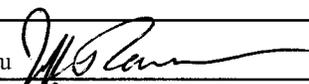
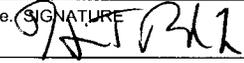


FSA-RA

ENGINEERING CHANGE PROPOSAL (ECP), PAGE 1				1. DATE (YYYYMMDD) 20020828		Form Approved OMB No. 0704-0188			
The public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.						2. PROCURING ACTIVITY NO. R2J2024			
						3. DODAAC			
4. ORIGINATOR a. TYPED NAME (First, Middle Initial, Last) Jeff Ranu		b. ADDRESS (Street, City, State, Zip Code) U.S. Army, TACOM-ARDEC AMSTA-AR-FSA-M/ Jeff Ranu Picatinny Arsenal, NJ 07806		5. CLASS OF ECP II		6. JUST. CODE D		7. PRIORITY R	
8. ECP DESIGNATION a. MODEL/TYPE 60MM Mortar				b. CAGE CODE 19200		c. SYSTEM DESIGNATION M888 60mm HE Mortar Cartridge			
d. ECP NO. R2J2024				e. TYPE		f. REV		9. BASELINE AFFECTED FUNCTIONAL <input checked="" type="checkbox"/> PRODUCT ALLOCATED	
11. SPECIFICATIONS AFFECTED				12. DRAWINGS AFFECTED					
		CAGE Code	Specification/Document No.	Rev.	SCN	CAGE Code	Number	Rev.	NOR
a. SYSTEM						19200	13001319		-
b. DEVELOPMENT						19200	13001320		-
c. PRODUCT		19200	MIL-P-48400			19200	13001321		-
13. TITLE OF CHANGE Ultrasonic Inspection for 60mm Shell Bodies									
14. CONTRACT NO. AND LINE ITEM					15. PROCURING CONTRACTING OFFICER				
					a. NAME (First, Middle Initial, Last)				
					b. CODE		c. TELEPHONE NO.		
16. CONFIGURATION ITEM NOMENCLATURE Cartridge, 60mm, HE, M888								17. IN PRODUCTION <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
18. ALL LOWER LEVEL ITEMS AFFECTED									
a. NOMENCLATURE Shell Body, 60mm				b. PART NO. 11751151			c. NSN		
19. DESCRIPTION OF CHANGE See Attached Sheet									
20. NEED FOR CHANGE See Attached Sheet									
21. PRODUCTION EFFECTIVITY BY SERIAL NUMBER					22. EFFECT ON PRODUCTION DELIVERY SCHEDULE				
23. RETROFIT									
a. RECOMMENDED ITEM EFFECTIVITY					b. SHIP/VEHICLE CLASS AFFECTED				
c. ESTIMATED KIT DELIVERY SCHEDULE					d. LOCATIONS OR SHIP/VEHICLE NUMBERS AFFECTED				
24. ESTIMATED COSTS/SAVINGS UNDER CONTRACT					25. ESTIMATED NET TOTAL COSTS/SAVINGS				
26. SUBMITTING ACTIVITY a. AUTHORIZED SIGNATURE Jeff Ranu 					b. TITLE Mechanical Engineer				
27. APPROVAL/DISAPPROVAL									
a. CLASS I <input checked="" type="checkbox"/> APPROVAL RECOMMENDED <input type="checkbox"/> DISAPPROVAL RECOMMENDED			b. CLASS II <input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED			c. CLASS II <input type="checkbox"/> CONCUR IN CLASSIFICATION OF CHANGE <input type="checkbox"/> DO NOT CONCUR IN CLASSIFICATION OF CHANGE			
d. GOVERNMENT ACTIVITY AMSTA-AR-FJA-M					e. SIGNATURE  HENRY T. RAND			f. DATE SIGNED (YYYYMMDD) 20020828	
g. APPROVAL <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED			h. GOVERNMENT ACTIVITY TACOM-ARDEC, AMSTA-AR-FJA-M			i. SIGNATURE ARTHUR J. HEYDERMAN CHIEF, FBAC Prod & Log Eng Spt Team		j. DATE SIGNED (YYYYMMDD) 20030319	

DD FORM 1692, AUG 96 (EG)

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Distribution Statement A: Unlimited

Stmt C, Govt & Contractors, controlling DOD office: AMSTA-AR-FJA-M

12: Drawings Affected

11751151
13001319
13001320
13001321

19: Removed all existing Military Specifications and Standards, unnecessary drawing references, unnecessary ASTM Test Methods, Service Pressure test, Panel (Arena) fragmentation test, Magnetic Particle Inspection, changed Critical defects to Critical I, and changed Special defects to Critical II. Rewrote lot definitions, tensile test sampling and acceptance procedures, metal defects visual inspection criteria and procedures, and salt spray procedures . Added MIL-STD-1916, Ultrasonic test procedures and information, definitions of Critical II and other types of defects, and made changes to Ordering Data and Packaging sections. comply with the latest Acquisition reform guidelines for format Packaging, Acquisition Requirements, and Definitions. *Added QAP 1175/150. Foreign material callouts were modified for clarity.*

20: Specs and standards were removed or added in accordance with various Acquisition reform format guidelines; same applies to the Ordering Data and Definitions paragraphs. ASTM E-350 was removed so that other methods of chemical analysis could be used and to be consistent with other mortar body specs. Service pressure test was also removed to be consistent with other body specs. Arena test is for R&D only. Mag Particle visual inspection is replaced with automated inspection to comply with QED policy for inspection of Critical characteristics. Tensile test, metal defect, and salt spray sections were changed where necessary to make them consistent with the procedures used in other applicable body specs. *The QAP was added for Marine Corps' requirements for larger ballistic test quantity and additional data collection on the UT system.*

Ranu, Jeff [AMSTA-AR-FSA-M]

B2J2024

From: Chin, Stanley [AMSTA-AR-WEA]
Sent: Wednesday, August 28, 2002 1:53 PM
To: Ranu, Jeff [AMSTA-AR-FSA-M]
Subject: M720 mechanical property

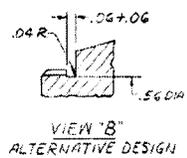
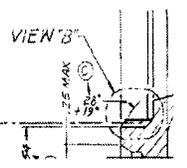
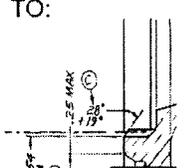
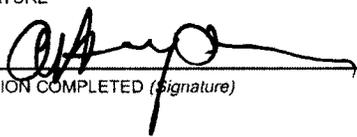
Jeff,

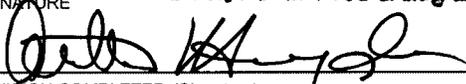
Rationale for 7% elongation and .2% elongation for the M720

The M720 requirement has been 7% elongation until early 1990 when it was changed to 10% elongation and 90ksi yield. No body knows the rationale for this change. All the rounds make to date has been made to the 7% elongation requirement. Medico expressed producibility concern of meeting the 90ksi and .1% elongation. Typically, our rounds yield strength is based on .2% elongation. This elongation requirement will not have any effect on the function or performance of the round. Our launch requirement is well below the 90ksi.

Stanley Chin
AMSTA-AR-WEA

NOTICE OF REVISION (NOR) THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED		1. DATE (YYMMDD)	Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington DC 20503. PLEASE DO NOT RETURN YOUR COMPLETED FORM TO EITHER OF THESE ADDRESSES. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.		2. PROCURING ACTIVITY NO. R2J2024	
3. DODAAC		6. NOR NO. R2J2024-11751150	
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	5. CAGE CODE	8. DOCUMENT NO.
a. TYPED NAME (First, Middle Initial, Last) CHIN, STANLEY	US ARDEC AMSTA-AR-WEA PICATINNY ARSENAL, NJ 07801-5000	19200	11751150
9. TITLE OF DOCUMENT PROJECTILE, 60MM., H.E., M720 OR M888 METAL PARTS ASSEMBLY		7. CAGE CODE 19200	11. ECP NO. R2J2024
10. REVISION LETTER			
a. CURRENT E		b. NEW F	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Cartridge, 60MM, H.E., M888			
13. DESCRIPTION OF REVISION Change Note 1 From: "1 - SPEC MIL-A-2550, ANSI Y14.5-1973 AND MIL-P-48400 APPLY." To: "1 - SPEC MIL-A-2550, ANSI Y14.5-1973, MIL-P-48400, AND QAP 11751150 APPLY."			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by this NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSAR		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN Chief, FSAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE 	f. DATE SIGNED (YYMMDD) 2003 03/9	
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature) 	c. DATE SIGNED (YYMMDD)	

