to use. The gross weight of each ignition cartridge shall be within the mean ± 1.5 grams. Adjustment of the mean gross weight due to continuous SPC must be approved by the technical agency.

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4.5.5 Velocity, functioning and security (proving ground test). The test shall be performed at a Government Proving Ground. The sample ignition cartridges shall be assembled into 81mm cartridges for which they were manufactured (live or inert loaded) with total cartridge weight as specified in Table I. The complete assembly, less propelling charges, shall be fired from an M252 81mm mortar, on a hard mount, at an elevation of 800 mils. Reference rounds shall be fired without propelling charges for the purpose of velocity correction (if deemed necessary by the testing agency). At least one reference round should be fired for every three test rounds. Individual velocities and individual chamber pressure shall be recorded for both reference and test rounds. Velocity and pressure standard deviations and arithmetic averages shall be calculated and recorded. Temperature of the day and time of firing shall also be recorded. In the event of a misfire, the suspect ignition cartridge shall not be disassembled by the proving ground but shall be forwarded to the responsible technical agency.

4.5.5.1 Ballistic defect classifications. The following defect classification apply to the ballistic testing:

- a. Misfires, Major defect (3.7.1)
- b. Metal part separation, Critical defect (3.7.3)
- c. Mean velocity and standard deviation, Major defect (3.7.2).

4.5.5.2 Initial production. Beginning with the first lot produced and continuing until three consecutive lots have complied with the applicable requirements, a sample of 50 ignition cartridges shall be selected and tested as specified in 4.5.5. The lot shall be:

- a. Rejected if the mean velocity exceeds the uniformity velocity by ± 3 mps
- b. Referred if the mean velocity exceeds the uniformity velocity by ± 1 mps to ± 3 mps
- c. Rejected if the velocity standard deviation exceeds the requirement.
- d. Rejected if one or more misfires attributable to the ignition cartridge occur.
- e. Rejected if one or more metal part separations attributable to the ignition cartridge occur.

4.5.5.3 Subsequent production. After three consecutive lots have met the criteria of 4.5.5.2, a sample of 35 ignition cartridges shall be selected and tested. If a lot is rejected, the contractor shall revert to the sampling plan listed in 4.5.5.2. This test shall be performed as specified in 4.5.5. The lot shall be rejected if:

- a. Rejected if the mean velocity exceeds the uniformity velocity by ± 3 mps
- b. Referred if the mean velocity exceeds the uniformity velocity by ± 1 mps to ± 3 mps

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- c. Rejected if the velocity standard deviation exceeds the requirement.
- d. Rejected if one or more misfires attributable to the ignition cartridge occur.
- e. Rejected if one or more metal part separations attributable to the ignition cartridge occur.

4.5.5.4 Refiring. If for any reason the proving ground concludes that conditions have detrimentally affected the test results, additional ignition cartridges shall be tested.

4.5.6 Propellant charge uniformity. (To be conducted at a U.S. Government Proving Ground). Ten ignition cartridges shall be loaded at charge weight established during the propellant assessment in accordance with MIL-P-60398 with a tolerance of plus or minus (\pm) 0.5 grains. The sample ignition cartridges shall be assembled into 81mm cartridges for which they were manufactured (live or inert loaded) with total cartridge weight as specified in Table I. The rounds shall be conditioned at 70°F (\pm 2.5°F) for 24 hours prior to firing and shall be maintained at this temperature until fired. The rounds shall be fired from a M252 81mm mortar, on a hard mount, at an elevation of 800 mils. Reference rounds shall be fired alternately for velocity correction (if deemed necessary by the testing agency). The corrected velocities of the group shall be compared to the established charge velocity. If the corrected velocity of the test rounds exceeds 2% (two percent) of the expected muzzle velocity, use of the propellant lot shall be referred. Test results shall be forwarded to the technical agency for evaluation (see 6.5).

4.5.7 Excessive pressure on fin boom (Static pressure test).

4.5.7.1 Sampling plan. Twenty-five ignition cartridge assemblies in accordance with Dwg. 9294752 shall be selected for first article testing. This test shall be performed only upon initial use of each propellant lot. The lot shall be rejected if the test results fail to comply with the requirements.

