

INCH - POUND

MIL-DTL-9926071 (AF)
CAGE Code: 18894
25 September 2003

**DETAIL SPECIFICATION
FOR THE
105MM PGU-44/B HE CARTRIDGE**

Prepared for:
OO-ALC/WM
Hill AFB, UT 84056

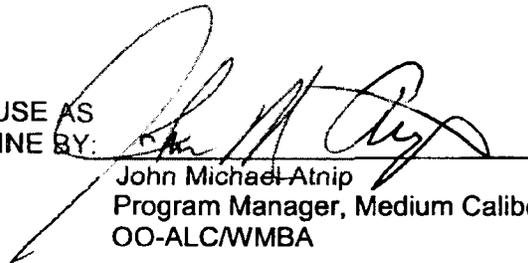
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AMSC N/A

FSC: 1315

1. SCOPE

1.1 Scope. This specification covers the requirements, examinations and tests for the loading, assembling and packing for the 105mm, High Explosive (HE) Cartridge, PGU-44/B (See 6.1 for cartridge description). Note that this cartridge may be built with either Refurb Projectile Assembly – 18894-20039982 which is a refurbished Army M1 Projectile previously filled with approximately 4.6 pounds of Comp B and having a deep fuze well with a 0.3 pound TNT supplemental charge, or a New Projectile Assembly – 18894-20039981 which is a new M1-type Body Assembly – 18894-20039985 filled approximately 5 pounds of Comp B and having a shallow fuze well with no supplementary charge.

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 specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to assure the completeness of this list, document users are cautioned that they must meet all requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government Documents.

2.2.1 Specifications, Standards and Handbooks. The following 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 supplemented thereto, cited in the solicitation.

SPECIFICATIONS

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

DTL8838129 - Primer Percussion M28A2 Assembly

STANDARDS

DEPARTMENT OF DEFENSE

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

MIL-STD-1916 - DOD Preferred Methods For Acceptance Of Product

(Unless otherwise indicated, copies of the above specifications, standards and handbooks are available 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 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

USAF AIR ARMAMMENT CENTER (AAC)

PRODUCT DRAWINGS

18894-9926071 - Cartridge, 105mm, HE, PGU-44/B

18894-20039964 - CYU-1/B Cartridge Case

18894-20039981 - Projectile 105mm, HE, New Loading Assembly

18894-20039982 - Refurb Projectile Assembly for 105mm PGU-44/B Ctg

18894-20039985 - New HE Body Assembly

18894-9483250 - Fuze, Point Detonating / Delay, FMU-153/B

PACKAGING DRAWINGS

18894-9926074 - Air Force Packing Marking for PA-71/A Container

18894-20039983 - Box Packing and Marking for USAF 105mm Ammunition

USAF OGDEN AIR LOGISTICS CENTER (OO-ALC)

PRODUCT DRAWING

98747-9825005 – Container Assy - PA-71/A, Modification of

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

PRODUCT DRAWINGS

19203-8838129 - M28A2 Percussion Primer Assembly

19200-9205472 - M67 Propelling Charge

19203-8797092 - Liner, Fuze Cavity

19203-8797090 - Supplementary Charge Assembly

19203-9278402 - Box, Pallet type, Wirebound

INSPECTION EQUIPMENT

19200 -7258482 - Profile and Alignment Gage

(Copies of specifications, standards, drawings and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the **Air Force Program Office (AFPO)**, OO-ALC/WM, 6033 Elm Lane, Hill AFB, UT 84056-5819)

2.3 Non-Government publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted, are those listed in the DoDISS cited on the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

E1742 - Standard Practice for Radiographic Examination

(Application for copies for ASTM publications should be addressed to the American Society for Testing and materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of Precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained

3. REQUIREMENTS. Requirements listed in this section shall be verified as stated in section 4 (see Table 1).

3.1 Components and Assemblies. The components and assemblies shall comply with all requirements specified on Drawing 18894-9926071, all associated drawings, and requirements specified in applicable specifications.

3.2 Acceptance Testing. Unless otherwise specified in the contract, First Article Acceptance Test (FAAT) is required of new vendors or when a break in production exceeding one year occurs. A Lot Acceptance Test (LAT) is required for each production lot unless otherwise specified. The contractor is responsible for the performance of all inspections and tests associated with FAAT & LAT. Gun testing may be performed at either a Government proving ground or a contractor owned proving ground approved by the Air Force Program Office. The Government reserves the right to perform any of the inspections set forth in this specification. A technical representative from the AFPO shall be invited to witness all acceptance tests.

3.2.1 FAAT. A first article sample of ten (10) PGU-44/B Cartridges and ten (10) PA-71/A Fiber Ammo Containers shall be produced and subjected to inspection in accordance with 4.2.1. Additionally, when specified in the contract FAAT will include a gun test of twenty-five (25) cartridges in accordance with the technical provisions herein. See Table 2. Any production started before all portions of the First Article Acceptance Test (FAAT) are satisfactorily completed is at the contractor's risk.

METHOD OF VERIFICATION						CLASSES OF VERIFICATION			
N/A – Not Applicable 1 - Analysis 2 - Demonstration 3 - Examination 4 - Test						A - Design Verification B - First Article Acceptance Test C - Lot Acceptance Test			
SECTION 3 REQUIREMENTS	METHOD					CLASS			SECTION 4 VERIFICATION
	N/A	1	2	3	4	A	B	C	
3.1		X	X	X	X	X	X	X	4.1
3.2	X								N/A
3.2.1		X	X	X	X	X	X		4.2.1
3.2.2		X	X	X	X	X		X	4.2.2
3.2.3					X		X	X	4.2.3
3.2.3.1					X		X	X	4.2.3.1
3.2.3.2					X		X	X	4.2.3.2
3.3		X	X	X	X	X	X	X	4.3
3.4				X	X	X	X	X	4.4
3.4.1				X		X			4.4.1
3.5				X		X	X	X	4.5
3.6		X				X			4.6
3.7		X				X			4.7
3.8						X	X	X	4.8
3.9	X								N/A
3.9.1					X	X	X	X	4.9.1
3.9.2					X	X	X	X	4.9.2
3.9.3					X	X	X	X	4.9.3
3.9.4					X	X	X	X	4.9.4
3.9.5					X	X	X	X	4.9.5
3.10	X								N/A
3.10.1				X		X			4.10.1
3.10.2				X		X			4.10.2
3.10.3				X		X			4.10.3
3.11					X	X			4.11
3.12					X	X	X	X	4.12
3.13					X	X	X	X	4.13
3.14				X		X	X	X	4.14
3.14.1				X		X	X	X	4.14.1
3.14.2				X		X	X	X	4.14.2
3.14.3				X		X	X	X	4.14.3
3.15					X	X			4.15

Table 1. Requirements/Verification Cross-Reference Matrix

3.2.2 LAT. A random sample of ten (10) PGU-44/B Cartridges from each lot shall be submitted for LAT. If multiple lots are simultaneously produced, differing only because of projectile weight zone, the LAT sample shall be randomly selected from the predominant weight zone lot and shall represent all those lots. Additionally, when specified in the contract LAT will include a gun test of twenty five (25) cartridges in accordance with the technical provisions herein. See Table 2.

First Article & Lot Acceptance Tests			
EXAMINATION OR TEST	QUANTITY	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Bullet Pull Test	10*	3.7	4.7
Gun Test	25**	3.2.3	4.2.3
Examination for Defects			
a. Cartridge	10	3.1	4.3.1 – 4.3.10
b. PA-71/A Container	10	3.1	4.3.11 – 4.3.12

Notes:

*These 10 projectiles shall also be used for examination for defects.