NOTICE OF REVISION (NOR)		1. DATE (YYYYMMDD)	<i>Form Approved</i> <i>OMB No. 0704-0188</i>
THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED			
<p>The public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p>PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.</p>		2. PROCURING ACTIVITY NO. R2J2024	
		3. DODAAC	
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	5. CAGE CODE	6. NOR NO.
a. TYPED NAME (First, Middle Initial, Last) Jeff Ranu	U.S. Army TACOM-ARDEC AMSTA-AR-FSA-M Picatinny Arsenal, NJ 07806	19200	R2J2024-11751151
		7. CAGE CODE	8. DOCUMENT NO.
		19200	
9. TITLE OF DOCUMENT BODY	10. REVISION LETTER		11. ECP NO.
	a. CURRENT H	b. NEW I	R2J2024
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Cartridge, 60MM, HE, M888			
13. DESCRIPTION OF REVISION			
<p>ZONE E7: CHANGE: FROM:  TO: DELETE</p> <p>ZONE G6: CHANGE: FROM:  TO: </p> <p>ZONE A8: NOTE 11: FROM: 11 - YIELD STRENGTH TO BE 90,000 PSI MINIMUM AT .1% OFFSET. TO: 11 - YIELD STRENGTH TO BE 90,000 PSI MINIMUM AT 0.2% OFFSET AND 7% MIN ELONGATION</p> <p>ZONE B8 NOTE 1: FROM: 1- SPEC MIL-A-2550, ANSI Y14.5 - 1973, MIL-STD-9 and ANSI B46.1 Apply. TO: 1- SPEC MIL-A-2550, ANSI Y14.5 - 1973, ANSI Y 14.6, and ANSI B46.1 Apply.</p>			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by this NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSA-R		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN Chief, FSAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE 	DATE SIGNED (YYYYMMDD) 2003 03 19	
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (signature)	c. DATE SIGNED (YYYYMMDD)	

NOTICE OF REVISION (NOR) THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED		1. DATE (YYYYMMDD) 20020828	Form Approved OMB No. 0704-0188
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4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	5. CAGE CODE	6. NOR NO.
a. TYPED NAME (First, Middle Initial, Last) Jeff Ranu	U.S. Army TACOM-ARDEC AMSTA-AR-FSA-M Picatinny Arsenal, NJ 07806	19200	R2J2024-13001321
		7. CAGE CODE	8. DOCUMENT NO.
		19200	13001321
9. TITLE OF DOCUMENT Ultrasonic Inspection Equipment and Procedure for Body, 60MM, M720/M888	10. REVISION LETTER		11. ECP NO.
	a. CURRENT	b. NEW	R2J2024
	-	-	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Cartridge, 60MM, HE, M888			
13. DESCRIPTION OF REVISION Initial Release of Envelope Drawing, Ultrasonic Inspection Equipment and Procedure for Body, 60MM, HE, M720/M888. To be released as drawn.			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	X	(1) Existing document supplemented by this NOR may be used in manufacture.	
		(2) Revised document must be received before manufacturer may incorporate this change.	
		(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSA-R		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN Chief, PSAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE	f. DATE SIGNED (YYYYMMDD) 20030319	
			
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature)	c. DATE SIGNED (YYYYMMDD)	

DD FORM 1695, AUG 96 (EG)

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Distribution Statement A: Unlimited

Smt C, Govt & Contractors, controlling DOD office: AMSTA-AR-FSA-R

DRAWING SIZE A

APPLICATION		REVISIONS				
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE(YR-MO-DA)	APPROVED	
		-	PRODUCT BASELINE R2J2024			

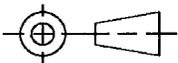
DISTRIBUTION STATEMENT D

Distribution authorized to the Department of Defense and U.S. DoD contractors only (Critical Technology) (17 July 2002). Other requests shall be referred to (AMSTA-AR-QAA).

ENVELOPE DRAWING

REV											
SHEET											
REV											
SHEET											
REV											
SHEET											
REV STATUS OF SHEETS	REV	-	-	-	-	-	-	-	-	-	-
	SHEET	1	2	3	4	5	6	7	8	9	

PART NO. 13001321

DO NOT SCALE DRAWING PMIC UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMAL FRACTION 2 PL ± ± 3 PL ± ±	CONTRACT NUMBER		DESIGN ACTIVITY U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NEW JERSEY 07806-5000	
	CONTRACTOR		ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720 / M888	
THIRD ANGLE PROJECTION 	DRAWN BY	DATE(YR-MO-DA)	SIZE	CAGE CODE
	CHECKER	ENGINEER	A19200	13001321
MATL ENGR	DRAWING APPROVAL		SCALE	UNIT WT.
	DESIGN APPROVAL			SHEET 1 OF 9

DRAWING SIZE A

1. Purpose:

This document is provided as guidance in the design, fabrication and use of ultrasonic equipment to inspect the projectile body.

2.0 Applicable drawings:

13001320 Circumferential Test Standard for Ultrasonic Inspection of Body, 60mm.

13001319 Longitudinal Test Standard for Ultrasonic Inspection of Body, 60mm.

11751151 Projectile, HE, 60mm, M720 / M888, Body.

2.1 Applicable specifications/standards:

NAS-410 Certification & Qualification of Nondestructive Test Personnel

3.0 Requirements:

3.1 The ultrasonic inspection system shall be designed to inspect the projectile body metal part. The notches in the standards represent discontinuities in each inspection area. The notches provide a signal of consistent amplitude which is used to set the system's sensitivity. A reject level will be established at a point below the amplitude of a standard notch (initially 6db down). Any discontinuity that produces a signal larger than the reject level will be considered a rejectable defect.

3.2 The system shall comply with all plant, municipal, state, and national codes and safety regulations including OSHA regulations.

3.3 It is a design goal for the system to have a mean time between failures (MTBF) of not less than 80 hours operating time and a mean time to repair (MTTR) of not more than one hour when the system is located in the production environment.

3.4 It is a design requirement that the system be fail-safe: that is, failure of any electrical, mechanical, hydraulic or pneumatic system shall result in rejection of the item being inspected. The accept/reject mechanism in the Automated System should normally be in the "reject" position and require a definite "accept" signal to accept the part.

3.5 System Configurations. The system may be configured for manual part loading, unloading, and marking (Manual System - Option A), or it may be fully automated (Automated System - Option B). *The term "system" as used in this document means that the paragraph shall apply to either configuration.*

3.5.1 It is a design goal for the Manual System to be able to inspect at a minimum rate of 30 parts per hour.

3.5.2 It is a design goal for the Automated System to be able to inspect at a minimum rate of 100 parts per hour.

TITLE	SIZE	CAGE CODE	13001321	
ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	A	19200	REVISION LEVEL	- SHEET 2

DRAWING SIZE A

3.6 Operational Modes

3.6.1 The Manual System shall have an operator place a part in the inspection fixture. The operator will then push a dual hand safety interlock switch to start the inspection cycle. The equipment will then scan the item for discontinuities. At the end of the scan the transducers will return to the home position. A green light will indicate an acceptable part. The operator will remove the part and manually mark it in accordance with the marking procedure. A red light will indicate a rejectable part. The operator will remove the part and place it in a secure reject area.

3.6.2 The Automated System shall automatically sequence through the complete inspection cycle which consists of loading the item into the test position, performing the inspection, unloading the test item and segregating acceptable and unacceptable items in a fail safe manner. The accept/reject mechanism shall normally be in a reject position. To move the mechanism to the accept position an accept signal will be required at the end of the inspection cycle. In the automatic mode the system design will be such that once the inspection cycle is started, the operator will have no influence over the system operation. The emergency stop switch will be the only means of stopping the system immediately while the system is set in the automatic mode. If the emergency stop switch is activated or the machine stops due to system failure, the item(s) that have not completed the inspection cycle shall be rejected and may be retested after the cause of the stoppage has been corrected. A normal stop switch will be provided that will allow stoppage while in the automatic mode but only after all units in the system have completed the inspection cycle. Regardless of when the normal stop switch is actuated the part being inspected will complete the inspection cycle. The system design shall provide for continuous operation while set in the automatic mode. That is, the system will continue to sequence through the inspection cycle provided that the next test item is in the loading position. If, while in the automatic mode, the next item is not in the loading position the system will complete the inspection cycle for all units in the system and will then hold until the next test item is in the loading position. When it is positioned for loading the sequencing shall automatically start again unless the stop switch has been actuated.

