

INCH-POUND

MIL-P-60377B (AR)

11 May 1992

SUPERSEDING

MIL-P-60377A (PA)

22 SEPT 1975

MILITARY SPECIFICATION

PROJECTILE, 155MM, HE, M107
LOADING, ASSEMBLING AND PACKING

This Specification is approved for use by the U.S. Army Armament Munitions and Chemical Command, 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 loading, assembling and packing for one type of HE Projectile designated as Projectile, 155MM, HE, M107 (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-A-48078 - Ammunition, Standard Quality Assurance Provisions, General Specification for

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army ARDEC, ATTN: SMCAR-BAC-S, Picatinny Arsenal, New Jersey 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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STANDARDS

MILITARY

- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-453 - Inspection, Radiographic
- MIL-STD-1235 - Single and Multilevel Continuous Sampling Procedures and Tables for Inspection by Attributes

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Standardization Documents Order Desk, Bldg, 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings and publications.
The following other Government documents, drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS (see 6.4)

US ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC)

PRODUCT AND PACKAGING DRAWINGS

- 9362569 - Packing & Marking for Pallet, Wood Ammo for PJCTL 155MM
- 9216352 - Projectile, 155MM, HE, M107 (W/Suppl. Chg.) Loading, Assembly and Marking Diagram
- 12944371 - Liner Assembly
- 12944383 - Liner Pad

(Copies of other Government documents, drawings and Publications required by contractors in connection with specific acquisition functions should be obtained from the Contracting activity or as directed by the Contracting activity.)

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2.2 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 Material. Material and parts shall be in accordance with applicable drawings and specifications.

3.1.1 Clean explosive scrap. Clean explosive scrap produced in regular operations may be remelted and reused provided that it complies with the requirements for the grade of high explosive specified, except for form. Scrap from risers, floor sweepings, ventilation and suction apparatus (other than from drilling operations specifically controlled to prevent contamination of explosive) shall not be used (see 6.12).

3.2 Loaded projectile. The loaded projectile shall comply with all requirements specified on Drawing (dwg) 9216352 and with all requirements specified in applicable specifications.

3.2.1 Liner assembly. The liner assembly and components shall comply with all requirements specified on Drawing (dwg) 12944371 and with all requirements specified in applicable specifications.

3.3 Cavitation in high explosive charge.

3.3.1 Cracks and projected cavities. Cavities having a projected length of 1/32 inch (in.) or less shall be disregarded. Cavities and cracks within the explosive charge shall not exceed the requirements specified in Table I when determined in accordance with 4.5.1.

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TABLE I Cast Defects

	Segments (see Figure 1)			
	A	B	C	D
Sum of projected areas of the cavities, excluding pipes, cracks and annular rings, square inch (sq. in.)	*1/64	1/4	1/2	1/2
Projected length of any cavity, excluding pipes, cracks and annular rings (in.)	1/8	1/2	1/2	3/4
Piping cavities, max. projected area (sq. in.)	0	1/4	1/2	-
Piping cavities, max. projected width (in.)	0	1/4	1/4	-
Cracks, max. projected width (in.)	1/32	1/32	1/16	-
Annular rings, max. projected width (in.)	0	0	1/4	-

* If the length of the largest cavity is 1/16 inch or less, the maximum total projected area may be 1/20 square inch.

Piping cavitation is defined as cavitation located on or near the vertical center line of the projectile with the longitudinal axis (length) three times or greater than the width.

An Annular ring is defined as cavitation that takes the form of a ring or portion thereof around the periphery of the cast.

3.3.2 Surface cavitation. Cavities formed due to chipped or broken explosive from the sidewalls of the fuze well shall not extend in aggregate around more than 1/4 of the circumference. Cavities in the base of the fuze well shall not be cause for rejection provided the sum of the areas of the cavities is not greater than 80 percent of the area of the fuze well base and no individual point extends more than 1/4 inch below the maximum depth of the fuze well permitted by the drawing, and provided no point extends above the flat surface on which the liner would rest. (Cavities having a maximum (max.) dimension of 1/32 inch or less shall be disregarded in this computation as shall voids within the applicable forward region of the fuze well prescribed by dwg. 9216352).