**Twenty w/standard M67 Propelling Charge, five with overpressure charge.

Table 2. FAAT & LAT

3.2.3 Gun Testing. When gun testing is required, choose the 25 gun test sample cartridges prior to crimping and fuze assembly. Prepare the samples as follows:

- a. Projectiles. Replace the supplemental charge (if applicable) and fuze with mass property mock-up (dummies).
- b. Primed Cartridge Cases. Load twenty (20) cases with standard M67 (or equivalent approved by AFPO) propelling charges. (These 20 will be used to check muzzle velocity). For the five (5) remaining cases, adjust the propelling charge to produce a chamber pressure of 42,500 psi +/- 1500 psi (measured by copper crush gage) at 70° +/- 5 °F. (The 5 "overpressure" cartridges will be used to check the security of parts).
- c. Cartridges. Crimp loaded cartridge case to projectile IAW Drawing 18894-9926071.

3.2.3.1 Muzzle Velocity. For the 20 cartridges with standard M67 Propelling charges, the corrected muzzle velocity shall be within +/- 1 ½ percent of that tabulated for the gun used for the test (Example: Not higher than 1645 feet per second (fps) nor lower than 1595 fps for the M137 Cannon). The standard deviation of the 20 shots shall not be greater than 8 fps regardless of the gun used.

3.2.3.2 Security of Parts. There shall be no indication of metal parts failure or separation in the gun bore or in flight.

3.3 Quality Assurance. The contractor shall utilize a quality program or detailed inspection system to provide assurance of compliance of all characteristics with the applicable drawing and specification requirements. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspections. Sampling inspection shall be conducted in accordance with MIL-STD-1916. Methods of inspection include visual, test, and acceptance inspection equipment (AIE).

3.4 Projectiles. (Critical) (New & Refurbished Projectiles) Projectiles with evidence of cracks, pipes, thin wall sections, or loose or damaged rotating bands shall not be used.

3.4.1 Charge Cavity Prior to Loading (New Projectiles). Projectiles with imperfectly coated charge cavities shall not be loaded. There shall be no un-solidified pool of paint, bare spot, blister, or foreign matter in the charge cavity prior to loading the explosive. The charge cavity shall be dry when the high explosive is poured into the projectile.

3.5 Cartridge Case. The CYU-1/B Cartridge Case shall comply with all requirements specified on Drawing 20039964, associated drawings, and with all requirements specified in applicable specifications.

3.6 Solid explosives. (Critical) (New Projectiles) There shall be no solid explosive in the charge cavity before loading nor shall any be added during either the pouring or cooling processes.

3.7 Explosive Scrap. (New Projectiles) Scrap from risers, floor sweepings, ventilation and suction apparatus (other than from drilling operations that are specifically controlled to prevent contamination of explosive) shall not be used. Clean explosive scrap produced in regular operations may be re-melted and re-used provided that it complies with the requirements for the grade of high explosive specified, except for form.

3.8 High Explosive (HE) Charge. (Critical) The HE charge shall contain no defects or contaminants that render it unsafe to fire from the AC-130 Gunship.

3.9 HE Charge Defects. Paragraphs 3.9.2 through 3.9.3 and Table 3 (for refurbished projectiles) and Table 4 (for new projectiles) define the maximum allowable geometry of defects within the HE charge in terms of the size of the defects projected onto the radiographs (x-rays) (see 4.8).

3.9.1 Surface Cavities. The maximum dimension of any visible cavity in the faced base surface of the fuze well shall not exceed $\frac{1}{4}$ inch in any direction and the total area of all such cavities shall not exceed 80 percent of the base surface area. Cavities having a maximum dimension less than $\frac{1}{32}$ inch shall be disregarded.

3.9.2 Projected Cracks and Cavities. (Critical) The projected geometry of cracks and cavities within the explosive charge shall not exceed the maximums listed in Table 3 or Table 4 (whichever is appropriate). Cavities having a maximum (max.) projected length of $\frac{1}{32}$ inch or less shall be disregarded. Not more than one transverse crack shall be permitted in Segment A and not more than two transverse cracks shall be permitted in any charge.

3.9.3 Porous Areas. (Critical) The maximum total projected area of porous spots within each segment of the charge shall not exceed the maximums listed in Table 3 or Table 4 (whichever is appropriate).

3.9.4 Foreign Material. (Critical) There shall be no foreign material in the explosive charge.

3.9.5 Base Separation. (Critical) Any separation between the base of the projectile cavity and the explosive cast shall not exceed fifteen thousandths of an inch (0.015 in).

Type of Defect	Max Allowed in Segment (See Figure 1)					
	A	B*	B1	B2	C	D
Porous areas (square inches – in ²).	0.02	-	5/32	1/2	7/8	7/8
Projected length of porous areas (inches – in)	5/32	-	3/16	5/8	7/8	15/16
Sum of projected areas of the cavities, excluding pipes, cracks and annular rings (in ²).	1/64**	1/4	-	-	1/2	1/2
Projected length of any cavity excluding pipes, cracks, and annular rings (inches - in).	1/8	1/2	-	-	1/2	3/4
Piping cavities maximum projected area (in ²).	0	1/2	-	-	1/2	-
Piping cavities maximum projected length (in).	0	1/2	-	-	1/2	-
Longitudinal and transverse cracks, maximum projected width (in).	1/32	1/32	-	-	1/32	-
Annular rings, maximum projected width (in).	0	0	0	0	1/4	0
Notes:						
* More porosity is allowed in Segment B2 than in Segment B1. Values for all other defects are the total allowed for Segment B1 + Segment B2.						
** If the length of the largest cavity is 1/16 inch or less, the maximum total projected area may be 1/20 in ² .						

Table 3. Maximum Allowable Cast Explosive Defects for Refurbished M1 Projectiles
(18894-20039982)

Type of Defect	Max Allowed in Segment (See Figure 2)			
	A	B	C	D
Porous areas (square inches – in ²).	0.02	5/16	5/8	5/8
Projected length of porous areas (inches – in)	5/32	5/8	5/8	15/16
Sum of projected areas of the cavities, excluding pipes, cracks and annular rings (in ²).	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 maximum projected area (in ²).	0	1/2	1/2	-
Piping cavities maximum projected length (in).	0	1/2	1/2	-
Longitudinal and transverse cracks, maximum projected width (in).	1/32	1/32	1/32	-
Annular rings, maximum projected width (in).	0	0	1/4	0
Notes: * If the length of the largest cavity is 1/16 inch or less, the maximum total projected area may be 1/20 in ² .				

Table 4. Maximum Allowable Cast Explosive Defects For Newly Cast Projectiles (18894-20039981)