4.5.7.2 Test. The static pressure test will be performed with equipment/fixtures in general conformance to the concept on Figure 1. The ignition cartridges shall be threaded into an M28/M29 Fin and firmly seated. A 1/8-inch hole shall be drilled in the ignition cartridge tube through one flash hole in the fifth row of flash holes in the fin boom, counting from the ignition cartridge end. A pressure transducer, mounted to a collar (see Figure 2), shall be attached to the fin boom and positioned so that the transducer will be directly over the flash hole drilled in the ignition cartridge tube. The collar shall be positioned carefully to prevent restriction of venting from other flash holes in the boom. The assembly shall be set up as shown in Figure 1 and the transducer connected to a recorder. The ignition cartridge shall then be functioned and maximum pressure and pressure/time trace shall be recorded. Equipment design shall be submitted for approval (see 4.4.4).

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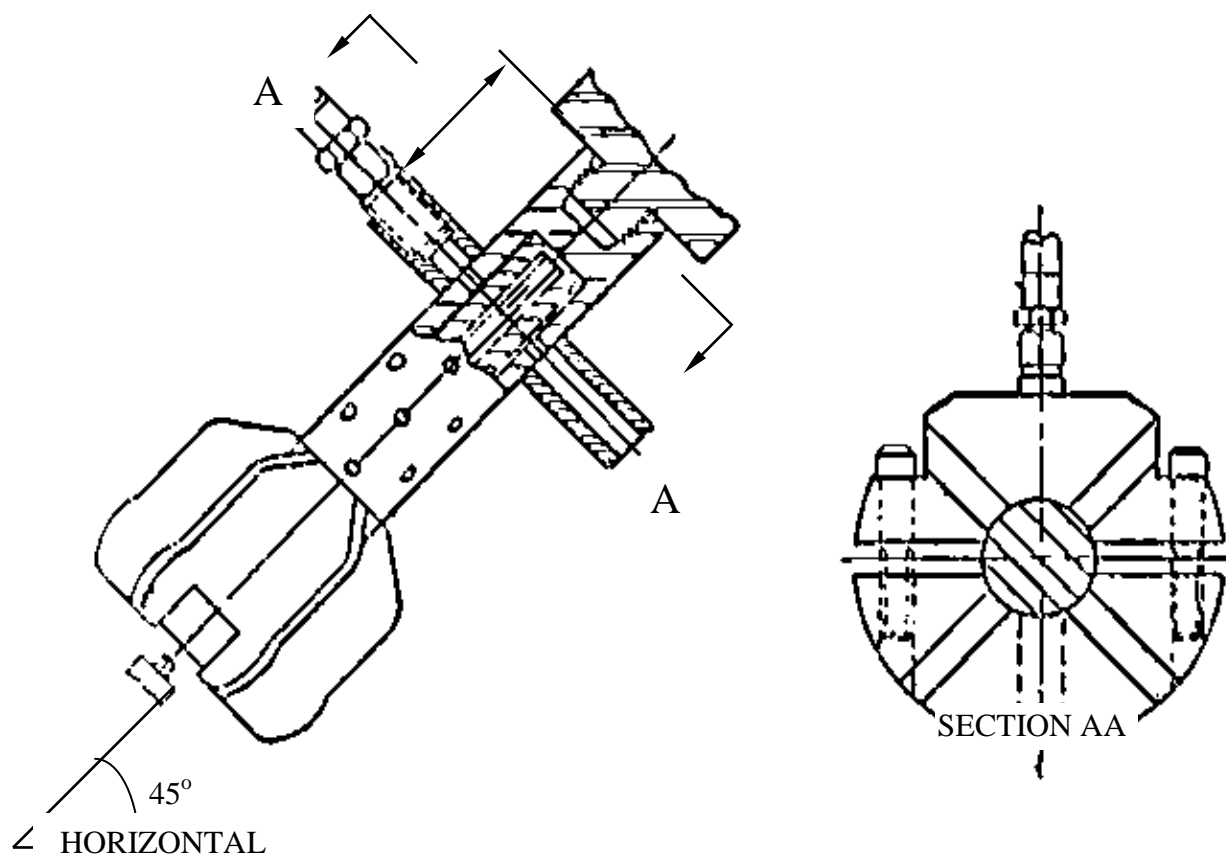


FIGURE 1. The collar used on fin (static pressure test setup)