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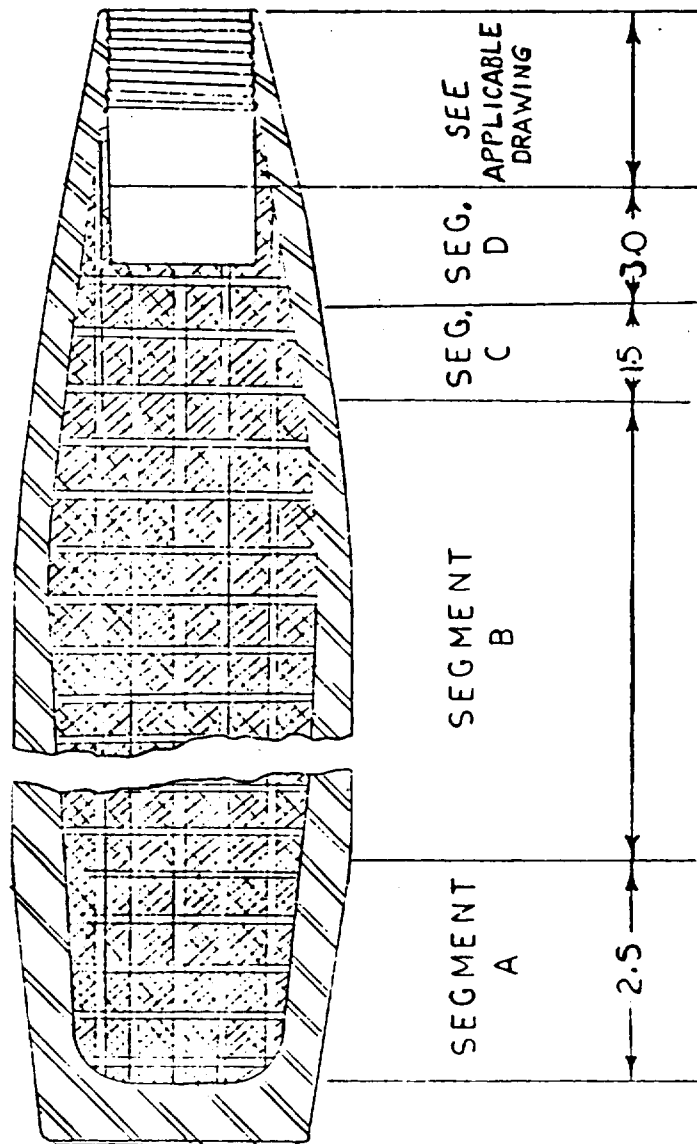


FIGURE I. Projectile, 155MM, M107, HE Charge segments.

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3.3.3 Porous areas. Porous areas shall be treated as cavities and shall be subject to the restrictions placed upon cavities, except that 80 percent of the projected length and 80 percent of the projected area shall be considered for acceptance purposes.

3.3.4 Cracked charges. Not more than one transverse crack shall be permitted in Segment A and not more than a total of two transverse cracks shall be permitted in Segments A, B, and C combined. Cracks shall be disregarded in Segment D.

3.3.5 Base separation. There shall be no base separation in excess of fifteen thousandths (.015) between the base of the shell cavity and the cast when determined in accordance with 4.5.3.

3.3.6 Metal parts defects. There shall be no cracks, pipes or thin wall sections in the projectile.

3.3.7 Foreign material. There shall be no foreign material in the explosive charge.

3.4 Loading of high explosive.

3.4.1 Mating surfaces. The mating surfaces of threads shall be free of caked explosives, and all threads shall be free of foreign material. If a chemical cleaner is required, acetone or methylene chloride shall be used. Care should be taken to prevent the chemical cleaner from coming into contact with the charge and becoming entrapped in the projectile.

3.4.2 Solid explosives. Solid explosives shall not be present in the projectile before loading or be added to the shell during pouring or cooling.

3.4.3 Coating. Projectile having the interior wall imperfectly coated shall not be loaded. The interior surface of the projectile shall be dry when the high explosive is poured into the projectile.

3.4.4 Projectile interior cavity. The interior cavity of the projectile prior to loading shall be free from foreign matter.

3.4.5 Fuze well. The fuze well shall be free from any foreign matter or loose explosive prior to assembly of the liner assembly.

3.4.6 Pool of paint. There shall be no pool of paint or blister in the bottom of the cavity prior to loading of the explosive.

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3.4.7 Exterior surfaces. There shall be no explosive on the exterior surface of the projectile after loading.

3.5 Proving ground. The projectile shall comply with the following requirements when tested as specified in 4.5.2.

3.5.1 Safety. There shall be no premature burst or indication of metal parts separation in the gun bore or in flight when fired at a pressure of 54,000 plus or minus 2000 pounds per square inch (PSI).

3.6 Body cavity. The body cavity shall be free of scale, fins, burrs, draw marks, lamination, imbedded foreign matter, pits and sharp edges in accordance with visual standards (see 6.8).

3.7 First article inspection. This specification contains technical provisions for first article inspection. Requirements for the submission of first article samples by the contractor shall be as specified in the contract.

3.8 Workmanship. The loaded projectile shall be free of chips, dirt, grease, rust and other foreign material and shall be painted as required by the projectile loading drawing. Care shall be exercised at all times so that the rotating band of each projectile will not be damaged by being nicked or burred.

3.8.1 Cleaning. If required the cleaning method shall not be injurious to any of the parts nor shall the parts be contaminated by the cleaning agent.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

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4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 General provisions. Unless otherwise specified herein, the provisions of MIL-A-48078, apply and form a part of this specification. Reference shall be made to MIL-STD-109 to define quality assurance terms used herein.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection.