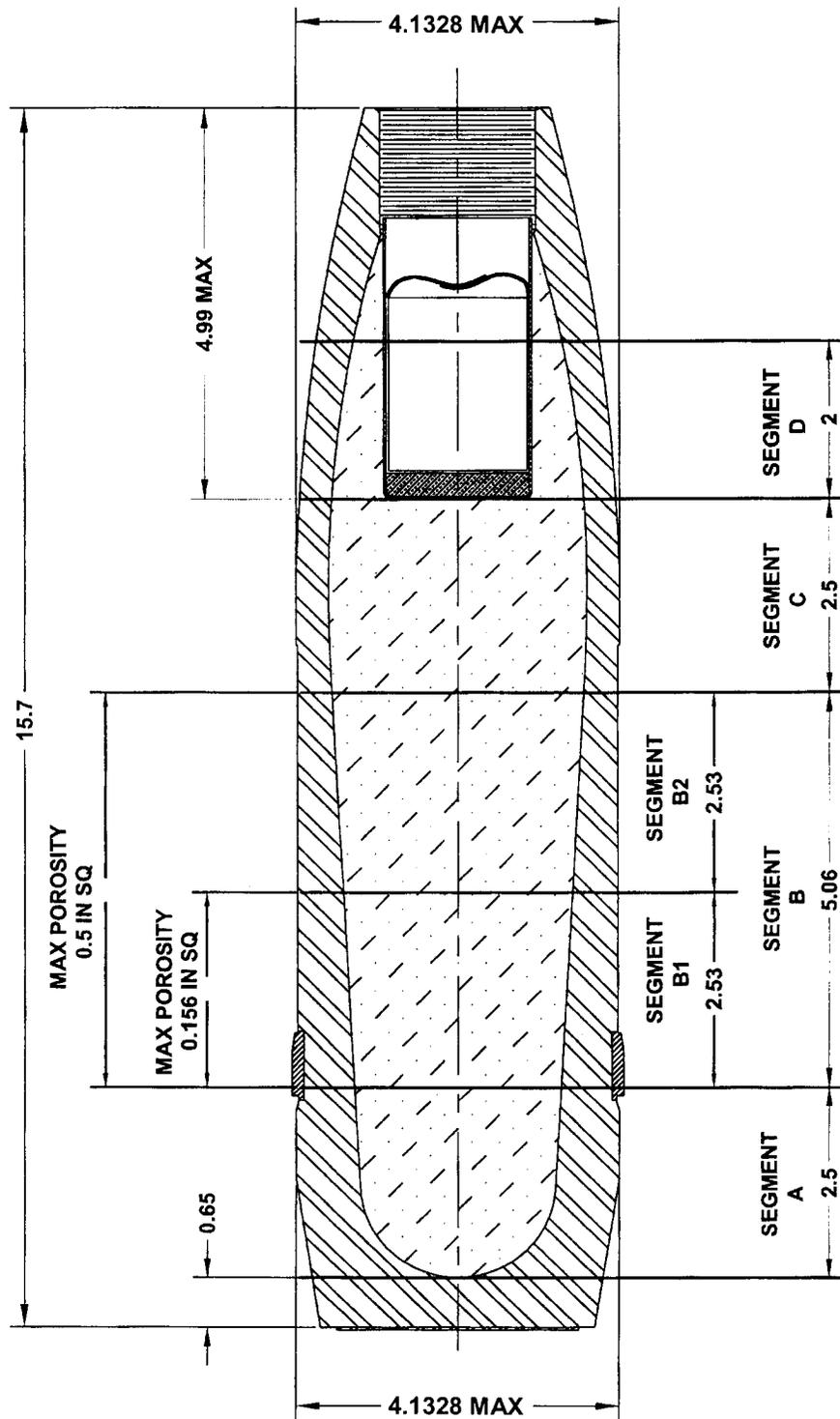
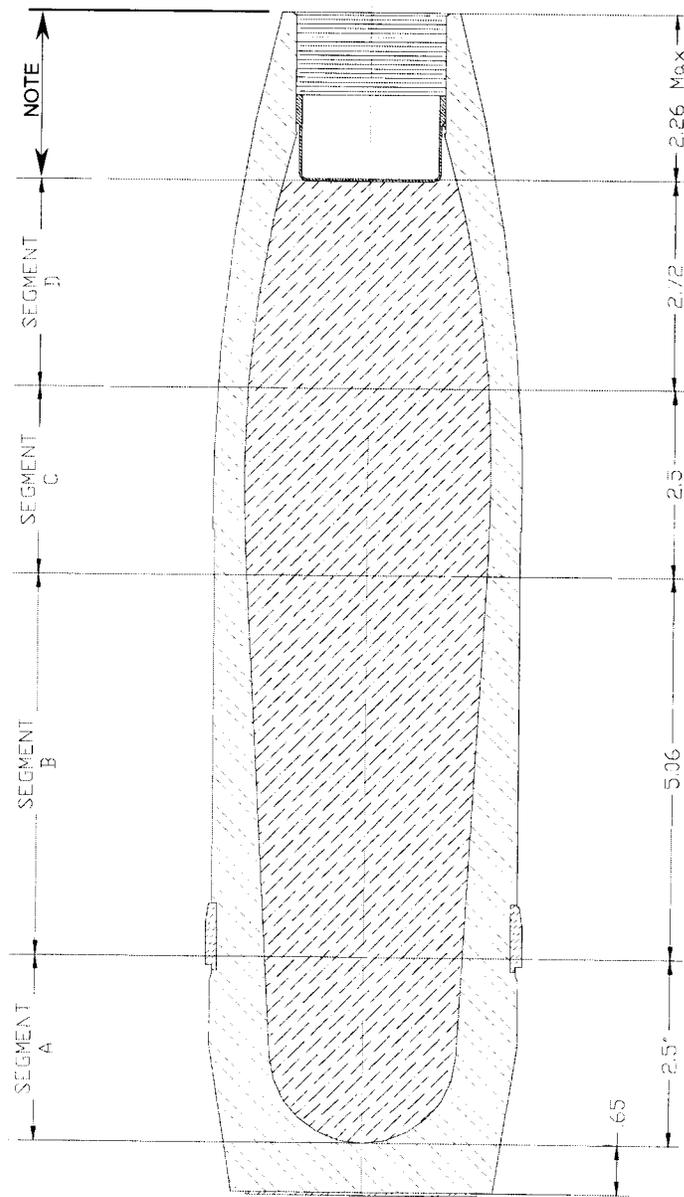


Figure 1. Explosive Charge Segment Definitions for Checking Refurbished M1 Projectiles (18894-20039982)



NOTE: VOIDS ALLOWED IN EXPLOSIVE FILLER TO DEPTH OF 2.25 INCHES FROM FRONT END OF PROJECTILE. FILLER CHIPPED OR BROKEN FROM PROJECTILE SIDE WALLS NEED NOT BE REPLACED.

Figure 2. Explosive Charge Segment Definitions For Checking Newly Filled HE Projectiles (18894-20039981)

3.10 Extraneous Explosive.

3.10.1 Mating Surfaces. The threads and other mating surfaces of the projectile shall be free of caked explosive or other foreign material.

3.10.2 Fuze Well. (New Projectiles) The fuze well shall be free of any foreign matter (including cleaners) or loose explosive prior to assembly of the Fuze Well Liner.

3.10.3 Exterior surfaces. (New Projectiles) There shall be no explosive on the exterior surface of the projectile after loading.

3.11 Percussion primer test. When required, M61 Primer lots must satisfactorily pass the Check Test for deterioration specified in DTL8838129.

3.12 Bullet Pull. (Special) The security of the crimp of the cartridge case to the projectile shall be in accordance with the requirements of drawing 9926071. Bullet pull tests shall be conducted for each production lot regardless of whether a LAT is required.

3.13 Chamber Compatibility. (Critical) The PGU-44/B Cartridge shall be compatible with the chamber of the modified M137 Cannon as evidenced by freely chambering in Profile and Alignment Gage –19200-7258482.

3.14 Workmanship. The requirements of workmanship are as shown on the applicable drawing, in the applicable specifications and the following: Parts shall be free of burrs, chips, dirt, cracks, grease, rust and other foreign material. All required markings shall be neat and sharply defined.

3.14.1 Cleaning. Any cleaning method and/or agents used shall not be injurious to, nor shall they contaminate either the parts or the environment.

3.14.2 Protection of the rotating band. Care shall be exercised at all times so that the rotating band of each projectile will not be nicked or burred.

3.14.3 Painting. Painting shall comply with the requirements of the applicable drawing. All paint shall be dry to the touch before testing and packing for shipment. Drying time prior to testing shall be in accordance with the applicable specification.

3.15 Cartridge Weight. The weight of the finished cartridge shall not be more than eight (8) ounces different from the average weight established for complete cartridges with projectiles of the same weight zone.

4. Verification.

4.1 Components and Assemblies. The AFPO may subject FAAT and LAT samples to any or all of the examinations and tests specified in this specification, and may inspect those samples for compliance with any or all requirements of the applicable drawings and specifications.