3.6.2 When the Automated System is set in the manual mode, sequencing through the inspection cycle will require switch actuation to load, inspect, unload and segregate. While in the manual mode the capability to stop the system anywhere in the inspection cycle shall be provided.

3.6.4 The Automated System, while in the automatic mode, shall provide for automatic marking of the test item in accordance with the marking procedure. The marking shall be accomplished in a fail-safe manner. While in the manual mode the system shall not provide for marking. A key switch to allow disabling of the marking device in the automatic mode shall be provided.

3.6.5 The system shall also have a calibrate mode to accommodate a single but complete inspection cycle of a calibration standard or single part.

TITLE	SIZE	CAGE CODE	13001321	
ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	A	19200	REVISION LEVEL	— SHEET 3

DRAWING SIZE A

3.7 The system shall be furnished with audible and visual alarms. A common audible alarm may be used for all channels, however, two separate visual alarms will be required for each channel. One shall provide a reject indicator which will be latched on during the inspection cycle when the intermittent alarm indicates a defect. In the production mode the system shall be designed to provide a second scan if a reject signal is generated during the first scan. That is, the part will be scanned and if a reject signal is generated the system shall automatically reset and immediately rescan the test item. If it passes the second time the test item will be considered acceptable and processed accordingly. If it generates a reject signal in the same area the second time the item shall be considered defective and rejected.

3.7.1 In the Automated System the latched alarm shall continue to indicate a reject until the rejected item actuates a reset switch that will be mounted in an inaccessible position in the reject chute.

3.8 Data acquisition

The system shall be capable of recording and printing the following data:

3.8.1 In the production inspection mode

1. Project/item number
2. Date and time
3. The position along the scan path during which the rejectable flaw signal was detected, with an adjustable resolution of 0.020" x 10.
4. The highest amplitude of rejectable flaw signal detected between scan position increments, recorded in percent (%) of screen height.
5. The number of the monitoring gate(s) that detected rejectable flaw signals.

This mode shall be automatic when flaws are detected during production inspection. This mode shall also be used when details are required to monitor the actual status of the calibration of the system.

3.8.2 In the data reduction mode (Calibration verification mode)

1. Project/item number
2. Date and time
3. Standard notch number only when notch is detected at least two (2) times.

TITLE	SIZE	CAGE CODE	13001321	
ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	A	19200	REVISION LEVEL	— SHEET 4

DRAWING SIZE A

3.9 The inspection system shall have the capability to vary the transducer scanning speed and test item rotational speed. In establishing the limits for these two variables the standard notch design must be taken into consideration. The transducer scanning and test item rotational speeds established for the inspection shall, as a minimum, provide for at least two full engagements of the sound beam with each notch during the inspection cycle. Also in the establishment of the test item rotational speed, the pulse repetition rate (PRR) must be considered. The RPR selected must provide a pulse of sound at intervals of no more than 0.030 inch on the outer periphery of the test item. After establishment of the scanning speed, rotational speed and PRR they shall be automatically monitored each inspection cycle. If during the inspection cycle the above parameters are not met the system shall reject the item under test and indicate a system fault.

3.10 The system shall incorporate automatic verification:

3.10.1 The automatic verification system shall monitor the flaw detection loop which includes the transducer positioning and the pulser/receiver functioning. This system shall assure proper system calibration for each inspection cycle.

3.10.2 The following system characteristics shall be monitored and verified for each inspection cycle:

1. Operation and position of the transducers
2. Operation of the pulsers (amplitude).
3. Operation of the receiver amplifiers (gain/attenuation).
4. Operation of the gates (position, width, and threshold level).

After initial calibration, if for any reason, the auto verification detects deterioration of inspection sensitivity that results in a loss of 3 dB or more, the system shall inhibit and indicate a fault.

After initial calibration, if for any reason, the auto verification detects that the monitoring gates are out of position or width by more than 500 nano seconds, the system shall inhibit and indicate a fault.

After initial calibration, if for any reason, the auto verification detects that the threshold level of any monitoring gate has increased by more than five percent (5%) of screen height, the system shall inhibit and indicate a fault.

3.11 Robust circuitry shall be used throughout the system.

3.11.1 Precaution shall be taken to eliminate conditions that may contribute to the generation of false signals. This would include such features as electrical filtering to suppress spurious electrical signals, shielding to eliminate picking up radio frequency signals and design features that would minimize the adverse effects of the introduction of air into the water during the inspection of the test item.

TITLE ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	SIZE A	CAGE CODE 19200	13001321	
	REVISION LEVEL		—	SHEET 5

DRAWING SIZE A

3.11.2 All electrical panels used in the system shall be provided with a means to control the temperature so that the maximum rated temperature of the equipment is never exceeded. The air circulation system used to provide this control shall be equipped with a filter to remove any contaminants which may have an adverse effect on system reliability.

3.12 A locked cover which will allow visibility of the ultrasonic flaw detector controls, will be provided to prevent access by unauthorized personnel.

3.13 Ultrasonic flaw detection instrumentation.

The ultrasonic inspection instrument, conventionally consisting of a pulser, receiver amplifier, timer, monitoring gates, signal display, and associated controls, shall be designed to allow digital and programmable control of most functions. The following are required, as a minimum:

3.13.1 The receiver/amplifier shall be programmable and digitally controllable over a range of 80db with a resolution of 1db.

3.13.2 To comply with the inspection characteristics verification listed in paragraph 3.10.2 and the requirement for inspection sensitivity compensation per paragraph 3.16.4 it is recommended that multiple gates be used for each scanning transducer.

3.13.3 Each gate shall be individually controllable and programmable for:

1. "Start" with a resolution of 250 nanoseconds.
2. "Width" with a resolution of 250 nanoseconds.
3. "Gain" (for the duration of the gate) with a resolution of 1 dB and a range of 80 dB.
4. "Threshold" (reject level within the gate) with a resolution of five percent (5%) of a one hundred percent (100%) screen height.

All of the above parameters shall be instantly changeable via program at any time during the scan of any transducer. The instant parameter changes shall take place within 0.005" scan length of their programmed actuation point.

3.13.4 Each monitoring gate shall be identified by a number to accommodate the data acquisition requirements of paragraph 3.8 and to identify the channel/transducer that may have failed in case of a fault condition.

3.14 A method shall be provided to couple the ultrasonic energy to the item under test using a liquid. Should a stream or thin film of liquid be used to couple this energy, controls shall be used to monitor the coupling and assure its effectiveness. Should an immersion method be used, a tank shall be provided with the following:

TITLE ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	SIZE A	CAGE CODE 19200	13001321	
	REVISION LEVEL		—	SHEET 6

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3.14.1 Be fabricated of corrosion resistant materials. Dissimilar metals should not be used due to possible electrochemical reactions.

3.14.2 Be large enough to allow easy insertion and removal of the part, contain the support fixture, the transducers with their manipulators and leave sufficient room for convenient adjustment of the transducers.

3.14.3 Have water supply and drainage connections.

3.14.4 Have a filtration system of sufficient capacity to remove particles larger than 15 microns without aerating or inducing vapor into the water.

3.14.5 Provide a temperature control to maintain the water temperature at least 3 degrees Celsius above the temperature of the test item.

3.14.6 Contain water to which a suitable rust inhibitor, wetting agent and fungicide shall have been added.

3.14.7 A means shall be provided to prevent or remove air bubbles from the face of the transducers and the surface of the test item.

3.15 The transducer shall be held in fixtures furnished with the following:

3.15.1 Corrosion resistant materials shall be used throughout.

3.15.2 Adjustments that will allow for all required movements needed to position the transducers into the proper settings. Mechanisms shall be incorporated to facilitate precision adjustment.

3.15.3 A means of securing the transducer at the desired setting which will not impart any transducer movement during locking or allow for any unwanted movement during the inspection cycle.

3.15.4 To facilitate adjustment, it would be desirable to use graduations that will allow for visual indication of all fixture settings.

3.15.5 A design that will minimize transducer vibrations throughout the range of operating speed.

3.15.6 To facilitate adjustment, it would be desirable to use a fixture that is easily accessible when the part is under test.

3.15.7 Transducers will be pulsed in a manner that will not allow cross talk.

3.16 The following are requirements for the transducers:

3.16.1 For each transducer used in the inspection system at least one spare transducer shall be provided.

TITLE ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	SIZE A	CAGE CODE 19200	13001321	
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3.16.2 Transducers, fixed and scanning as required shall be chosen to optimize detection of natural discontinuities as represented by notches contained in the standard(s) referenced in paragraph 2.0.