4.3.1 Submission. The contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with the provisions of 4.3.2. The first article sample shall consist of the assemblies, components and test specimens listed below in the quantities indicated.

<u>Part Description</u>	<u>Drawing</u>	<u>Quantity</u>
Projectile, 155MM, HE, M107 (W/Suppl. Chg.) Loading, Assembly	9216352	20
Liner Assembly	12944371	5
Liner Pad	12944383	5

4.3.2 Inspection to be performed. See MIL-A-48078 and Table II specified herein.

4.3.3 Rejection. See MIL-A-48078.

TABLE II. First article inspection

CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE Projectile, 155MM, HE, M107 (W/Suppl. Chg.) Loading, Assembly and Marking Diagram	SHEET 1 OF 1		DRAWING NUMBER See below
		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	
CLASSIFICATION	EXAMINATION OR TEST			INSPECTION METHOD REFERENCE
	<p><u>Projectile, 155MM, HE, M107</u> (Dwg 9216352)</p> <p>Examination for defects (Except Proving Ground Test) Proving Ground Test (Safety)</p> <p>Components <u>Liner Assembly</u> (Dwg. 12944371) Examination for defects</p> <p><u>Liner Pad</u> (Dwg. 12944383) Examination for defects</p>	<p>5(a), 100%</p> <p>15, 100%</p>	<p>3.1</p> <p>3.5</p>	<p>4.4.2.5 thru 4.4.2.7</p> <p>4.5.2</p>
		<p>5, 100%</p>	<p>3.2.1</p>	<p>4.4.2.4</p>
		<p>5, 100%</p>	<p>3.2.1</p>	<p>4.4.2.3</p>
<p>NOTES: a. Five of the projectile submitted for first article shall be disassembled to allow checking of the examination from 4.4.2.5 through 4.4.2.7. CAUTION: DO NOT REMOVE the threaded liner (since it is swaged in place) while performing examinations of paragraph 4.4.2.5.</p>				

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4.4 Quality conformance inspection

4.4.1 Inspection lot formation. Inspection lots shall conform with the lot formation provisions of MIL-A-48078. In addition, each inspection lot of loaded projectile shall contain:

- a. Projectile metal parts of one lot interfix number from one manufacturer.
- b. Loaded projectile of one weight zone.
- c. Fuze well liner, threaded of one lot interfix number from one manufacturer.
- d. TNT of the same type from one lot interfix number from one manufacturer, or Composition B of the same grade from one lot interfix number from one manufacturer which contains TNT from not more than one lot interfix number from one manufacturer.
- e. Supplementary charge of one lot interfix number from one manufacturer.
- f. Liner, pad of one lot interfix number from one manufacturer.

4.4.2 Examinations and tests.

a. Classification of characteristics. Quality conformance examinations and tests are specified in the following Classification of Characteristics paragraphs. The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable drawing and specification requirements utilizing as a minimum the conformance criteria specified. When cited herein, attributes sampling inspection shall be conducted in accordance with Table III below, using the inspection levels stated in the Classification of Characteristics paragraphs.

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TABLE III. Attributes sampling inspection

<u>Lot Size</u>	<u>Inspection Levels</u>					
	I	II	III	IV	V	VI
2 to 8	*	*	*	*	5	3
9 to 15	*	*	*	13	5	3
16 to 25	*	*	*	13	5	3
26 to 50	*	*	32	13	5	3
51 to 90	*	*	32	13	13	5
91 to 150	*	125	32	13	13	5
151 to 280	*	125	32	32	20	8
281 to 500	*	125	32	32	20	8
501 to 1200	*	125	80	50	20	13
1201 to 3200	1250	125	80	50	32	13
3201 to 10000	1250	125	125	50	32	13
10001 to 35000	1250	315	125	80	50	13
35001 to 150000	1250	315	125	80	50	13
150001 to 500000	1250	500	200	125	50	13
500001 to over	1250	500	200	125	50	13

Numbers under inspection levels indicate sample size; asterisks (*) indicates one hundred percent inspection. If sample size exceeds lot size, perform one hundred percent inspection. Accept on zero and reject on one or more for all inspection levels.

b. Alternative quality conformance provisions. Alternative quality conformance procedures, methods or equipment, such as statistical process control, tool control, other types of sampling procedures, etc. may be used by the contractor when they provide as a minimum the level of quality assurance required by the provisions specified herein. Prior to applying such alternative procedures, methods or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation (see 6.19). When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified quality assurance provision(s) herein. In cases of dispute as to whether the contractor's proposed alternative(s) provides equivalent assurance, the provisions of this specification shall apply. All approved alternative provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable.