4.1.1 Rejection. If any assembly, component or test specimen fails to comply with any of the applicable requirements, the sample shall be rejected. The Air Force reserves the right to terminate inspection upon any failure of an assembly, component or test specimen to comply with any of the requirements.

4.2 Acceptance Testing. See Table 2. A technical representative from the AFPO shall be invited to witness acceptance tests.

4.2.1 FAAT. See Table 2. FAAT will include bullet pull testing, gun testing, and any or all examinations for defects listed in 4.3.1 through 4.3.12.

4.2.2 LAT. See Table 2. LAT will include bullet pull testing, gun testing, and any or all examinations for defects listed in 4.3.1 through 4.3.12.

4.2.2.1 Lot formation. Lot formation shall be in accordance with lot formation requirement of MIL-STD-1168. In addition, each inspection lot shall contain:

- a. Comp B of one type from one lot interfix number.
- b. Projectiles of one weight zone.
- c. Propelling charges from one lot, from one manufacturer.

4.2.3 Gun Testing. When required, the gun test shall be conducted at a facility approved by the Air Force Program Office. The sample cartridges shall be temperature conditioned at 70° +/-5° F for a minimum of 12 hours, and then fired from a M101A1, M102, M119A1, or similar 105mm Howitzer approved by the Air Force Program Office. The cartridges may be fired into a berm or other catch device. A camera shall be used to observe the projectile in flight in order to record any possible malfunctioning. Remote firing is permitted. The Firing Record (test report) shall include the model and lot or serial number for all weapon and ammunition components used in support of this test, details/evidence of any metal parts separation, chamber pressure, muzzle velocity of each shot, and photographic records of the projectiles in flight.

4.2.3.1 Muzzle Velocity. For the 20 cartridges with standard M67 propelling charges corrected muzzle velocities more than +/- 1.5% different than that tabulated for 70° F and the gun used for the test shall be cause for rejection. Standard deviation greater than 8 fps shall be cause for rejection.

4.2.3.2 Security of Parts. Inspect the chamber and barrel after each shot. Reject the sample if there is any evidence of metal parts failure either in the gun or observed visually or photographically in flight.

4.3 Quality Assurance. Analyses, inspections, examinations, and tests to insure conformance with requirements are specified in the following conformance inspections 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. When cited herein, attributes sampling inspection shall be conducted in accordance with MIL-STD-1916, using the inspection levels cited in the following paragraphs (presented in tabular format). Definitions of Critical, Special, Major, and Minor shall be as defined in MIL-STD-1916 and paragraph 6.11. Acceptance criteria shall be in accordance with MIL-STD-1916. Alternative conformance inspections may be submitted and approved in accordance with MIL-STD-1916. The Government reserves the right to perform any of the inspections set forth in this specification.

Paragraph	Drawing	Next Higher Assembly		
4.3.1	18894-20039985	18894-9926071		
Assembly	New Projectile, Prior to Loading Filler			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	Presence of Solid Explosive in Charge Cavity	100%	3.6	Visual
2	Defects in Projectile Body	100%	3.4	Visual
SPECIAL	None Defined			
MAJOR				
101	Presence of Paint Pools, Blisters, or Foreign Matter	100%	3.4.1	Visual
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14 - 314.3	Visual

Paragraph	Drawing	Next Higher Assembly		
Assembly	New Projectile, Prior to Assembly of Fuze Well Liner Refurb Projectile, Prior to Replacing Supplemental Charge			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
	HE Cast Charge			
1	a. Presence of Defects Larger Than Allowed in Table 3 or Table 4 as appropriate b. Presence of foreign Objects or Material c. Presence of Base Separation > 0.015 in	100%	3.8 – 3.9.5	X-Ray*
2	Projectiles w/ evidence of pipes, cracks, thin wall sections, or loose rotating band	100%	3.4	Visual & X-Ray*
SPECIAL				
1	Presence of Explosive on Mating Surfaces and/or Exterior Surfaces of Projectile (New)	100%	3.10.1 & 3.10.3	Visual
MAJOR				
101	Excessive Surface Cavitation (New)	Level III	3.9.1	Visual
102	Depth of Fuze Well Bore (New)	Level IV	3.1	AIE
103	Diameter of Fuze Well Bore (New)	Level IV	3.1	AIE
104	Evidence of Loose Explosive or Foreign Matter in Fuze Well (New)	100%	3.10.2	Visual
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14 - 314.3	Visual
* Each Projectile Shall be X-Rayed Twice, Once In Each of Two Planes Parallel to the Longitudinal Axis of the Projectile and at 90° to Each Other.				

Paragraph	Drawing	Next Higher Assembly		
4.3.3	18894-20039981	18894-9926071		
Assembly	New Projectile, After Assembly of Fuze Well Liner			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL	None Defined			
SPECIAL	None Defined			
MAJOR				
101	Improper Depth to Bottom of Fuze Well Liner	Level III	3.1	AIE
102	Improper True Position of Inside Diameter of Fuze Well Liner In Relation to the Minor Diameter of the Projectile Threads and the End Face of the Projectile	Level III	3.1	AIE
103	Swage Missing or Incomplete	Level III	3.1	Visual
104	Fuze Well Liner Damaged	Level III	3.1	Visual
105	Foreign Material in Fuze Well Liner	Level III	3.10.2	Visual
201	Evidence of Poor Workmanship	Level II	3.14 – 3.14.3	Visual

Paragraph	Drawing	Next Higher Assembly		
4.3.4	18894-20039981 or 20039982	18894-9926071		
Assembly	Projectile, Prior to Assembly of Fuze			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	Weight Zone Marking Incorrect	100%	3.1	Visual & Scale
SPECIAL				
1	Supplemental Charge Missing, Damaged, or Installed Incorrectly (Refurb Projectile)	100%	3.1	Visual
2	Pad Missing from Supplemental Charge (Refurb Projectile)	100%	3.1	Visual
MAJOR				
101	Other Markings Incorrect	Level IV	3.1	Visual
102	Rotating Band Damaged*			
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14 – 3.14.3	Visual
202	Bare Spots in Protective Coating With Total Damaged Area > ¼ in ²	Level II	3.14.3	Visual

* Minor Dings May be Smoothed With a File

Paragraph	Drawing	Next Higher Assembly		
4.3.5	19203-8838129	18894-9926071		
Assembly	Primer Assembly, Prior to Assembly w/ Cartridge Case			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	One or More Flash Holes Missing	100%	3.1	Visual
SPECIAL	None Defined			
MAJOR				
101	M28 Primer Check Test	100%*	3.11	Test*
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14	Visual
*Applicable Lots (see 4.11)				

Paragraph	Drawing	Next Higher Assembly		
4.3.6	18894-20039964	18894-9926071		
Assembly	Cartridge Case, Prior to Adding Propelling Charge			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	Primer Assembly Above Flush w/ Base	100%	3.1	AIE
SPECIAL	None Defined			
MAJOR				
101	Primer Assembly Missing or Damaged	Level III	3.1	Visual
102	Markings Missing or Incorrect	Level IV	3.1	Visual
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14	Visual

Paragraph	Drawing	Next Higher Assembly		
4.3.7	19200-9205472 or 9276669*	18894-9926071		
Assembly	Propelling Charge, Prior to Assembling w/ Cartridge Case			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL	None Defined			
SPECIAL				
1	Any Bag Missing (M-67)	100%	3.1	AIE
MAJOR				
101	Opening in Any Bag Large Enough to Allow Propellant to Escape	100%	3.1	Visual
201	Foil Side of Bag Not Facing Flash Tube *	Level III	3.1	Visual
202	Lead Foil Missing *	Level III	3.1	Visual
MINOR				
202	Evidence of Poor Workmanship	Level II	3.14	Visual
* Or Other Equivalent Propelling Charge Approved by the AFPO				
**Check Lots That Utilize Lead Foil for Barrel Lubricant				