3.16.3 For each transducer the following data shall be provided:

- A. Beam profile
- B. Real time wave form
- C. Frequency spectrum
- D. Beam focus information

3.16.4 For each scanning transducer covering an area that includes two (2) or more calibration notches, the disparity of the optimum signal amplitudes of those notches shall not exceed 2 dB.

4.0 Standards: standard(s) made in accordance with drawings 13001319 and 13001320 are required.

4.0.1 Measurement of the notches in each referenced standard is best accomplished by use of a replication technique and an optical comparator. One casting material found satisfactory for the replication is room temperature vulcanizing silicone rubber.

5.0 A dynamic test will be conducted at the system vendor's site after the system has been set up in accordance with the operating instructions. A second test will be conducted at the contractor's site to demonstrate the capabilities of the installed inspection system. A plan defining details of these tests will be prepared by the contractor and submitted to the government for approval.

6.0 Government approval:

Government approval is required prior to fabrication or publication of the following:

- A. Inspection system design
- B. Test plans for tests referenced in paragraph 5.0
- C. Specifications for commercial items
- D. Set up procedures
- E. Calibration procedures
- F. Operating instructions
- G. Maintenance and troubleshooting procedures
- H. Verification procedures

TITLE

ULTRASONIC INSPECTION
EQUIPMENT AND PROCEDURE
FOR BODY, 60MM, M720/M888

SIZE

A

CAGE CODE

19200

13001321

REVISION LEVEL

-

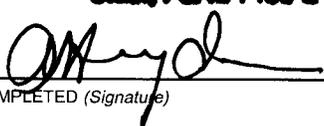
SHEET 8

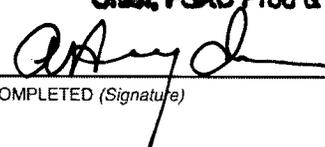
DRAWING SIZE A

7.0 Use of inspection system: as a minimum the standards will be inspected at the beginning, middle, and end of each shift to assure proper system function. If all notches in the standards are not detected twice and rejected, then the system must be adjusted to the proper levels before testing may continue. In the event of a calibration failure, all projectile bodies inspected since the last successful calibration check shall be retested.

8.0 The certified (in accordance with NAS-410) ultrasonic operator of the system shall maintain a logbook. The logbook shall contain, as a minimum, documented use of the standards, number of items inspected, number of suspects and rejects by zone, changing of transducers, instrumentation repairs, reason for malfunctions, if any, and changing of qualified operators. The logbook shall be made available when requested for government review.

TITLE ULTRASONIC INSPECTION EQUIPMENT AND PROCEDURE FOR BODY, 60MM, M720/M888	SIZE A	CAGE CODE 19200	13001321	
	REVISION LEVEL		-	SHEET 9

NOTICE OF REVISION (NOR) THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED		1. DATE (YYYYMMDD) 20020828	Form Approved OMB No. 0704-0188
The public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.			2. PROCURING ACTIVITY NO. R2J2024
			3. DODAAC
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	5. CAGE CODE	6. NOR NO.
a. TYPED NAME (First, Middle Initial, Last) Jeff Ranu	U.S. Army, TACOM-ARDEC AMSTA-AR-FSA-M/ Jeff Ranu Picatinny Arsenal, NJ 07806	19200	
		7. CAGE CODE	8. DOCUMENT NO.
		19200	13001319
9. TITLE OF DOCUMENT Longitudinal Test Standard for Ultrasonic Inspection of 60mm Shell Body	10. REVISION LETTER		11. ECP NO.
	a. CURRENT	b. NEW	R2J2024
	-	-	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Cartridge, 60MM, HE, M888			
13. DESCRIPTION OF REVISION Initial Release of Longitudinal Test Standard for Ultrasonic Inspection drawing, will be released as drawn			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by this NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSA-M		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN Chief, FSAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE	f. DATE SIGNED (YYYYMMDD)	
		20030319	
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature)	c. DATE SIGNED (YYYYMMDD)	

NOTICE OF REVISION (NOR)		1. DATE (YYYYMMDD) 20020828	Form Approved OMB No. 0704-0188
THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED			
<p>The public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p>PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.</p>		2. PROCURING ACTIVITY NO. R2J2024	3. DODAAC
		5. CAGE CODE 19200	6. NOR NO. R2J2024-13001320
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	7. CAGE CODE 19200	8. DOCUMENT NO. 13001320
a. TYPED NAME (First, Middle Initial, Last) Jeff Ranu	U.S. Army TACOM-ARDEC AMSTA-AR-FSA-M Picatinny Arsenal, NJ 07806		
9. TITLE OF DOCUMENT Circumferential Test Standard for Ultrasonic Inspection of 60mm Shell Body	10. REVISION LETTER		11. ECP NO. R2J2024
	a. CURRENT -	b. NEW -	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Cartridge, 60MM, HE, M888			
13. DESCRIPTION OF REVISION Initial Release of Circumferential Test Standard for Ultrasonic Inspection drawing, will be released as drawn			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by this NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSA-M		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN	
d. TITLE	e. SIGNATURE 	DATE SIGNED (YYYYMMDD) 2003 03 19	
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature)	c. DATE SIGNED (YYYYMMDD)	

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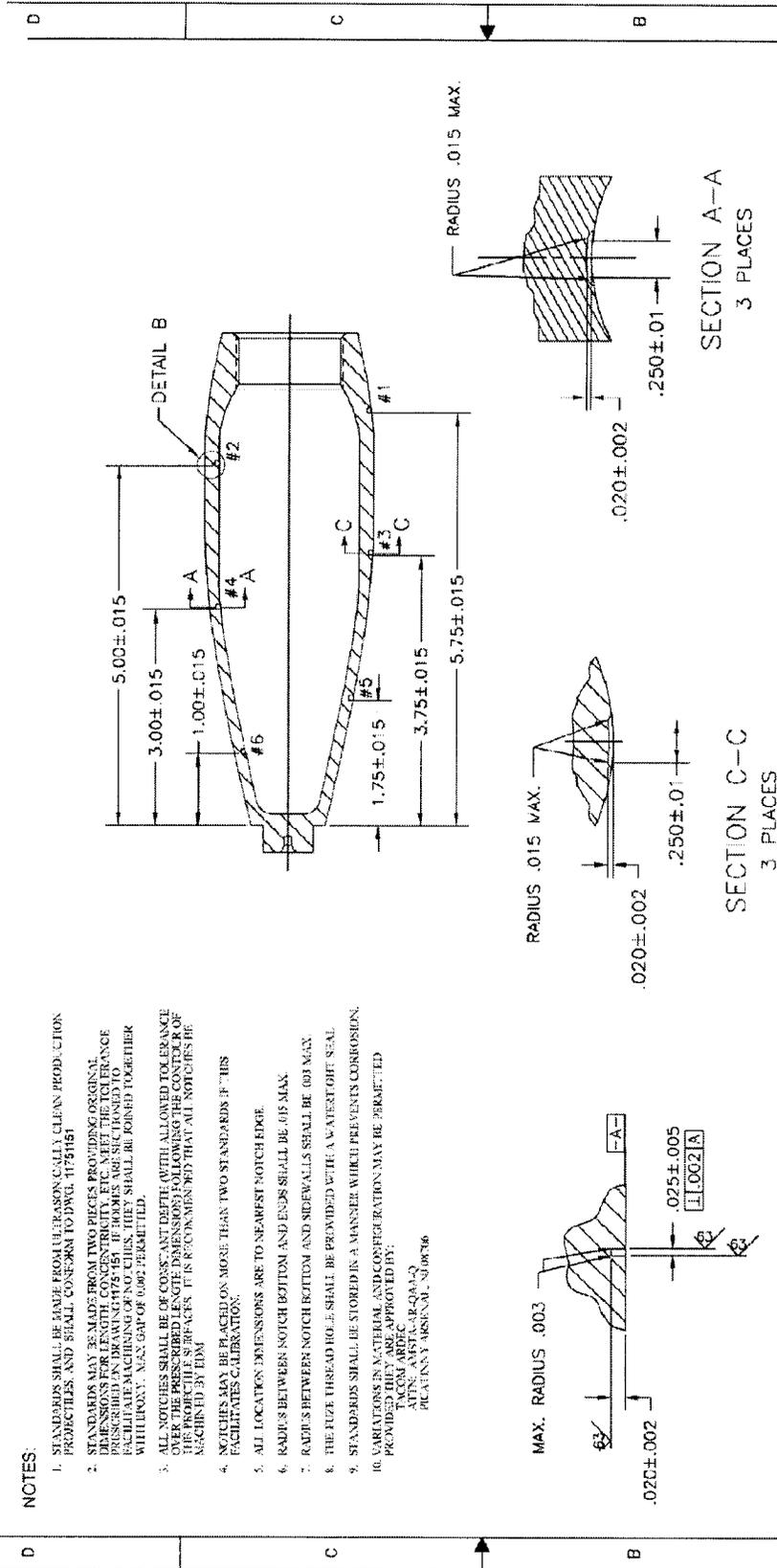
PREVIOUS EDITION MAY BE USED.