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE	EXAMINATION OR TEST	CONFORMANCE CRITERIA	SHEET 1 OF 1	REQUIREMENT PARAGRAPH	DRAWING NUMBER
						9216352
CLASSIFICATION						NEXT HIGHER ASSEMBLY
						INSPECTION METHOD REFERENCE
4.4.2.1	Projectile, 155MM, HE, M107 (W/Suppl. Chg.) LAP (Prior to loading)					
<u>Critical</u>	None defined					
<u>Special</u>	Foreign matter in charge cavity		100%		3.4.4	Visual
a	Pool of paint in bottom of cavity		100%		3.4.6	Visual/Manual
b	Body cavity		100%		3.6	Visual
c						
<u>Major</u>	Interior protective coating with bare spot		Level III		3.4.3	Visual
101						
<u>Minor</u>	Evidence of poor workmanship		Level V		3.8	Visual
201						

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CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH 4.4.2.2	TITLE Projectile, 155MM, HE, M107 (W/Suppl. Chg.) LAP (Prior to assembly of liner Assembly)	SHEET 1 OF 1		DRAWING NUMBER 9216352
		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101 102 103	Depth of fuze well, max Foreign matter or loose explosive in fuze well Adhesive sealant missing or not 360°	Level III Level III Level III	3.2 3.4.5 3.2	Gage Visual Visual
<u>Minor</u> 201 202 203	Diameter of fuze well, max Surface cavitation excessive Evidence of poor workmanship	Level V Level V Level V	3.2 3.3.2 3.8	Gage Visual Visual

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CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE	SHEET 1 OF 1		DRAWING NUMBER 12944383
		EXAMINATION OR TEST	CONFORMANCE CRITERIA	
4.4.2.3	Liner Pad			NEXT HIGHER ASSEMBLY 12944371
				INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Major</u> 101	Thickness	Level III	3.2.1	Gage
<u>Minor</u> 201 202	Diameter Evidence of poor workmanship	Level V Level V	3.2.1 3.8	Gage Visual

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CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH 4.4.2.4	TITLE Liner Assembly (Prior to assembly to projectile)	SHEET 1 OF 1		DRAWING NUMBER 12944371
		EXAMINATION OR TEST	CONFORMANCE CRITERIA	
<u>Critical</u>	None defined			9216352
<u>Major</u> 101	Excessive adhesive on liner pad or liner sidewall	100%	3.2.1	Visual
102	Crack, split, puncture or similar damage extended through liner	Level III	3.2.1	Visual
103	Liner pad missing or not centered on base of liner	Level III	3.2.1	Visual
<u>Minor</u> 201	Damage (not extended through liner) or distortion	Level V	3.2.1	Visual
202	Liner pad loose or adhesive not completely cured	Level V	3.2.1	Visual/Manual
203	Evidence of poor workmanship	Level V	3.8	Visual

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CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH 4.4.2.5	TITLE Projectile, 155MM, HE, M107 (W/Suppl. Chg.) LAP (Prior to assembling of supplementary charge)	SHEET 1 OF 1		DRAWING NUMBER 9216352
		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Special</u> a	Presence of explosive on exterior of shell body, threads and forward face	100%	3.4.7	Visual
<u>Major</u> 101	Torque of liner (witness during application of assembly torque)	Level III	3.2	Visual (witness during assy.) Visual
102	Swage missing or incomplete	100%	3.2	Gage
103	Inside diameter of liner after swaging (at threaded area), min	Level III	3.2	Gage
104	True position of inside diameter of liner with minor diameter of internal thread and forward face	Level III	3.2	Gage
105	Depth to bottom of liner, min	Level III	3.2	Gage
106	Depth to top of liner	100%	3.2	Gage
<u>Minor</u> 201	Liner damaged	Level V	3.2	Visual
202	Foreign matter in threads and liner cavity	Level V	3.2	Visual
203	Evidence of poor workmanship	Level V	3.8	Visual

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CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE Projectile, 155MM, HE, M107 (W/Supp. Chg.) LAP (Prior to assembly of shock attenuating Plug)	SHEET 1 OF 1		DRAWING NUMBER 9216352
		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical</u>	None defined			
<u>Special</u> a	Supplementary charge pad or supplementary charge missing	100%	3.2	Visual
<u>Major</u> 101 102	Supplementary charge inverted Supplementary charge not removable by hand	Level III Level III	3.2 3.2	Visual Manual
<u>Minor</u> 201 202 203 204	Spacer missing or damaged Supplementary charge damaged Silicone compound missing from threads Evidence of poor workmanship	Level V Level V Level V Level V	3.2 3.2 3.2 3.8	Visual Visual Visual Visual
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PARAGRAPH	TITLE	EXAMINATION OR TEST	CONFORMANCE CRITERIA	SHEET	1 OF	2	DRAWING NUMBER	NEXT HIGHER ASSEMBLY	INSPECTION METHOD REFERENCE
4.4.2.7	Projectile, 155MM, HE, M107 (W/Supp. Chg.) Loading Assembly and Marking Diagram		100% 100%				9216352		
<u>Critical</u>	None defined								
<u>Special</u>									
a	Projectile zone weight incorrect		3.2				Balance		
b	Zone stenciling incorrect		3.2				Visual		
<u>Major</u>									
101	Torque test failure of shock attenuating plug		Level III				Test 4.5.4		
102	Diameter of bourrelef max. (if retouched)		100%				Gage		
103	Energy absorbing lifting plug gasket missing		Level III				Visual		
104	Any weight zone punch mark inadequate		Level III				Visual		