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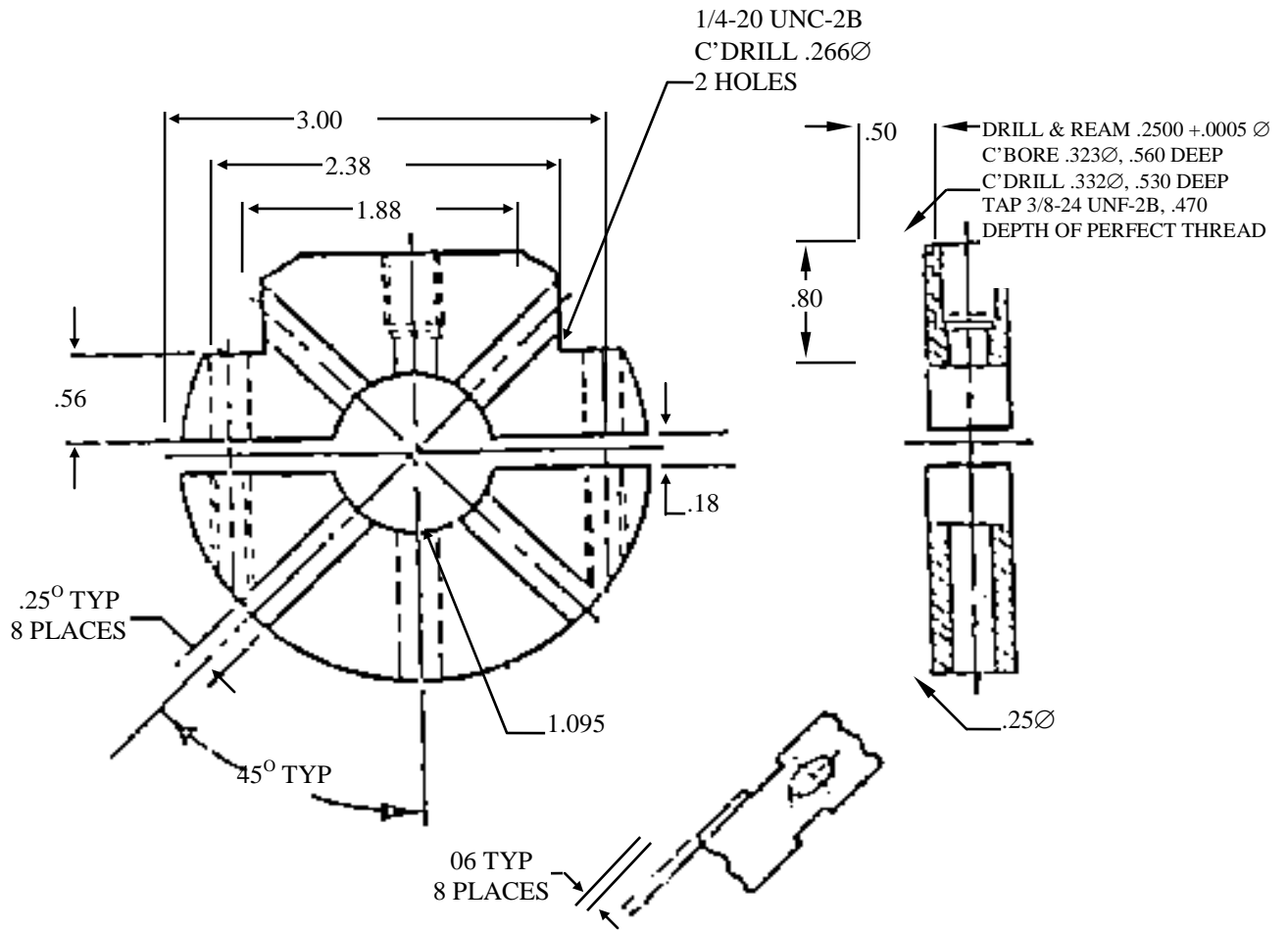


FIGURE 2. Sample dimensions of collar

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4.5.8 Bursting strength. The tube shall be cut in half lengthwise and one of the halves placed in the fixture (see Figure 3-1, 3-2, 3-3). The stop (3) shall be completely removed or backed off so that it does not touch the punch (2). Place fixture in universal tester set for a travel speed of 0.125 inches per minute. Proceed with Test Number 1 and 2.