Designed using Perform Pro, WHS/DIOR, Aug 96

Distribution Statement A: Unlimited

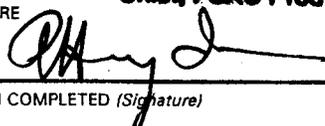
Semi C. Govt & Contractors, controlling DOD office: AMSTA-AR-FSA-M

DRAWING SIZE C	4	3	2	1
REVISIONS				APPROVED
ZONE	TR	DESCRIPTION	DATE	DATE



PART NO. 13001320		U.S. ARMY AVIATION RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PLATTENET ARSENAL, NEW JERSEY 07065-5000	
CIRCUMFERENTIAL TEST STANDARD FOR ULTRASONIC INSPECTION OF PROJECTILE BODY, 60MM		DATE CODE	UNIT WT.
C	19200	13001320	SHEET
CONTRACT NUMBER		DESIGN ACTIVITY	
CONTRACTOR		U.S. ARMY AVIATION RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PLATTENET ARSENAL, NEW JERSEY 07065-5000	
MAN BY	DATE (YR-MO-DA)	CHECKER	ENGINEER
DRAWING APPROVAL		DRAWING APPROVAL	
TECHNICAL PROPERTIES	DO NOT SCALE DRAWING	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL FRACTION	
YP	2 PL ±	THIRD ANGLE PROJECTION	
TS	3 PL ±	MATERIAL	
EL2		NEXT ASSY	
PA		APPLICATION	
BH			
RH			

SMCAR FORM 67, 1 DEC 57(EMP), REPLACES SMCAR FORM 67, 1 MAR 67(EMP), WHICH MAY BE USED UNTIL EXHAUSTED.

NOTICE OF REVISION (NOR) THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED		1. DATE (YYMMDD) 02 10 09	Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington DC 20503. PLEASE DO NOT RETURN YOUR COMPLETED FORM TO EITHER OF THESE ADDRESSES. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.			2. PROCURING ACTIVITY NO. R2J2024
4. ORIGINATOR		5. CAGE CODE	6. NOR NO.
a. TYPED NAME (First, Middle Initial, Last) Michael B. Voit	b. ADDRESS (Street, City, State, Zip Code) US Army - ARDEC AMSTA-AR-QAA-C Picatinny Arsenal, NJ 07806-5000	19200	1 of 1
		7. CAGE CODE 19200	8. DOCUMENT NO. MIL-P-48400
9. TITLE OF DOCUMENT Projectile, 60mm, HE, M720 (or M888) Metal Parts Assembly		10. REVISION LETTER	
		a. CURRENT A + Amd 5	b. NEW
11. ECP NO. R2J2024			
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES Body, 60mm, HE, M720 or M888			
13. DESCRIPTION OF REVISION Delete paragraphs 1 through 6 and Figures 2, 3, and 4 in their entirety and substitute the following new paragraphs 1 through 6 and Figures 1, 2, and 3. See attached.			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by this NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM-ARDEC, AMSTA-AR-FSA-R		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERIAN Chd, FBAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE 		f. DATE SIGNED (YYMMDD) 20030319
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature)		c. DATE SIGNED (YYMMDD)

1. SCOPE

1.1 This specification covers Projectile, 60MM, HE, M720 (or M888) Metal Parts Assembly.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

TT-C-490 - Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings

STANDARDS

Department of Defense

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

PRODUCT AND PACKAGING DRAWINGS

US Army ARRADCOM

7548319 - Box, Fiberboard Ammunition for Interplant Shipment of Projectile, Empty
11751150 - Projectile, 60mm, HE, M720 (or M888) Metal Parts Assembly

INSPECTION EQUIPMENT DRAWINGS

13001319 - Longitudinal Test Standard for Ultrasonic Inspection of Projectile Body, 60mm
13001320 - Circumferential Test Standard for Ultrasonic Inspection of Projectile Body, 60mm
13001321 - Ultrasonic Inspection Equipment and Procedure for Body, 60mm, M720 (or M888)

(Copies of specifications, standards, drawings, and publications required by supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

ANSI-B46.1 - Surface Texture

(Application for copies should be addressed to the American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.)

ASTM Method E-8 - Tension Test of Metallic Materials
ASTM Method E-10 - Brinell Hardness of Metallic Materials
ASTM Method E-18 - Rockwell Hardness and Rockwell
Superficial Hardness of Metallic
Materials
ASTM Method B-117 - Salt Spray (Fog) Testing

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

3. REQUIREMENTS

3.1 General. Materials, parts, and assemblies shall comply with all requirements specified on drawing 11751150 and associated drawings and with all requirements specified in applicable specifications and standards. The materials specified on drawing 11751150 were selected to provide high fragmentation.

3.2 Stress-relief. Each projectile body shall be cold worked and stress-relieved to the required physical properties.

3.3 Mechanical properties. All components shall meet the mechanical properties requirements as specified on the applicable drawings.

3.3.1 Micro-structure test. The projectile shall be sectioned and microstructure specimen shall meet the minimum of 90% spheroidization that is comparable to the degree of spheroidization depicted in Figure 2.

3.4 Metal defects. Using white light, each body assembly shall be found to be free from defects in the metal matrix and discontinuities that depart from the profile of the interior or exterior shape, when inspected prior to nosing, before and after phosphating, and after painting. These defects include, but are not limited to, cracks, splits, bursts, solid shuts, pipes, porosity, inclusions, tears, fissures, blow holes, folds, seams, scale, fins, draw marks, laminations, embedded foreign matter, pits, sharp edges, burrs, dents, depressions, and material missing from the matrix. The components and assemblies accepted during first article shall be used as internal and external visual standards during production unless other mutually acceptable standards are established.

3.4.1 Metal soundness. After passing the hydrotest, bodies shall be free from defects that produce an ultrasonic signal equal to or greater than the signals produced by the defects depicted on drawing 13001321.

3.5 Protective coating. Protective coating shall be in accordance with the applicable drawing and the specifications referenced thereon.

3.6 Proving ground test. Projectiles fired at maximum average pressure shall not break up in the mortar tube, or lose any assembled metal parts during flight, clearly attributable to a body material defect or the body manufacturing process.

3.7 Workmanship. The requirements for workmanship are as shown on the applicable drawings in the applicable specifications and the following:

3.7.1 Surface finish. The requirements for surface finish shall be as detailed on the applicable drawing.

3.7.2 Threads. Threads shall be full and undamaged for entire minimum length as required by the applicable drawings.

3.7.3 Burr. No part shall have a burr which might interfere with the assembling of the round or which might be injurious to personnel handling the item.

3.7.4 Foreign matter. No part or assembly shall contain dirt, grease, chips, rust, corrosion, or other foreign matter. Particular attention be given to the cavity of the body assembly, to insure that no grit, scale, or other foreign matter remains therein after final cleaning.

3.8 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.

3.9 Hydrotest. Each body shall successfully withstand an internal hydrostatic test load of 9500 + 500 psi prior to machining the obturating band groove when tested in accordance with 4.5.5 without cracking, leakage, rupture, or permanent deformation.

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 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements. Unless otherwise specified herein or in the contract, the provisions of MIL-STD-1916 shall apply and are hereby made a part of this detail specification.

4.1.1 Responsibility for compliance. All items shall meet all requirements of Sections 3 and 5. The inspections 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.

4.2 Classification of inspections. The following types of inspection shall be conducted on this item:

- a. First Article Inspection
- b. Quality Conformance Inspection

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 provisions of 4.3.2. The first article sample shall consist of five (5) painted and five (5) unpainted projectile bodies in addition to the following quantities.

<u>TEST</u>	<u>TEST PARAGRAPH</u>	<u>TEST QUANTITY</u>
a. Maximum average pressure test	4.5.4.1	5 complete projectile assemblies

4.3.2 Inspections to be performed. The first article parts submitted in accordance with paragraph 4.3.1 will be inspected at a Government laboratory for all the requirements of the applicable drawing specification.