Paragraph	Drawing	Next Higher Assembly		
4.3.8	18894-20039964	18894-9926071		
Assembly	Cartridge Case, Prior to Assembling w/Projectile			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	Propelling Charge Missing	100%	3.1	Visual or AIE
SPECIAL	None Defined			
MAJOR	None Defined			
MINOR	None Defined			

Paragraph 4.3.9	Drawing 18894-9926071	Next Higher Assembly 18894-9926074		
Assembly	Cartridge, Prior to Packing			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL				
1	Weight Differs From Average by More than 8 Ounces	100%	3.15	AIE
SPECIAL				
1	Cartridge Fails to Freely Enter Chamber Gage	100%	3.13	AIE
MAJOR				
101	Low or Erratic Bullet Pull Force	10 per Lot	3.12	AIE
102	Incorrect Fuze Torque	Level III	3.1	AIE
103	Fuze Damaged or Incorrectly Set	Level III	3.1	Visual
104	Fuze Not Fully Seated	Level III	3.1	Visual
105	Rotating Band Damaged *	Level III	3.1	Visual
106	Aggregate of Bare Spots in Protective Coating of Projectile in Excess of ¼ in ²	Level III	3.1	Visual
107	Markings Missing, Incorrect, or Illegible	Level III	3.1	Visual
MINOR				
201	Evidence of Poor Workmanship	Level II	3.14 – 3.14.3	Visual

* Minor Dings May be Smoothed With a File

Paragraph 4.3.10	Drawing 98747-9825005	Next Higher Assembly 18894-9926074		
Assembly	PA-71/ A Container - Empty			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL	None Defined			
SPECIAL	None Defined			
MAJOR				
101	Interior Components Missing, Damaged, or Improperly Assembled	Level III	3.1	Visual
102	Evidence of Poor Workmanship a. Cuts, Scuffs or Gouges Through 2 Outer Layers b. Metal End Bent, Loose or Distorted c. Markings Missing, Incorrect, or Illegible	Level III	3.14	Visual
MINOR	None Defined			

Paragraph 4.3.11	Drawing 18894-9926074	Next Higher Assembly 18894-20039983		
Assembly	PA-71/ A Container – Packed & Sealed			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL	None Defined			
SPECIAL	None Defined			
MAJOR	Evidence of Poor Workmanship			
101	a. Contents Loose b. Tape incomplete or Badly Wrinkled c. Tear Tab Length Incorrect d. Gap Between Cover and Body in Excess of 1/8 in	Level III	3.14	Visual/ Test
102	Improper, Illegible, or Missing Markings	Level III	3.1	Visual
MINOR	None Defined			

Paragraph 4.3.12	Drawing 18894-20039983	Next Higher Assembly		
Assembly	Pallet Type Wirebound Box - Loaded			
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	Inspection Method
CRITICAL	None Defined			
SPECIAL	None Defined			
MAJOR	Evidence of Poor Workmanship			
101	a. Contents Loose b. Damage - Exposing Tubes c. Strapping Missing, Broken, Badly Bent, or Loose d. DoD Symbol Missing or Incorrect e. Board Broken f. Car Seal Missing, Unsealed, or Improperly Positioned	Level III	3.14	Visual/ Test
102	Wrong Strapping Material	Level III	3.1	Visual
MINOR	None Defined			

4.4 Projectiles. (Critical) (New & Refurbished Projectiles) Visually examine all projectiles for evidence of cracks, pipes, or thin wall sections in the projectile. Each X-Ray (see 4.8) shall be examined for any such indication. The presence of any such indication shall cause that projectile to be classified defective and removed from the lot.

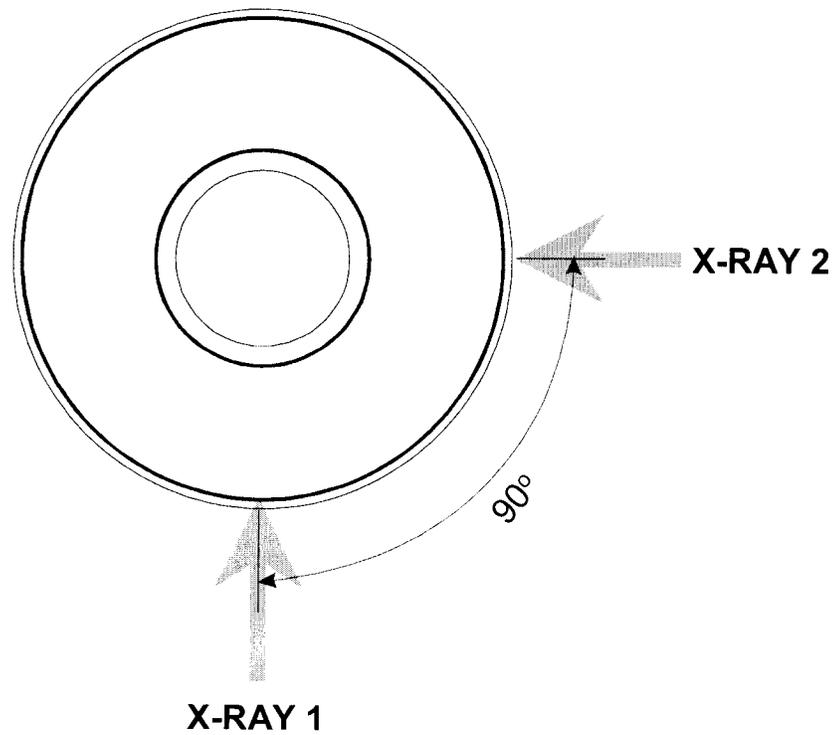
4.4.1 Charge Cavity Prior to Loading. (New Projectiles) Visually inspect charge cavity for evidence of un-solidified pools of paint, bare spots, blisters, and foreign matter. Clean as required. If a chemical cleaner is required it shall be approved by the procuring agency. Insure that cavity is completely dry prior to loading.

4.5 Cartridge Case. Cartridge cases shall be certified by the vendor to comply with all requirements specified on Drawing 20039964, associated drawings, and with all requirements specified in applicable specifications, or they shall be submitted to an incoming inspection designed to insure compliance. Visually check cases for metal defects (cracks, blisters, seams, laminations, deep scratches, porosity, splits, inclusions, pipe, and other metal defects deeper than 1/10 of the metal thickness at the defect site) prior to installing primer assemblies.

4.6 Solid Explosives. (Critical) (New Projectile) Design filling and cooling procedures to insure that no solid explosive is introduced into the charge cavity before, during, or after loading. Visually inspect cavity prior to loading.

4.7 Explosive Scrap. (New Projectile) Design explosive melting and loading procedures to insure that no scrap from risers, floor sweepings, ventilation and suction apparatus (other than from drilling operations that are specifically controlled to prevent contamination of explosive) is reused in the production of Air Force cartridges.

4.8 High Explosive Charge. (Critical) (Both New and Refurbished Projectiles) Radiographically examine (x-ray) each projectile (100% inspection). X-ray new projectiles after loading the charge cavity and boring the fuze well (if fuze wells are bored). Take two radiographs (x-rays) of each projectile. Orient the plane of the second x-ray at 90 degrees angle rotation of the projectile from the first (see Figure 3). 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. Examine the radiographs to insure that neither the projectiles nor the HE charges have defects that would render them unsafe for use on the AC-130 Gunship.



Overhead View of Projectile Standing on Its Base

Figure 3. X-Ray Orientation

4.8.1 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 Image Quality Indicator (IQI) (see Figure 4 for refurbished projectiles and Figure 5 for new projectiles) and radiation screening required to 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 ASTM E1742. 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, with the maximum density no greater than to permit adequate inspection over the entire area of interest. All defect-like features in the area of interest on a radiographic image shall be treated as defects unless identified as extraneous artifacts. Acceptability in all cases shall be judged on the basis of the film giving the largest projection, except in the case where the second radiograph reveals multiple superimposed cavities, each of which individually complies with the requirements. All additional radiographs of a projectile for defect conditions will be identified on the film as retakes and stored with the originals.