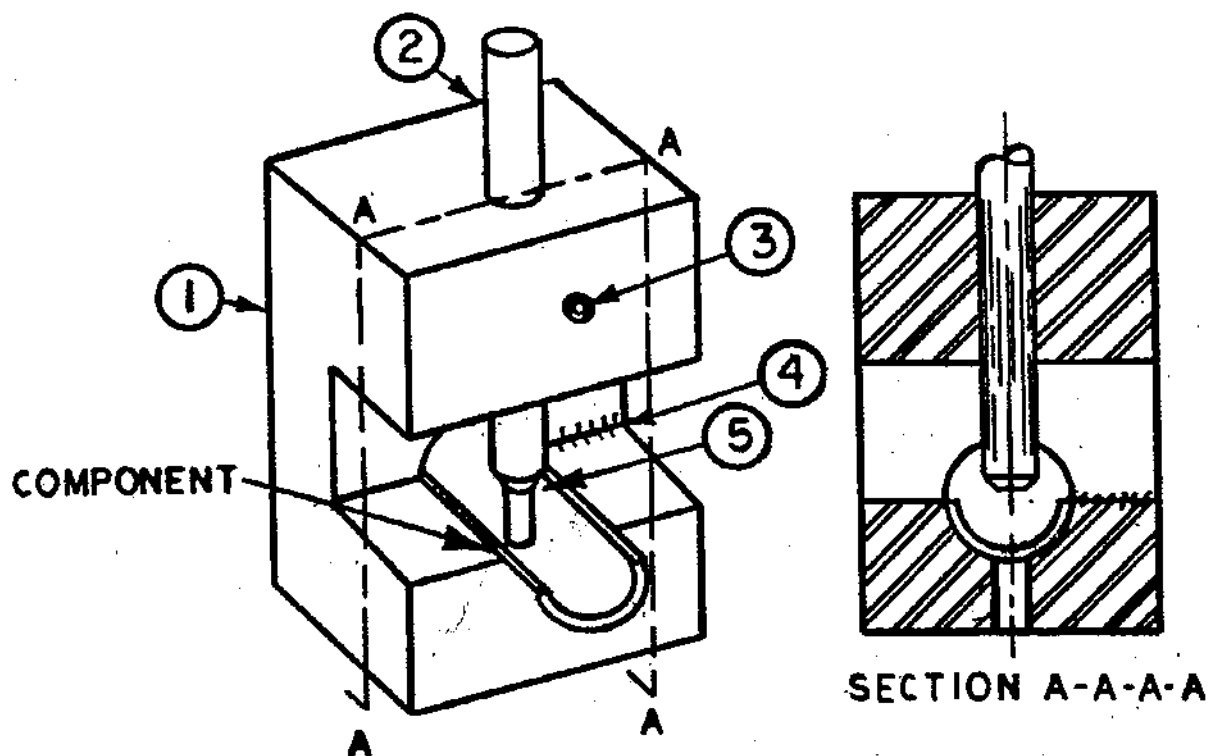
TEST NUMBER 1: NO BURST

Apply 57-pound compression load, remove tube. Item is rejected if evidence of bursting is observed. Tearing or puncturing of material shall be considered evidence of bursting.

TEST NUMBER 2: BURSTING

If item is not rejected, replace it in fixture, using opposite end of tube and apply 192 pounds compression load. If item shows no evidence of bursting (punch travels through material) it shall be rejected.

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ASSEMBLY BUSTING STRENGTH TEST FIXTURE