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PARAGRAPH	TITLE	SHEET 2 OF 2		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	DRAWING NUMBER
CLASSIFICATION	EXAMINATION OR TEST					NEXT HIGHER ASSEMBLY
4.4.2.7	Projectile, 155MM, HE, M107 (W/Supp. Chg.) Loading Assembly and Marking Diagram					216352
<u>Minor</u> 201	Grommet missing, damaged or improperly assembled	Level V	3.2	Visual		
202	Rotating band damaged (if grommet is missing)	Level V	3.2	Visual		
203	Protective coating with total damaged area in excess of 1/4 square inch.	Level V	3.2	Visual		
204	Marking misleading or unidentifiable (except for zones), including incorrect color code	Level V	3.2	Visual		
205	Evidence of poor workmanship	Level V	3.8	Visual		

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PARAGRAPH	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	SHEET 1 OF 1	DRAWING NUMBER
					9216352
CLASSIFICATION					NEXT HIGHER ASSEMBLY
					INSPECTION METHOD REFERENCE
4.4.2.8	THE Projectile, 155MM, HE, M107 (W/Supp. Chg.) LAP Destructive Lot Acceptance Test				
<u>Critical</u> 1	<u>Government Proving Ground</u> <u>Ballistic test (Safety)</u>	4.4.3.2	3.5		
<u>Major</u>	Components break-up or become disassembled in bore or in flight				4.5.2
<u>Minor</u>	None defined				
	None defined				

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PARAGRAPH	TITLE	SHEET 1 OF 1		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	DRAWING NUMBER
4.4.2.9	Packing & Marking for Pallet, Wood Ammo for PJCTL 155MM					9362569 NEXT HIGHER ASSEMBLY
<u>CLASSIFICATION</u>	<u>EXAMINATION OR TEST</u>					
<u>Critical</u>	None defined					
<u>Major</u>	Pallet damaged or improperly assembled	Level III	3.2	Visual		
102	DOD symbol missing or unidentifiable	Level III	3.2	Visual		
103	Projectile of different weight zones on the same pallet	Level III	3.2	Visual		
104	Strapping missing or loose	Level III	3.2	Visual/Manual		
<u>Minor</u>	Number of projectile assemblies incorrect	Level V	3.2	Visual		
202	Strapping improperly engaged	Level V	3.2	Visual		
203	Marking missing misleading or unidentifiable	Level V	3.2	Visual		
204	Evidence of poor workmanship	Level V	3.8	Visual		

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4.4.3 Testing. Testing is described in the First Article and Quality Conformance Inspection tables and the following:

4.4.3.1 Cavitation (see 3.3, except 3.3.2). Cavitation defects, Metal parts defects and foreign material defects are as follows:

Critical:

1. Cavitation, (including porous areas), cracks, or annular rings in Segment A, B, C, or D in excess of that permitted in Table I.
2. Cracks in excess of that permitted in 3.3.4.
3. Base separation in excess of that permitted by 3.3.5.
4. Metal parts defects in excess of that permitted by 3.3.6 (see Section 6.11).
5. Foreign material in excess of that permitted by 3.3.7.

The sampling plan and procedures for this test shall be in accordance with MIL-STD-1235, using a CSP-1 plan having an AQL of .010 percent. The appropriate production interval shall be as specified by the procuring activity. Any projectile having cavitation in excess of that permitted by the applicable requirement for any segment shall be classified defective. The test shall be performed as specified in 4.5.1, using equipment in accordance with 4.4.4.

4.4.3.1.1 Base separation. (See 3.3.5) - Critical Defect-Eight (8) projectiles with base separations as determined by X-ray will be selected for test per post cycle heat treatment lot. If insufficient samples are available with base separation a sufficient number of samples shall be randomly selected from that portion of the lot that was not X-rayed to make up the required samples. The samples shall be placed in the coldest area of room. Any projectile having base separation in excess of that permitted by the applicable requirement shall be classed defective and the post cycle treatment lot represented by that sample shall be rejected. The test shall be performed as specified in 4.5.3 using equipment in accordance with 4.4.4.

4.4.3.1.2 Metal parts defects. (Critical defect). All radiographs of projectile loading assemblies shall be examined for evidence of cracks, pipes and thin wall sections in the projectile body. The presence of any such indication in excess of that permitted by the applicable requirement shall be classed defective and the lot represented by that sample shall be rejected (see 6.11).