4.8.2 The sensitivity of radiographic technique shall be determined by means of IQIs, fabricated as specified herein. The IQI's shall be placed on the radiographic source side of a projectile so that the 2T holes are at the point shown in Figure 4 or Figure 5 (whichever is appropriate). Three IQI's for each projectile shall be used. When radiographing a number of similar projectiles the frequency of the sensitivity check shall be no less than one in each fifty radiographs, and on a rotating ring, the IQI's 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 outline of the entire internal cavity of the projectile and the image of the IQI's, including the 2T holes, are perceptible in accordance with ASTM E1742. The IQI's shall be made of steel having an approximate specific gravity of 7.8. For further details on construction of the IQI's see ASTM E1742.

4.8.3 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. Photographic densities shall be measured with a diffuse density, photoelectric densitometer providing direct display of numerical density units. Accuracy of densitometer shall be maintained by calibrating with a photographic step tablet each hour immediately prior to measurement on the radiographic film. Calibration shall be made at a step tablet density level within 0.5D of that being measured on the radiographic film. Each point of density measurement on the radiographs shall be identified by a circumscribed circle (made with a suitable pen or pencil) of no more than 1/4 inch in diameter. All photographic step tablets used in normal operation shall be checked for accuracy monthly by calibrating the densitometer with a reference photographic step tablet calibrated by National Institute of Standards and Technology (NIST) or approved by the Air Force Program Office. Reference tablet shall be kept available, but shall be protected from wear and damage and shall not be used in daily operations. Any photographic step tablet having severe surface damage or showing a deviation from previous calibrations by 0.05D or more shall be replaced with a new, unused step tablet.