FIGURE 3-1. Burst strength fixture

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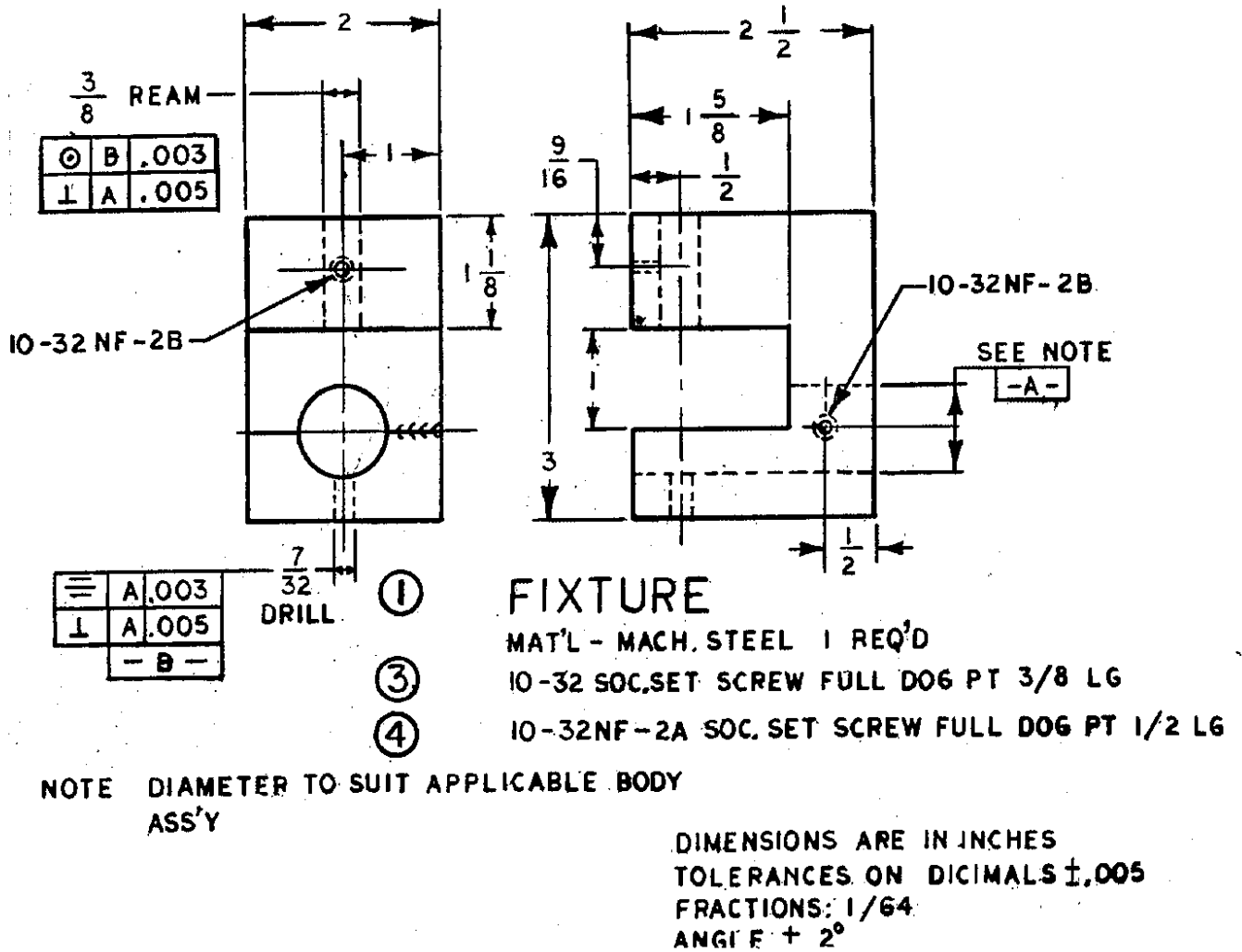