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4.4.3.1.3 Foreign material (Critical defect). All radiographs of projectile loading assemblies shall be examined for foreign material in the explosive charge. The presence of any foreign material in excess of that permitted by the applicable requirement shall be classed defective and the lot represented by that sample shall be rejected.

4.4.3.2 Proving ground functional tests. The following proving ground tests will be performed by the Government:

4.4.3.2.1 Safety (see 3.5.1) - Critical defect

4.4.3.2.1.1 First article and initial production lot samples. Beginning with the first article produced and continuing until three consecutive production lots have complied with the applicable specified requirements, 15 projectiles shall be randomly selected from each lot for this test. If any projectile fails to comply with the applicable requirements, the lot shall be rejected.

4.4.3.2.1.2 Production lot samples. After three consecutive initial production lots have met the criteria of 4.4.3.2.1.1, 5 projectiles shall be randomly selected from each lot for this test. If any projectile fails to comply with the applicable requirements, the lot shall be rejected.

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 listing starting with paragraph 4.4.2.1. Contractor inspection equipment designs shall be submitted for Government approval as specified in the contract. See section 6 of MIL-A-48078 and 6.3 herein.

4.5 Methods of inspection.

4.5.1 Determination of cavities. The sample projectiles shall be subjected to radiographic examination. The radiographic beam shall be located in a plane which is perpendicular to the longitudinal axis of the projectile and tangent to the base of its internal cavity. The outline of the explosive charge shall be clearly defined at all points. Examination of the radiograph shall be made to determine compliance with applicable requirements. No images of lead masks, containers, fixtures, identifying marks, or other extraneous features should project into the region of explosive under inspection, with the exception of specified penetrameters and radiation screening required to

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reduce film densities to readable levels in the thinner areas of the shell. Such screening should be free of any radiographically observable features in the projected area under inspection. Radiographic equipment, operations and procedures shall be qualified in accordance with MIL-STD-453 (see 6.15). In addition the sensitivity of the radiographic technique shall be 2.0 percent and the minimum photographic density of the film used shall be no less than 1.25 at every point within the projected area of explosive, including the base and rotating band area, with the maximum density no greater than to permit adequate inspection over the entire area of interest, as determined in accordance with 4.5.1.1 and 4.5.1.2. In the event an original radiograph leaves doubt as to its acceptability, the projectile shall be reradiographed 90 degrees from the original exposure. Acceptability shall be determined on the basis of the film giving the largest projected area of defect.

4.5.1.1 Check of sensitivity of radiographic technique. The sensitivity of radiographic technique shall be determined by means of penetrameters fabricated as specified herein. The penetrameters shall be placed on the radiographic source side of the projectile so that the 2T holes are at the points shown in Figure 2. Three penetrameters for each projectile shall be used. When radiographing a number of similar projectile and frequency of sensitivity check shall be no less than one in each fifty radiographs and on a rotating ring, the penetrameters shall be used at one station for each complete rotation of the ring. The sensitivity of the radiographic technique shall be considered satisfactory when the image of the penetrameters, including the 2T holes, are sharply defined on the radiograph.

The penetrameters shall be made of steel having an approximate specific gravity of 7.8. The penetrameters shall be located as shown on Figure 2. For further details on construction of the penetrometer see MIL-STD-453.

4.5.1.2 Check of photographic density of film. The photographic density of the film shall be determined on the film in the region of minimum film density within the projected area of the explosive charge. Film density shall be checked each hour of operation or fraction thereof, for each film processor. Greater frequency shall be required for any period during which difficulty is encountered in establishing the required densities. To judge densities it is recommended that standards be used (6.14). Comparison of the film with standards may be made visually, however, the use of a densitometer is recommended.

4.5.1.3 Radiographic film. Only film type and vendor as listed herein are approved for use in radiographing the projectile. A substitute item shall not be used before prior testing and approval by the technical agency (see 6.16).