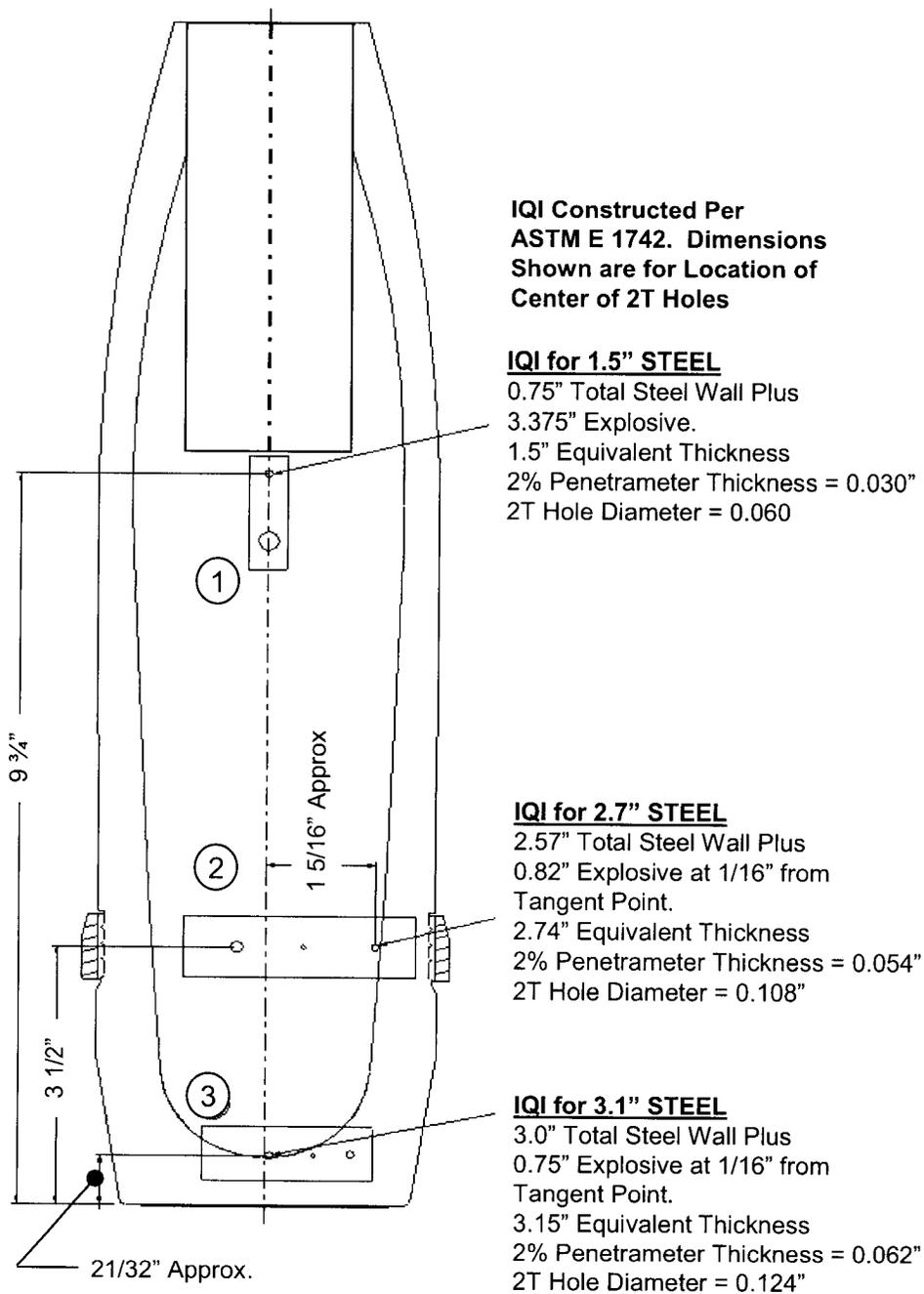


Figure 4. X-Ray IQI Requirements for Refurbished Projectiles

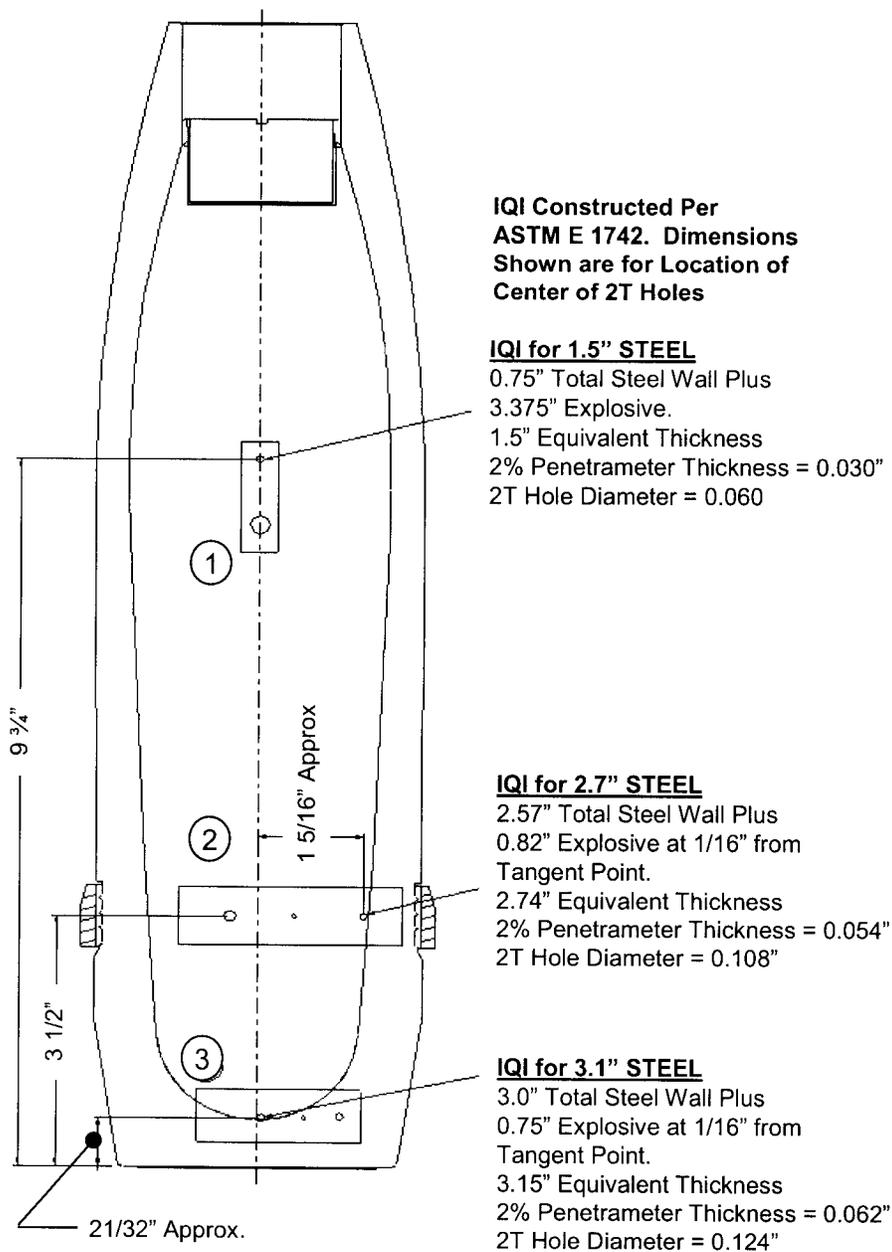


Figure 5. X-Ray IQI Requirements for New Projectiles

4.8.4 The sensitivity of the radiographic technique shall be reviewed by submitting at least one radiograph of the projectile containing the IQI's and a copy of radiographic procedures prior to the start of initial production. These radiographs shall be taken and processed using the same techniques as will be used in production. In addition one radiograph of the projectile containing the IQI's shall be submitted to the AFPO for review once a month for the first three months of each contract and every three months thereafter. After qualification of the radiographic technique no changes to developing process, film, manufacturer or type radiographic source or exposure time shall be made without first submitting additional sample radiographs of the IQI's projectile for approval.

4.9 HE Charge Defects.

4.9.1 Surface Cavities. Visually examine the faced base surface of the fuze well to insure that any cavities having a maximum dimension greater than 1/32 inch meet the requirements of 3.9.1.

4.9.2 Projected Cracks and Cavities. (Critical) Examine both X-rays of each projectile to insure that the maximum projected geometry of cracks and cavities is equal to or less than the maximum allowed in Table 3 or Table 4 (as appropriate) and that the requirements of 3.9.2 are met.

4.9.3 Porous Areas. (Critical) Examine both X-rays of each projectile to insure that the maximum projected geometry of porous areas is equal to or less than the maximum allowed in Table 3 or Table 4 (as appropriate).

4.9.4 Foreign Material. (Critical) Examine both X-rays of each projectile to insure that there are no foreign objects or material in the explosive charge.

4.9.5 Base Separation. (Critical) Examine both X-rays of each projectile to insure that any separation between the base of the charge cavity and the explosive cast does not exceed fifteen thousandths of an inch (0.015 in). If x-rays show any projectile to have a base separation greater than 0.015 in., reject that projectile. Destructively section three (3) projectiles per lot to verify the findings of the radiographic examination. Select projectiles with the largest acceptable base separations (0.015" or smaller), as determined by radiographic examination, for sectioning. If fewer than three projectiles per lot have base separation, randomly select projectiles for sectioning. Allow projectiles to be sectioned to stabilize at the ambient temperature. Then temperature condition for a minimum of eight (8) hours at $70^{\circ} \pm 5^{\circ}$ F before sectioning. Cut (saw) a notch from the projectile base in the following manner: Cut parallel to the base approximately 4 inches up from the base to the center of the projectile. Next cut through the base toward the nose perpendicular to aforementioned cut so as to expose the explosive and metal interface. Next push the explosive charge towards the nose of the projectile using finger pressure. Measure for base separation with a 0.015 in. thick feeler gage. If any projectile has a base separation in excess of 0.015 in. reject the lot it represents.

4.10 Extraneous Explosive.

4.10.1 Mating Surfaces. Visually examine the threads and other mating surfaces of the projectile. Remove any explosive or other foreign material found. If a chemical cleaner is required it shall be approved by the procuring agency. Do not allow any chemical cleaner to come into contact with the explosive charge.

4.10.2 Fuze Well. (New Projectile) Visually inspect the fuze well prior to assembly of the fuze well liner. Remove any foreign matter or loose explosive found.

4.10.3 Exterior surfaces. (New Projectile) Visually inspect the exterior surface of the projectile after loading. Remove any explosive found.

4.11 Percussion Primer Test. Immediately before the M28 Primer Assembly is assembled into the cartridges, perform the check test for deterioration specified in DTL8838129 on M61 Primers from each lot that has been stored under normal conditions for more than two years or under adverse conditions for any period of time.

4.12 Bullet Pull. (Special) Select a random sample of 10 cartridges from each lot for this test (For lots of less than 2,000 cartridges, select one sample for each 200 cartridges in the lot, with a minimum of 2 samples per lot). Determine the security of the crimp of the cartridge case to the projectile by applying a load in the axial direction with a rate of travel of the testing machine head of 0.100 to 0.125 inch per minute. For Projectile Assembly, New for 105mm PGU-44/B HE Ctg – 18894-20039981, compute average force (\bar{x}) and standard deviation (s) using the (n-1) formula. Compute $k_L = (\bar{x} - 950)/s$. Reject the lot if k_L is less than 1.58, or if any individual bullet pull is less than 950 pounds. For Projectile Assembly, Refurb for 105mm PGU-44/B HE Ctg – 18894-20039982, compute average force (\bar{x}) and standard deviation (s) using the (n-1) formula. Compute $k_L = (\bar{x} - 860)/s$. Reject the lot if k_L is less than 1.58, or if any individual bullet pull is less than 860 pounds.

4.13 Chamber Compatibility. (Critical) Check each completed cartridge in the profile and alignment gage described in drawing 19200-7258482 (or a similar one approved by the Air Force Program Office). Cartridges must freely and completely enter the chamber gage with a maximum insertion force of 15 pounds dead load. The gage door shall close completely after insertion of the cartridge.

4.14 Workmanship. Inspect parts, assemblies, and sub-assemblies for evidence of poor workmanship. Prior to packing, inspect completed cartridges for evidence of poor workmanship.

4.14.1 Cleaning. Inspect parts, assemblies, and sub-assemblies after cleaning to insure that the cleaning agents or methods have not caused damage or contamination.

4.14.2 Protection of the Rotating Band. Inspect the rotating bands of incoming projectiles, loaded projectile assemblies, and completed cartridges.

4.14.3 Painting. Inspect completed projectile assemblies and completed cartridges to insure that paint meets drawing and specification requirements.

4.15 Cartridge Weight. Cartridges weighing more than eight (8) ounces different from the average weight established for complete cartridges with projectiles of the same weight zone shall be rejected.

5. Packaging. The PGU-44/B Cartridge shall be packaged in the PA-71/A Tube, 9825005. No Hardened Packing Stop ("C" Washer) is required with the FMU-153/B Fuze. Markings shall be IAW drawing 18894-9926074. Thirty-nine packaged cartridges shall be packaged, nose down in Pallet Type Wirebound Box, 19203-9278402. The box shall be marked IAW drawing 18894-20039983.