FIGURE 3-2. Sample dimension of test fixture

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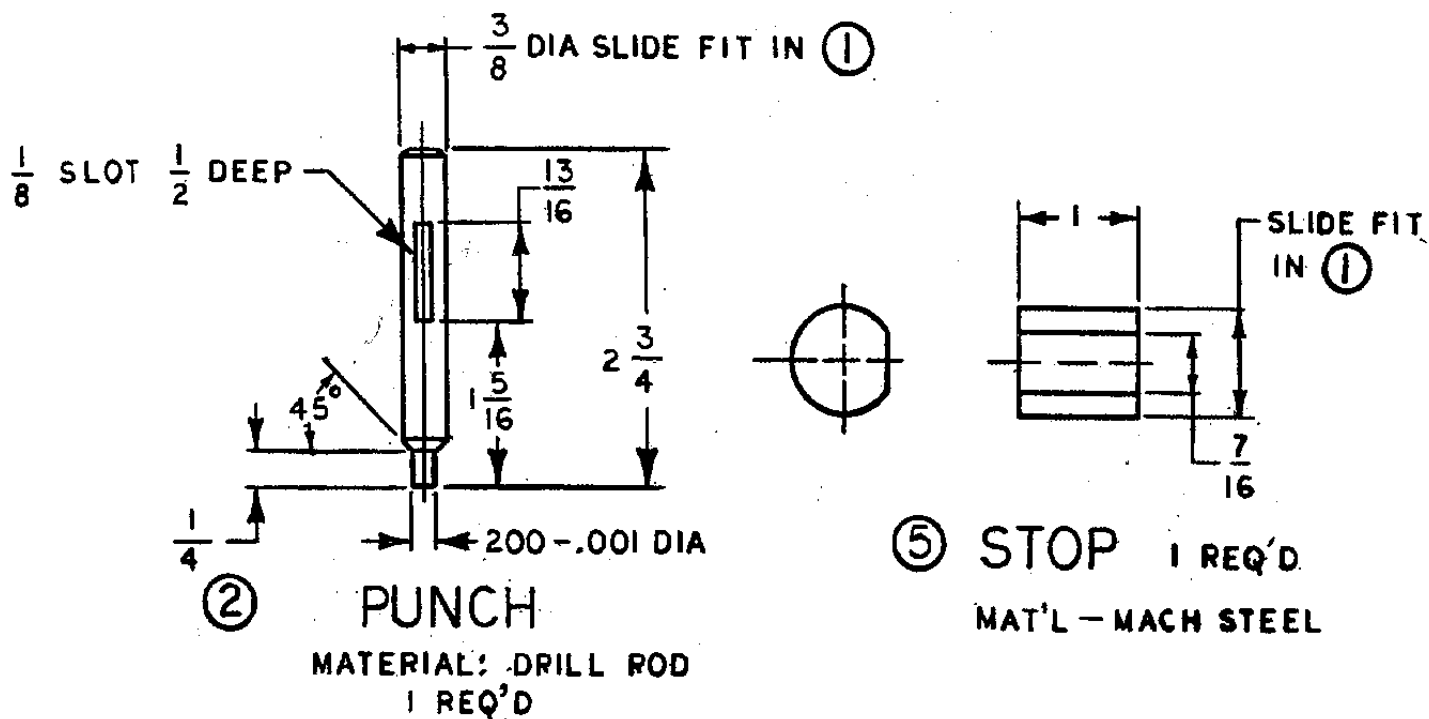


FIGURE 3-3. Sample dimension on punch for test fixture

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4.5.9 Salt spray testing. Samples shall be tested using equipment and procedures in accordance with ASTM B117. Test duration shall be specified on the drawing. Parts shall be rinsed, dried and examined for evidence of pitting or mottling of the finish. One or more pits or mottling shall be cause for rejection of all parts represented by the sample.

4.5.10 Check for deterioration of ignition cartridge. The following test is designed to prevent the loading of major ammunition items with ignition cartridges which have deteriorated. The test shall be performed on each lot of ignition cartridges which have been stored under normal conditions for more than two years or under adverse conditions for any period of time, as determined by the technical agency. A sample of 50 ignition cartridges shall be selected for this test. If the mean velocity or velocity standard deviation exceeds the requirements (Table I), the lot shall be rejected. If any round fails to function for reasons attributable to ignition cartridge failure, or if a metal parts separation occurs, the lot shall be referred. This test shall be performed as specified in 4.5.5.

4.5.11 Teardown inspection. Each ignition cartridge shall be subjected to an inspection of every critical defect and major defect as listed in the Table IV. Samples may be accumulated or inspected upon selection providing the selection remains random and represents the lot. The inspection shall be witnessed by the Government. The detection of any of the specified defects shall be the cause for rejection of that day's production.

Table IV. Teardown Inspection

Paragraph number	Examination or Test
4.4.2.9	Critical – Flash hole(s) missing or excessive in number or obstructed
4.4.2.11	Critical – Heat shrinkable tubing missing, loose or does not completely cover all flash holes Critical – Pin missing
4.4.2.14	Critical – Firing plug above flush with head surface Major – Flash tube assembly missing
4.4.2.15	Critical – Flash tube assembly missing Critical – Propellant weight Major – Propellant weight
4.4.2.16	Critical – Propellant weight Critical – Assembly improper or damaged to the extent that propellant can escape