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PROJECTILE 155MM, HE, M107
RADIOGRAPHIC PENETRATOR REQUIREMENTS

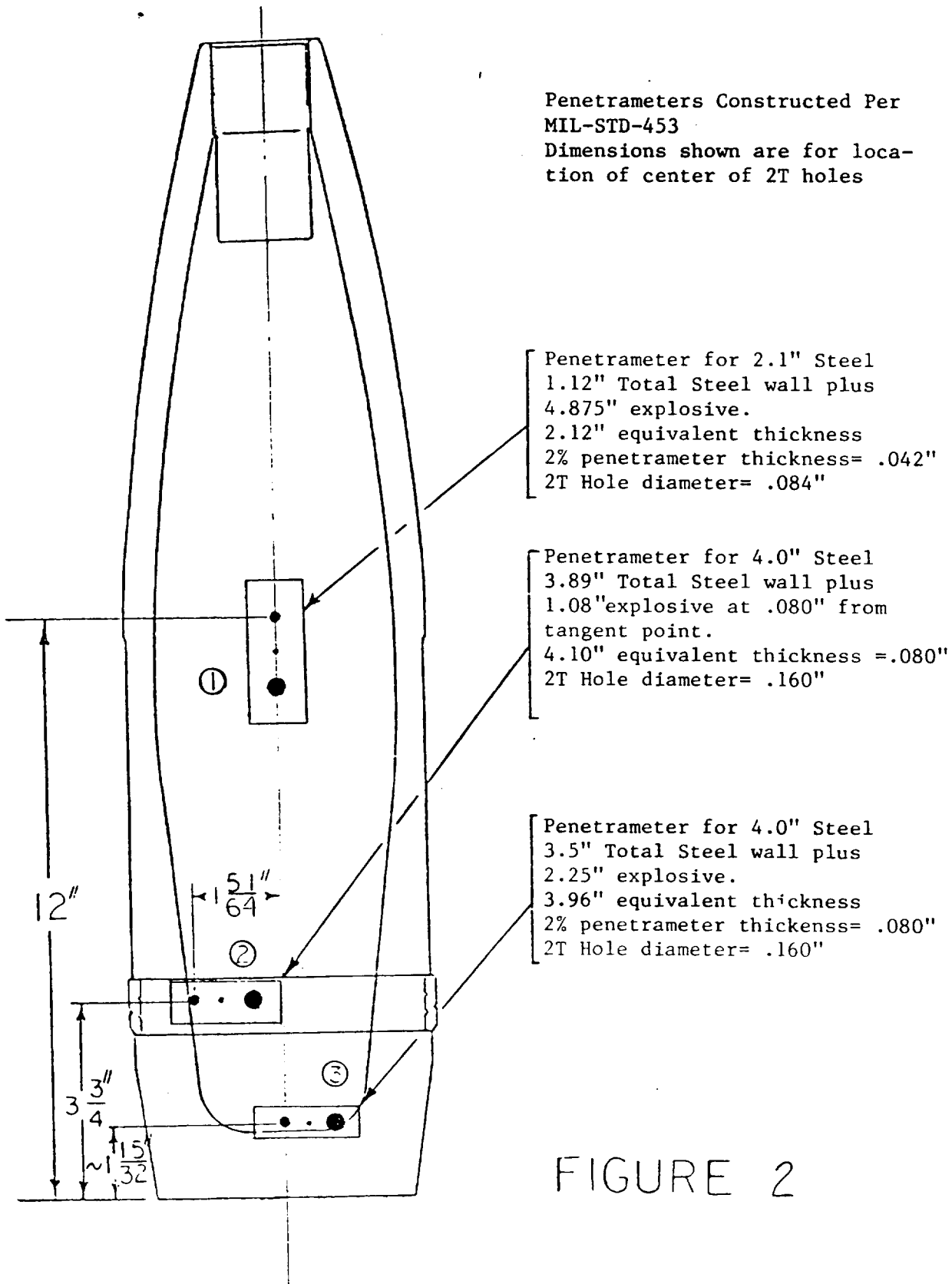


FIGURE 2

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4.5.2 Proving ground test. The following test shall be conducted at a Government proving ground.

4.5.2.1 Safety. The sample projectile shall be assembled with dummy or inert loaded fuzes and be fired in the M126 Series cannon with 50% minimum tube life remaining. The propellant charge XM119E4 shall be adjusted to meet 54,000 psi plus or minus 2,000 psi. Camera coverage shall be provided to observe the projectiles in flight in order to record any malfunctions until 3 consecutive lots (see 4.4.3.2.1.1) have met the applicable requirements. Muzzle velocity and chamber pressures shall be recorded for information.

4.5.3 Determination of base separation. After heat treatment the samples from each post cycle heat treatment lot shall be cooled to ambient temperature. The projectiles shall be conditioned for a minimum of eight (8) hours at $75 \pm 10^{\circ}\text{F}$ and sectioned at $75 \pm 10^{\circ}\text{F}$. A notch shall be cut from the base in the following manner: Cut parallel to the base approximately two (2) inches up from the base to the center of the projectile axis. Next cut through the base toward the nose perpendicular to aforementioned cut so as to remove a wedge of steel to expose explosive and metal parts interface. Gap measurement shall be made with one half (.5) inch wide feeler gage. Base separation shall be measured with the projectile in the nose down orientation.

4.5.4 Torque tests. These tests shall be performed on the sample selected in accordance with 4.4.2.7. A thin line shall be drawn across the joint in question to aid in observing movement. The minimum and maximum disassembly torques for the shock attenuating plug shall be applied in the disassembly direction.

5. PACKAGING

5.1 Packing. Level A. The projectile shall be packed in accordance with dwg. 9362569.

5.2. Marking. Marking shall be in accordance with dwg. 9362569.

6. NOTES

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

6.1 Intended use. The item covered by this specification is intended for use on the 155MM, Howitzer.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.2).
- c. Requirements for submission of first article sample.
- d. Applicable stock number.