4.3.3 Rejection. See MIL-STD-1916.

4.4 Quality conformance inspection.

4.4.1 Lot numbering and lot formation. Lot numbering shall be in accordance with MIL-STD-1168. Lot formation shall be in accordance with the lot formation requirements of MIL-STD-1916, paragraph 4.4.2 and the following:

4.4.1.1 Stress-relieved lot. A stress-relieved lot shall contain bodies from not more than one mill heat of steel, that have been cold worked and then (final) stress-relieved in the same heat-treatment equipment, at the same temperature and time (if a batch-type furnace is used), in one unchanged process. If a continuous furnace is used, when stress relief begins on a new mill heat of steel, the furnace must be at operating temperature continuously from the time that the first body enters until the time that the last body exits, in order for the product to be considered a single stress-relieved lot. A body shall not be re-heat treated without Government approval if it fails to meet the yield strength or elongation requirement cited on drawing 11751151.

4.4.1.2 Body lot. A body lot shall consist of body assemblies produced by one manufacturer under one contract in one unchanged process, in accordance with the same drawing revision and specification revision under conditions of a continuous production, free of interruptions other than those due to the end of shift day or work week. Any stress-relieved lot that has complied with the

mechanical property requirements of drawing 11751151 may be re-grouped for delivery into a body lot. A body lot may contain bodies from more than one mill heat of steel.

4.4.1.3 Miscellaneous lot. A miscellaneous lot shall consist of bodies produced from more than one mill heat of steel, which have been worked and (final) stress relieved at the same temperature and time in one unchanged process.

4.4.2 Examinations and tests.

- a. For the conformance inspection paragraphs (4.4.2.2 to 4.4.2.5), the definitions of major and minor defects are provided in paragraph 3 of MIL-STD-1916. See 6.10 herein for the definition of Critical I and Critical II characteristics.
- b. Alternative conformance acceptance. Unless otherwise specified herein or provided for in the contract, alternate conformance procedures may be proposed by the contractor (see paragraph 4.1 of MIL-STD-1916).

4.4.2.1 Tool control dimensions. Dimensions marked tool control (see drawing) shall be gaged at the beginning or end of each working day (24 hrs), during first article inspection and for the first component after each tooling change, adjustment, or repair. Where destruction of the component is necessary to gage such dimensions, measurements of the tool may be substituted provided the contractor has established correlation between the tool dimensions and the component dimensions prior to the start of production. When acceptability has been determined, visual inspection of tool control dimensions will be permitted. If any tool control dimension(s) is in doubt during visual inspection, the dimension(s) shall be immediately gaged to determine acceptability. Corrective action will immediately be instituted by the contractor whenever a defective tool control dimension is found and all material produced since the last successful inspection shall be rejected.

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 1 of 2		DRAWING NUMBER	
4.4.2.2	M720/M888 Body (prior to phosphating)			11751151	
				NEXT HIGHER ASSEMBLY 11751150	
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>CRITICAL I</u>					
1.	Hydrotest		100%	3.9 <u>1</u> /	4.5.5
<u>CRITICAL II</u>					
A.	Metal soundness (ultrasonic inspection)		100%	3.4.1	Gage
B.	Metal defective (prior to nosing)		100%	3.4	Visual/4.5.2.2
C.	Major diameter of rear (male) thread, min.		100%	3.1	Gage
D.	Metal defective (prior to phosphating)		100%	3.4	Visual/4.5.2.2
E.	Presence of embedded foreign matter in the cavity (see 6.10)		100%	3.4	Visual/4.5.2.2
<u>MAJOR</u>					
101.	Weight		VL-IV	3.1	Approved Scale
102.	Runout of pitch diameter of nose thread with bourrelet and front face		VL-IV	3.1	Gage
103.	Runout of pitch diameter of rear thread with bourrelet and rear shoulder		VL-IV	3.1	Gage
104.	Runout of ogive with bourrelet		VL-IV	3.1	Gage
105.	Runout at rear of body with bourrelet		VL-IV	3.1	Gage
106.	Runout of obturating ring groove with bourrelet		VL-IV	3.1	Gage
107.	Diameter of bourrelet		VL-IV	3.1	Gage
108.	Diameter of obturating ring groove		VL-IV	3.1	Gage
109.	Diameter of forward basic length on taper rear of bourrelet		VL-IV	3.1	Gage
110.	Diameter at middle basic length on rear of bourrelet		VL-IV	3.1	Gage
111.	Diameter at rear basic length on taper near base end		VL-IV	3.1	Gage
112.	Location of basic diameter on ogive (front)		VL-IV	3.1	Gage
113.	Location of basic diameter on ogive (rear)		VL-IV	3.1	Gage
114.	Thickness of wall ogive area		VL-IV	3.1	Gage
115.	Thickness of wall at bourrelet		VL-IV	3.1	Gage
NOTES: Note <u>1</u> / This test is performed prior to machining the obturator groove.					

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 2 of 2		DRAWING NUMBER	
4.4.2.2 (cont.)	M720/M888 Body (prior to phosphating)			11751151	
				11751150	
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>MAJOR</u>					
116.	Thickness of wall at rear taper		VL-IV	3.1	Gage
117.	Thickness through base		VL-IV	3.1	Gage
118.	Width of obturating ring groove		VL-IV	3.1	Gage
119.	Surface finish of cavity improper		VL-IV	3.7.1	Visual (see 6.3)
120.	Presence of burrs in threads		VL-IV	3.4	Visual
121.	Pitch diameter of forward thread		VL-IV	3.1	Gage
122.	Minor diameter of forward thread		VL-IV	3.1	Gage
123.	Pitch diameter of rear thread		VL-IV	3.1	Gage
124.	Length of thread boss		VL-IV	3.1	Gage
125.	Rear thread effective length <u>1</u> /		VL-IV	3.1	Gage
126.	Length of nose thread		VL-IV	3.1	Gage
<u>MINOR</u>					
201.	Diameter of rear thread chamfer		VL-II	3.1	Gage
202.	Diameter of rear thread undercut (if applicable)		VL-II	3.1	Gage
203.	Length from front face to rear shoulder		VL-II	3.1	Gage
204.	Length of rear thread boss		VL-II	3.1	Gage
205.	Location of obturating ring groove		VL-II	3.1	Gage
206.	Width of rear thread undercut (if applicable)		VL-II	3.1	Gage
207.	Angle at rear of obturating ring groove		VL-II	3.1	Gage
208.	Radii of chamfers missing or incorrect		VL-II	3.1	Visual (see 6.3)
209.	Surface finish improper (except as otherwise classified)		VL-II	3.7.1	Visual (see 6.3)
210.	Burr		VL-II	3.7.3	Visual
211.	Presence of foreign matter (except as otherwise classified)		VL-II	3.7.4	Visual
NOTES: <u>1</u> / Major diameter shall be checked to full form for minimum length.					

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE				DRAWING NUMBER
4.4.2.2a	M720/M888 Body (after phosphating, prior to painting)	SHEET 1 of 1			11751151
					NEXT HIGHER ASSEMBLY 11751150
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>CRITICAL I</u>	None Defined				
<u>CRITICAL II</u>					
A.	Metal defective		100%	3.4	Visual/4.5.2.2
<u>MAJOR</u>					
101.	Phosphate coating missing or inadequate		VL-IV	3.1	Visual
<u>MINOR</u>					
201.	Evidence of poor workmanship		VL-II	3.7	Visual
NOTES :					

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 1 of 1		DRAWING NUMBER	
4.4.2.3	M720/M888 Metal parts assembly (after painting)			11751150	
				NEXT HIGHER ASSEMBLY 9236378	
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>CRITICAL I</u>					
1.	Proving ground test		100%	3.6 <u>1</u> /	4.5.4
<u>CRITICAL II</u>					
A.	Metal defective		100%	3.4	Visual/4.5.2.2
B.	Hydrostatic stamp test missing		100%	3.1	Visual
C.	Ultrasonic stamp test missing		100%	3.1	Visual
<u>MAJOR</u>					
101.	Diameter of bourrelet, max.		VL-IV	3.1	Gage
102.	Paint in cavity inadequate		VL-IV	3.1	Visual
103.	Pool of paint in cavity		VL-IV	3.1	Visual
104.	Thread(s) damaged or not full		VL-IV	3.1	Visual
105.	Presence of paint in threads		VL-IV	3.4	Visual
<u>MINOR</u>					
201.	Corrosion preventive compound missing from threads and indicated surfaces		VL-II	3.1	Visual
202.	Presence of foreign matter (except as otherwise classified)		VL-II	3.7.4	Visual
203.	Paint not dry		VL-II	3.1	Visual/Tactile
204.	Paint inadequate or damaged		VL-II	3.1	Visual
205.	Marking missing, incorrect or illegible		VL-II	3.1	Visual
NOTES: <u>1</u> / See 4.4.3.3.					