4.5.12 Automatic Inspection of Ignition Cartridge. Automatic inspection of the ignition cartridge shall be performed 100% in accordance with paragraph 4.5.13 using Government approved equipment to assure that the ignition cartridge does not contain the defects listed in Table V. This inspection must be performed after final assembly of the ignition cartridge. All ignition cartridges classified as defective shall be automatically segregated. (See 6.10)

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Table V. Automatic Inspection

Paragraph number	Examination or Test
4.4.2.16	Major - Pellet broken or chipped Major - Firing Plug Missing Major - Primer Missing Major - Pellet Missing

4.5.13 Automatic Inspection of Ignition Cartridge. The automatic inspection of the ignition cartridge shall be accomplished with an inspection system designed and maintained in accordance with paragraph 4.4.5. A non-destructive means shall be used to verify the defects listed in Table V. The equipment shall automatically accept or reject the ignition cartridge without requiring operator analysis or intervention and mark each accordingly. As a minimum the inspection equipment shall be checked at each inspection station with specially designed accept and reject standards, for each hour of production. If at any time the inspection system is found to be inoperative, the testing device shall be declared inoperative until repair and all assemblies tested since the last satisfactory verification shall be subjected to re-inspection. Designs of the proposed inspection equipment and associated procedures are required and shall be submitted in accordance with paragraph 6.3.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DOD 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 activity within the Military Department or Defense Agency, or within the Military Department's system Command. Packaging data retrieval is available from the managing Military Departments or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The components covered by this product description are intended for assembly to M819, M853A1, and M816 cartridges for use with the 81mm Mortar system.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Provisions for submission of first article sample.

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- c. Test support hardware (see 6.10).
- d. Requirements for Ammunition Lot Number (see 4.4.1)
- f. Requirements for acceptance inspection equipment (AIE) designs (see 6.3).
- g. Certificate of Conformance requirement for each lot of material and each lot or shipment of product.
- h. Requirements for First Article (see 4.2)
- i. Provision for Quality Plan and Critical Nonconformance Control Plan.
- j. Critical Characteristic Clause.

6.3 Submission of contractor inspection equipment designs for approval. Submit copies of designs as required to:

Commander, US Army ARDEC
ATTN: AMSRD-AAR-QEM-C
Building 62, Picatinny Arsenal, NJ 07806-5000

This address will be specified on the Contract Data Requirements List, DD form 1423 in the contract.

6.4 Drawings. Drawings listed in Section 2 of this specification under the heading U.S. Army Armament, Research Development and Engineering Center (ARDEC) may also include drawings prepared by, and identified as ARRADCOM, Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal or Picatinny Arsenal drawings. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.5 Submission of test data. One copy of proving ground ballistic acceptance test data (i.e., firing record) should be forwarded to each of the following:

Commander, U.S. Army ARDEC
ATTN: AMSRD-AAR-QEM-C and AMSRD-AAR-AEE-W
Picatinny Arsenal, NJ 07806-5000

6.6 Submission of alternative conformance provisions. All contractor proposed alternative conformance provisions will be submitted to the Government for evaluation/approval as directed by the contracting activity.

6.7 Burst strength test fixture. Equipment designs for similar paper tubes are available for reference in MIL-C-48161, MIL-C-48155 and MIL-C-48396. For copies contact,

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Commander, U.S. Army ARDEC
ATTN: AMSRD-AAR-QEM-C
Picatinny Arsenal, NJ 07806-5000

6.8 Definitions.

- a. Analysis - The use of analytical methods and mathematical formulas to determine if an item meets a requirement
- b. Demonstration - A functional test (for example, ballistic firing) that provides verification that a requirement is met
- c. Examination - Inspections utilizing gage(s) or visual means to assure conformance to requirement
- d. Test - The conduct of specific procedures and methods to provide data verifying a requirement is met