6. NOTES. This section contains information of a general or explanatory nature.

6.1 Description and Intended Use. The PGU-44/B Cartridge (see Figures 6 and 7) is intended for use in the modified M137 Cannon on the AC-130 Gunship. The primary use of the cartridge is to attack large hard targets such as bunkers and concrete roofs. The refurbished projectile – 18894-20039982 is filled with approximately 4.6 pounds of Comp B High Explosive and has a 0.3 pound TNT supplemental charge in the fuze well. The new projectile – 18894-20039981 is filled with approximately 5 pounds of Comp B High Explosive and has a shallow fuze well with no supplemental charge. Additionally the Rotating Band Relief Groove on the new projectile is modified to enhance the crimp quality. The FMU-153/B PD/Delay Fuze has a hardened steel case that protects the thinnest portion of the fuze well wall. The PGU-44/B is capable of penetrating up to 12 inches of steel reinforced concrete.

6.1.1 When Using M1 Parts.

- a. Remove PA-55 tubes from wooden box. Discard box.
- b. Remove cartridge from PA-55.
- c. Discard PA-55.
- d. Inspect projectile and refurbish IAW drawing 18894-20039982.
- e. Remove M67 propelling charge from cartridge case. Inspect. If serviceable, save for reuse.
- f. DEMIL and discard cartridge case and primer assembly.

6.2 Acquisition Requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Requirements for submission of first article sample.
- c. Requirements for Gun Test

d. Requirements for submittal of Acceptance Inspection Equipment for approval.

6.3 Lot Size. The size of production lots may differ from the quantities contractually scheduled for delivery.

6.4 Submission of Ballistic Test Data and Ammunition Data Cards. In addition to the normal distribution of records for loaded items provided by the Department of the Army, a copy of all ballistic test data and ammunition data cards shall be forwarded to the Air Force Program Office (electronic submittals acceptable).

6.5 Submission of Alternate Quality Conformance Provisions. All contractor proposed alternative quality conformance provisions will be submitted to the Air Force Program Office for evaluation/approval.

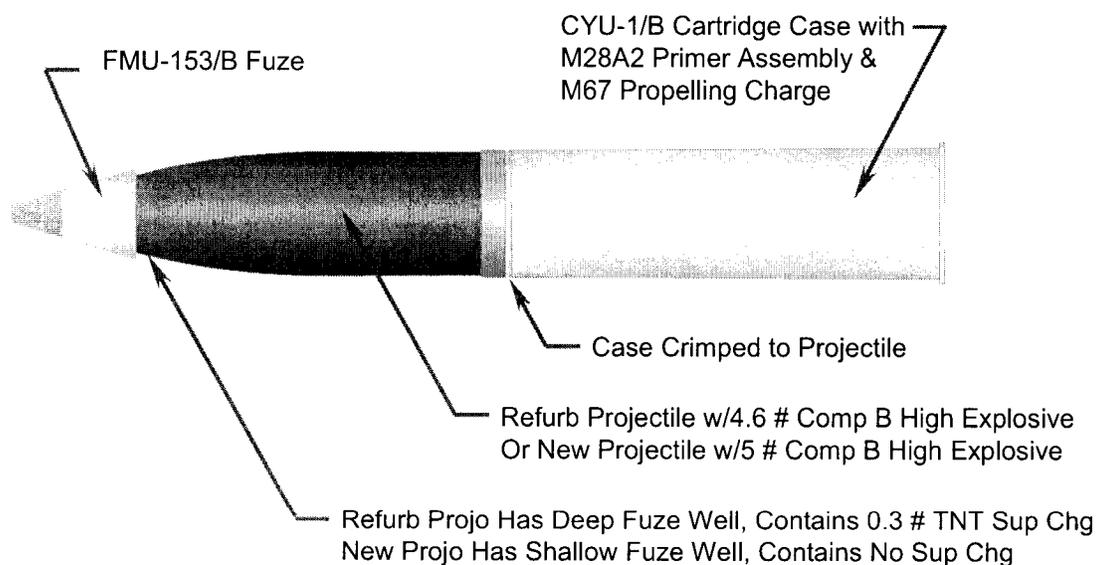


Figure 6. PGU-44/B

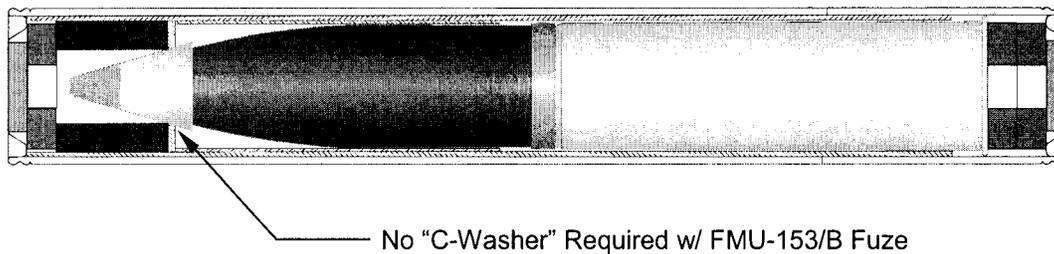


Figure 7. PGU-44/B in PA-71/A Tube

6.6 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, U.S. Army Armament, Research and Development Command (ARRADCOM), Frankfort Arsenal, Rock Island Arsenal or Picatinny Arsenal drawings. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.7 Personnel Qualification for X-Ray Technicians. Personnel performing the radiographic testing shall be qualified and certified in accordance with recommended practice ASNT-TC-1A or equivalent and procedures approved by the Air Force Program Office. Minimum qualification levels shall be as follows:

- a. Level III: Review and approval of radiographic procedures, equipment, and personnel certifications.
- b. Level II: Set-up, calibration, modification of radiographic equipment and procedures.
- c. Level I: Operation of equipment and performance of radiographic exposures.
- d. Level I Special: Reading and interpretation of radiographic film. All personnel certified to read and interpret radiographic film must be trained by a Level III Technician.

6.8 Radiographic Procedures. Radiographic procedures, standards and sample radiographs shall be submitted to the Air Force Program Office for review and approval. No non-film methods may be employed without prior review and approval by the Program Office. Compliance with ASTM-E1255 (Radioscopic Real-time Examination) and an approved qualification plan shall be required, including a demonstration of the specific non-film system proposed for production inspection.

6.9 Notification of Defective Projectiles. The program office will be notified of any projectile rejected for metal parts defects found upon inspection of radiographs. The rejected projectile will be held pending disposition instructions from the program office.

6.10 Processing Aid Material for HE Charge. Only qualified process aid materials are permitted with Composition B, MIL-C-401. Before adding materials, the temperature of the Comp B must 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.

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

6.11 Definitions.

Air Force Program Office (AFPO). OO-ALC/WM, 6033 Elm Lane, Hill AFB, UT 84056-5819

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

Piping Cavitation. Cavitation located on or near the center line of the projectile with the longitudinal axis (length) three times (or more) the width.

Annular Ring. Cavitation that takes the form of a ring or portion thereof around the periphery of the cast.

Transverse Crack. A crack with elements within 30 degrees of the base plane.

Lot. A homogeneous collection of units of product from which a representative sample is drawn or which is inspected 100 percent to determine conformance with applicable requirements. Units of product selected for inspection shall represent only the inspection lot from which they are drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. Homogeneity shall be considered to exist provided the inspection lot has been produced by one manufacturer, in one unchanged process, using the same materials and methods, in accordance with the same drawings, same drawing revisions, same specifications, and same specification revisions.

Acceptance Inspection Equipment (AIE). Any measuring device that is traceable to the national or international standard used to assure conformance of material to the contract requirements.

Special Characteristic. Special characteristics are those attributes, other than critical, that in the event of a nonconformance may (depending upon the degree of divergence from requirements, the presence of other nonconformance or procedural errors) result in hazardous or unsafe conditions. Depending upon the degree of divergence from the requirement the defect may be classified as critical or major and require the appropriate corrective actions.