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE		SHEET 1 of 1		DRAWING NUMBER
4.4.2.4	Box, Fiberboard (prior to sealing)				7548319
					NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>CRITICAL I</u>	None Defined				
<u>CRITICAL II</u>	None Defined				
<u>MAJOR</u>	None Defined				
<u>MINOR</u>					
201.	Support missing or damaged		VL-II	3.1	Visual
202.	Separator missing or damaged		VL-II	3.1	Visual
203.	Improper assembly		VL-II	3.1	Visual
204.	Incorrect number in box		VL-II	3.1	Visual
NOTES:					

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE				DRAWING NUMBER
4.4.2.5	Box, Fiberboard (after sealing)	SHEET 1 of 1			7548319
					NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	NO. OF SAMPLE UNITS	AQL OR 100%	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE / INSPECTION METHOD
<u>CRITICAL I</u>	None Defined				
<u>CRITICAL II</u>	None Defined				
<u>MAJOR</u>	None Defined				
<u>MINOR</u>					
201.	Box damaged, cut, or gouged through all layers		VL-II	3.1	Visual
202.	Box not completely sealed		VL-II	3.1	Visual
203.	Contents loose		VL-II	3.1	Visual/Manual
204.	Marking missing, incorrect, or illegible		VL-II	3.1	Visual
NOTES :					

4.4.3 Inspection testing. The following tests shall be performed in accordance with the provisions of 4.5.

4.4.3.1 Mechanical properties.

4.4.3.1.1 Tensile test sample selection (hardness test). A minimum of fifty (50) bodies from each stress-relieved lot (from a batch-type furnace) shall be randomly selected from different locations within the furnace load, and tested for relative hardness in accordance with 4.5.1.1 after all cold working and stress relief operations have been completed. If a miscellaneous lot is tested, the sample size for hardness tests shall be 100%.

Hardness indentations shall be made in the zone where the obturating band groove will later be machined. Except for miscellaneous lots, the hardest and softest bodies from this group shall be subjected to tension testing in accordance with 4.5.1.2. If any tension test specimen fails to achieve the required yield strength or elongation, all bodies from that lot shall be hardness tested; harder or softer bodies as applicable shall be selected and additional tension tests shall be performed until the range of hardness has been established that correlates with acceptable tensile results. For miscellaneous lots, the three (3) hardest and three (3) softest bodies shall be made into tensile specimens. All tensile specimens must meet the required yield strength and elongation in order to accept all the bodies in that miscellaneous lot.

If a continuous furnace is used, a minimum of the first twenty-five (25) bodies, and five (5) per hour thereafter shall be selected for hardness testing, provided that a single stress-relieved lot is being processed (see 4.4.1.1). 100% hardness testing and tripling of the tensile specimen sample size also applies to miscellaneous lots when a continuous furnace is used. If harder or softer bodies are found than were in the original 25, new tensile specimens shall be made from those bodies to widen the acceptable hardness range, or trigger 100% hardness screening if any specimen failed to meet the required yield strength or elongation.

If 100% hardness screening is required on bodies that have had the obturating band groove machined, then the new indentations shall be made on the bourrelet, followed by removal of any upset metal.

4.4.3.1.2 Tensile test. Two (2) specimens each shall be fabricated from the hardest and softest bodies selected from the hardness test in 4.4.3.1.1; four (4) specimens, total. If a miscellaneous lot is tested, the three (3) hardest and softest bodies shall be selected, for a total of twelve (12) tensile specimens. All specimens must meet the minimum requirements for both yield strength and elongation shown on drawing 11751151. The failure of any specimen to meet either requirement shall be cause for the initial rejection of all bodies from the applicable stress-relief lot. Harder or softer bodies as applicable shall be selected, new tensile specimens made, and 100% hardness screening performed as described in 4.4.3.1.1 in order to deliver only those bodies whose hardness correlates with acceptable yield strength and elongation. If any failures occur on a miscellaneous lot, the lot shall be rejected and not screened.

The specimens shall be the largest round specimens obtainable in conformance with the proportions shown in ASTM E8, except that the grip areas may be less than full round sections. The tensile specimens may be fabricated prior to machining the obturating band grooves. The center of the tensile test specimens shall be from the center or rear of the zone where the obturating band groove would normally be located.

4.4.3.1.3 Microstructure test.

4.4.3.1.3.1 Heat treatment batch. The samples selected in accordance to 4.4.3.1.2 shall be tested to determine the degree of spheroidization. Failure of the specimen to exhibit the degree of spheroidization depicted in the standard (see Figure 2) shall be cause for rejection of the heat treatment batch when tested as specified in 4.5.1.3. When it has been determined that the microstructure specimens comply, the furnace temperature and time shall be established and maintained throughout spheroidization operation. An advisory spheroidization cycle is 1290°F at heat for 24 hours. At no time during the process shall the critical temperature of 1300°F maximum be exceeded in any thermal treatment after spheroidization.

4.4.3.2 Salt spray test. (See 4.5.3) In performing the following tests, TT-C-490 shall apply unless specified otherwise herein. The tests shall be performed for first article inspection, each day of painting during production and whenever a change is made to the paint process, until all samples from five (5) consecutive days of painting have passed the test. Thereafter the sample frequency may be reduced to twice per week during continuous days of painting. Five (5) specimens shall be selected, consisting of randomly chosen projectiles which have been processed through all the same cleaning, phosphating, painting and drying steps at the same time using the same equipment as other production projectile bodies. The samples shall be taken from each continuous final paint operation up to 24 hours long. One projectile shall be taken during the first thirty (30) minutes of painting, one during the last thirty (30) minutes and the others at any other time.

Prior to salt spray testing, two (2) of the specimens must only pass an adhesion test using the procedures and pass-fail criteria contained in 4.2.8 and 3.5.6 respectively, of TT-C-490. If both specimens pass the adhesion test, the three (3) remaining specimens shall be scored lengthwise using a precision scribing tool/insert or equivalent in preparation for the salt spray test.

4.4.3.3 Proving ground test. (See 3.6)

4.4.3.3.1 Maximum average pressure. (See 4.5.4.1) Five (5) projectiles shall be tested from the first article sample, from each of the first three (3) production lots and from three (3) consecutive lots when a new mill heat of steel is introduced into production. Defect classification and individual accept/reject criteria shall be in accordance with Table I.

Table I Proving Ground Test

Maximum Average Pressure Phase

<u>Category</u>	<u>Defect</u>	<u>Accept/Reject</u>	
<u>Critical</u>	Premature burst or metal part breakup	0	1
<u>Critical</u>	Horizontal range less than 80% of average range	0	1

4.4.4 Inspection equipment. The inspection equipment required to perform the examinations and tests prescribed herein is described in the 'Paragraph Reference/Inspection Method' column in the tables starting with paragraph 4.4.2.2. The contractor shall submit for approval inspection equipment designs in accordance with the terms of the contract (see 6.2).

4.5 Test methods and procedures.

4.5.1 Mechanical properties.

4.5.1.1 Hardness test. (See 4.4.3.1.1) The test shall be performed using any automates tester that will produce accurate, repeatable results with readings for an acceptable projectile between 25-80% of the full scale capability of the test equipment. When the Brinell hardness test is used, equipment and procedures shall be as prescribed in ASTM Method E-10, except that the minimum dwell time shall be five (5) seconds, otherwise operating procedures shall be as specified by the applicable equipment manual, standard ASTM test methods and the following subject to approval by the Government Representative:

- a. The surface of the body in the area to be hardness tested shall be prepared by machining or grinding to a depth sufficient to remove the decarburization zone. (Note: Impressions shall be completely removed by machining of the obturating band groove or final machining.)
- b. The hardness tester calibration shall be tested at start up, at least once each four (4) hours of continuous operation or after a layoff of three (3) or more hours.
- c. The body shall be fixtured so that no rocking, shifting or deflection of the body will occur during the test.
- d. The hardness tester shall not produce indentations deeper than fifty 50% of the indenter ball diameter or 25% of the wall thickness of the projectile in that zone.
- e. Hardness readings shall be taken at least ten indenter ball diameters apart. At least two (2) readings shall be taken and averaged on each projectile.