6.9 Critical Classification Rationale:

Paragraph	Critical Callout(s)	Critical Rationale
4.4.2.7	Flash hole missing or obstructed	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.9	Longitudinal flash hole missing or obstructed	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.9	Flash hole(s) missing or excessive in number or obstructed	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.11	Heat Shrinkable tubing missing, loose, or does not completely cover the flash holes	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.11	Pin missing	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.14	Non-functioning sensitivity	A defect may lead to primer initiation during cartridge handling resulting in death or serious injury to the soldier.
4.4.2.14	Ignition Cartridge function with Primer (Safety drop test)	A defect may lead to primer initiation during cartridge handling resulting in death or serious injury to the soldier.
4.4.2.14	Firing plug above flush with head surface	A defect may lead to primer initiation during cartridge handling resulting in death or serious injury to the soldier.
4.4.2.15	Flash tube assembly missing	Defect may prevent propulsion gases from evenly igniting surrounding propelling charges leading to a short round.
4.4.2.15	Propellant weight greater than 10 grains	A low amount of propellant could produce a critical short round. A high amount of propellant could

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	below lower limit or above upper limit (after loading)	produce high pressure build up in the tube resulting in death or serious injury to the soldier.
4.4.2.16	Propellant weight	A low amount of propellant could produce a critical short round. A high amount of propellant could produce high pressure build up in the tube resulting in death or serious injury to the soldier.
4.4.2.16	Assembly improper or damaged to the extent that propellant can escape	A low amount of propellant could produce a critical short round.
4.4.2.16	Excessive pressure on Fin Boom (Static Pressure test)	High pressure could cause a rupture of the fin boom resulting in death or serious injury to the soldier.
4.4.2.16	Teardown Inspection	A low amount of propellant could produce a critical short round. A high amount of propellant could produce high pressure build up in the tube resulting in death or serious injury to the soldier.
4.4.2.16	Gross Weight (Propellant missing)	A low amount of propellant could produce a critical short round.

Short Round: The cartridge that fails to has a horizontal range less than 80 percent of the average horizontal range (calculated without the short rounds).

6.10 Major Classification Rationale for automated inspection. The use of this inspection system will identify and remove ignition cartridge defects that are known causes of misfires in mortar ammunition. In the past, 100% visual inspections were relied on to detect these defects. Inspection escapes have been encountered in the past (three different suppliers) and costly re-inspection methods were used to remove the defects from the lots. This system will implement a more reliable inspection technique for missing firing plugs, missing primers, missing black powder pellet (s) and broken or chipped black powder pellets. The defects are classified as major but misfires can affect safety under certain conditions. Misfires have been identified as contributing factors in historical double load malfunction investigations. The purpose of implementing this system is to eliminate the obvious causes of misfires and isolate misfire causes to primer sensitivity failures.

6.11 Test support hardware. The following test hardware quantity is required to conduct the safety drop test and ballistic test for each of the First Article and Lot Acceptance Testing.

<u>Hardware</u>	<u>Safety Drop</u>	<u>Static Pressure</u>	<u>Ballistic</u>
Inert M772 fuze	25	-	50
Inert loaded M816/M819/M853A1 body assembly	12	-	50
M28/M29 fin	25	25	50

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6.12 Primer sensitivity calculations.

Example:

Drop weight = 7.8 lbs					
Height of Drop (inch)	Number of Misfires	Dec. Fraction of Misfires	Std Deviation Factor	Std Dev Factor x Dec. Failure Rate	in-oz
0.20	50				24
0.25	47	0.940	1	0.94	30
0.30	42	0.840	3	2.52	36
0.35	26	0.520	5	2.60	42
0.40	5	0.100	7	0.70	48
0.45	0	0.000	9	0.00	54
C	B	A	M	L	
0.025	0.2	0.12000	5.7600	6.76	
		Sum * Increment Step (.05)			
			Inch	Wt of ball (oz)	(in-oz)
		H bar =	0.3450	120	41.400
H bar =	0.3450	H bar + 3s =	0.5950	120	71.400
s =	0.0500	H bar - 2s =	0.2450	120	<u>29.400</u>

Where $H \text{ bar} = A + B + C$

$$s = 0.05 * ((L-M)^{0.5})$$

A = sum of the values under the column "Dec Fraction of Misfires" multiplied by .05

B = drop height at which all primers misfired

C = one-half of the drop height increment

L = the sum of the values under the column "Std Dev Factor x Dec Failure Rate"

M = the square of the sum of the values under the column "Dec Fraction of Misfires"

6.13 Amendment notations. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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6.14 Subject term (key word) listing.

Functioning test
Leak test
Sensitivity
Velocity

Custodian:
Army – AR

Preparing Activity:
Army – AR
(Project 1315-2012-004)

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 the ASSIST Online database at <https://assist.daps.dla.mil>.