6.3 Submission of inspection procedures and equipment designs for approval. Submit copies of designs as required to: Commander, US Army ARDEC, ATTN: SMCAR-QAR-I, 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 US Army Armament Research, Development and Engineering Center (ARDEC) may also include drawings prepared by and identified as Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal, Picatinny Arsenal, US Army Research and Development Command (ARRADCOM) or US Army Armament Research and Development Center (ARDC) drawings. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

6.6 Submission of test data and ammunition data cards. In addition to the normal distribution of records, when the projectile is procured by the US Army Armament Munitions and Chemical Command, one copy of all ballistic test data and ammunition data cards shall be forwarded to each of the following: Commander, ARDEC, ATTN: SMCAR-FSA-MS and SMCAR-QAR-Q, Picatinny Arsenal, NJ 07806-5000, and Commander, ARRCOM, ATTN: AMSMC-QAD, Rock Island, IL 61299-6000.

6.7 Visual examination qualification. When compliance with the applicable requirements is in doubt as a result of visual examination, the characteristics may be measured or gaged to determine acceptability.

6.8 Visual standards. Visual standards consistent with those used for metal parts acceptance shall be established at or provided to the contractor's plant in compliance with 3.6.

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6.9 Alternative testing procedures. Alternative testing procedures may be used by the contractor when such testing and procedures provide as a minimum the quality assurance provisions specified herein. Prior to applying alternative procedures, the contractor shall describe them in a written proposal and shall demonstrate for the approval of the responsible technical agency that their effectiveness is equal to, or better than, the quality assurance provisions specified herein.

6.10 Inspection lot size. It is noted that the size of inspection lots of components, assemblies or items of delivery may differ from the actual quantities contractually scheduled for delivery. However, in order to facilitate scheduling of tests or deliveries, inspection lots of items of delivery may be equivalent to such contract quantities provided all of the lot formation criteria and sampling provisions of this specification are maintained.

6.11 Metal parts defects. The procuring activity will be notified of any projectile rejected for metal parts defects found upon inspection of the radiographs. The rejected projectile will be held pending disposition by the procuring activity.

6.12 Clean explosive scrap. Clean explosive scrap is defined as scrap formed in kettles, pails and loading machines used in the pouring and cooling operations, and scrap formed during the drilling operation.

6.13 Processing aid material for high explosive charge. Only qualified process aid materials are permitted with Composition B, MIL-C-401. Before adding materials, the Comp B temperature shall be above 194 degrees Fahrenheit to provide satisfactory emulsion. The following materials have been found acceptable as wax dispersants when added to molten Comp B:

Lecithin, MIL-L-3061, in quantity of 0.10% - 0.02% by weight added.

Pegosperse 400 DS in quantity of 0.08% - 0.02% by weight added.

6.14 Photographic densities. "American Standard for Diffuse Transmission Density" published by American Standards Association, 70 East 40th Street, New York has been found satisfactory as a source of information of filter densities.

6.15 Radiographic procedures. Radiographic procedures, standards and sample radiographs shall be submitted to: Commander, AMCCOM, ATTN: SMCAR-QAR-Q, Picatinny Arsenal, New Jersey 07806-5000 for review and approval.

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6.16 Radiographic film. List of approved radiographic film vendors are as follows:

Eastman Kodak Company
1187 Ridge Road, West Rochester
New York 14650

Film Types: AA, M, or T

E. I. Dupont deNemours and Company
Photo Products Department
Wilmington, Delaware 19898

Film Types: NDT-55, NDT-65 or NDT-70

6.17 Qualification of post cyclic heat ovens. Before the post cyclic heat ovens are released for use in Loading Projectile, 155MM, HE, M107 the following minimum test shall be run. Segregate by X-ray examination at least twenty-four (24) projectiles with indications of base separation (base separation is defined as air space between the shell metal part and the base of the HE fill). Holding six (6) samples as control rounds, heat cycle the remaining eighteen (18) by placing them through the normal cycle as it would be conducted during production taking care that the sample projectiles are located at the point in the ovens farthest from the incoming heating ducts. A schematic of the oven temperature distributions representing projectile exposure shall be submitted and the areas in which the control samples are placed shall be delineated. Approval of this facility is applicable to no more than the number of projectiles utilized in this qualification plus five percent. All projectiles should be inspected for base separation in accordance with 4.5.3. Record results being careful to clearly identify the control and test rounds. Forward results to Commander, US Army Armament, Munitions and Chemical Command, ATTN: SMCAR-QAR-Q, Picatinny Arsenal, NJ 07806-5000.

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6.18 Subject term (key word) listing.

Loading of High Explosives
Processing aid material for HE charge
Base separation
Radiographic inspection
Threaded Liner

6.19 Submission of alternative quality conformance provisions. Unless otherwise specified in the contract, proposed alternative quality conformance provisions will be submitted by the contractor for evaluation by the technical activity responsible for the preparation of this specification.

Custodian
Army-AR

Preparing activity:
Army-AR

(Project 1320-AC61)