4.5.1.2 Tension testing. From each sample selected for testing in accordance with 4.4.3.1.1, two (2) tension test specimens (one (1) bourrelet area, one (1) boat tail area) conforming to the largest obtainable standard or subsize flat or round specimen as prescribed by

ASTM Method E-8 shall be taken longitudinally from opposite sides of the body, 180 degrees apart. The number of specimens and their location is to determine the acceptability of the mechanical properties requirements. With the approval of the procuring agency, the Government shall not be restricted from testing additional specimens to determine that the mechanical properties meet the drawing requirements. Procedures and criteria for determining yield strength, elongation, reduction in area and tensile strength shall be as prescribed by ASTM Method E-8 except that elongation shall be measured to the nearest thousandth (0.000) prior to conversion into percent elongation. Percent elongation shall be recorded to the nearest tenth (0.0).

4.5.1.3 Microstructure test.

4.5.1.3.1 Stress-relieved lots. A sample shall be selected for determining percent spheroidization. The sample shall be removed from the hardest body(ies) undergoing tensile testing, from an area approximately 2.5 inches forward of the fin shoulder. The surface of the sample representing the longitudinal cross section shall be ground and polished for metallurgical examination. After polishing, the specimen shall be etched in nital reagent (97% ethyl alcohol - 3% nitric acid) to reveal the microstructure. The specimen shall be examined at 750X-800X magnification and compared with the standard (Figure 2) to determine degree of spheroidization. Figures 1 and 3 are provided for comparison purposes. If any specimen fails the 90% spheroidization requirement, the applicable stress-relieved lot shall be rejected.

4.5.2 Metal defects inspection.

4.5.2.1 Before paint (metal soundness). After hydrotesting, each body shall be ultrasonically inspected to determine compliance with the requirements of 3.4.1. The body shall be final machined except for the obturating band groove, and shall have no protective coating.

The body shall be ultrasonically inspected using ultrasonic energy at right angles to assure that orientation does not prevent detection of a defect. The equipment and procedures shall be in accordance with 4.5.2.1.1. Standards in accordance with 4.5.2.1.3 shall be used to check the effectiveness of the inspection process. Any body failing to meet the requirements shall be classed defective and removed from the lot. All bodies rejected by ultrasonics shall be visually inspected at the location of the ultrasonic indication. An ultrasonic critical defect shall be defined as any ultrasonic reject that has a visual crack or pipe, or a visual defect other than a crack or pipe (lap, fold, seam, etc.) that has an ultrasonic signal that is twice the level of the ultrasonic standard notch for that area. Visual defects other than cracks or piping with less than twice the level are not considered critical but shall be rejected.

4.5.2.1.1 Equipment and procedures. The ultrasonic inspection shall be performed with the use of a liquid to assure a reliable coupling to transmit ultrasonic energy. Should a stream or thin film of liquid be used to couple this energy, controls shall be used to monitor the coupling and assure its effectiveness. Such monitoring is not required if submergence in a liquid is used.

Using ultrasonic energy at right angles requires at least two (2) separate sources of ultrasonic energy. This means that in the wall and bourrelet ultrasonic regions, ultrasonic energy shall move within the walls of the body with separate significant axial or circumferential components of velocity to detect flaws located on the outside, inside or within the walls. For the base region, significant ultrasonic velocity components shall separately be radial and circumferential.

Criteria for detection of cracks are machined notches, which simulate actual larger cracks. Details are contained on drawings 13001319 and 13001320. All notches machined on the standards are targets for rejection. That is, any body that sends back an echo signal that is equal to or greater than the signal from the standard shall be rejected. Relief portions or radially oriented notches where the full depth approaches the surface are not inspection criteria.

4.5.2.1.2 Calibration and operation procedures and equipment. See 6.2. As a minimum, the adequacy of the inspection process shall be checked by using the standards (see 4.5.2.1.3) at the start and finish of each production shift and change in operator, as well as at the shift midpoint during production. All channels shall properly indicate a rejection signal when encountering the notches of the defect standards. If the inspection process is determined to be inadequate, the condition shall be corrected and all items inspected since the last acceptable inspection check shall be reinspected. Equipment used shall provide for a positive activation of a buzzer or alarm as well as a light system for each channel to alert the operator of the signal indications that are the criteria for rejection.

4.5.2.1.3 Ultrasonic standards. The ultrasonic inspection standards shall be provided by the contractor for use during the ultrasonic inspection. The standards shall be machined from an acceptable body in accordance with drawings 13001319 and 13001320, and shall be inspected for all drawing requirements to determine their acceptability prior to use (see 6.9).

4.5.2.2 Metal defects visual inspection. Body and body assembly visual inspection shall consist of internal and external examination for defects using any type of lighting that will facilitate good inspection of all surfaces. Standards shall be referred to if a questionable indication is found. If the standards do not resolve the question, the indication shall be rejected until a mutually acceptable standard is established. Body or body assemblies exhibiting indications suspected of being shallow surface defects shall have involved areas that are blended with adjacent surfaces to ensure that no sharp edges, steps or gouges remain. The involved areas shall be independently checked for verification that all applicable drawing characteristics are within acceptable limits.

4.5.3 Salt spray test. The salt solution, test equipment and drying procedures shall be in accordance with ASTM B117, Salt Spray (Fog) Testing, unless specified otherwise herein. Specimens shall be positioned between 15 and 30 degrees from vertical during the test. No coating of any kind shall be permitted over the paint on stamp marks of the specimens prior to testing, however, areas in contact with racks or supports, unpainted surfaces and areas within 0.125 inch of unpainted surfaces may be protected.

When examining the specimens for signs of paint failure, the significant surface shall be 60 degrees on either side of a scribe line drawn down the length of the body except in the obturator groove, and within 0.125 inch from any edges.

See 6.10 for the definitions of blisters, pits, and spots. Blisters that are present when the test is over are to be counted within five minutes of removal from the test chamber.

Bodies shall be tested for the duration specified on drawing 11751150. After testing, any body that fails for any of the following reasons shall be cause for rejection of all bodies painted since the last successful test and a return to the original sampling plan if the failure occurred during the reduced sampling. The failure criteria in a-i apply to the significant surfaces only.

- a. The paint shows more than 0.125 inch creepage, blistering, or loss of adhesion of paint from the scribe mark, stamp mark, or edge.
- b. There are more than five (5) blisters total.
- c. Any blister exceeding 0.0625 inch average diameter.
- d. Any pit exceeding 0.125 inch average diameter.
- e. There are four (4) or more scattered pits exceeding 0.0625 inch average diameter.
- f. There are three (3) or more spots within one (1) square inch.
- g. There are two (2) spots within one (1) square inch in three (3) or more places.
- h. There are more than seven (7) scattered spots, total.
- i. There is evidence of rust under the paint (a brown discoloration showing through the paint) in excess of 0.25 inch in diameter total area.
- j. There is some variation of the above that the Government Representative deems excessive, or an unlisted defect such as inadequate paint coverage anywhere on the body, including the obturating band groove.

4.5.4 Proving ground tests.

4.5.4.1 Maximum average pressure. The bodies provided for this test shall be inert loaded to service weight and assembled with dummy fuzes into complete rounds. Firing tests shall be conducted in a mortar for which the round is standard. The tube shall have a minimum of 25 percent life remaining, based on current mortar tube condemnation criteria. The propelling charge will be adjusted to obtain 9363-10,050 psi with cartridges conditioned at 70°F. The test shall be performed at a Government proving ground in accordance with the applicable acceptance test procedure. Photographic equipment shall be set up near the gun muzzle to record the flight of the projectile. Provisions shall be made to recover any projectiles deemed questionable, otherwise recovery is not necessary.

4.5.5 Hydrotest. After the wall thickness is in conformance with final size but prior to machining the obturating band groove, each projectile shall be subjected to an internal hydrotest to determine compliance with the requirements of 3.9. Each projectile that successfully passes the hydrotest shall be stamped "H" 0.125 inch

high by 0.01 inch deep approximately 0.35 inch below the location of the zone used for projectile nomenclature immediately after removal from the hydrotest equipment. Projectile bodies shall be tested using equipment capable of performing the test accurately and consistently. During the test, the pressure will be applied gradually until the required minimum pressure is reached and held for five (5) seconds, minimum. The equipment shall be calibrated prior to the start of each day's operation and at intervals of not over four (4) hours of continuous operation. It shall also be calibrated prior to restarting the operation after a lay-off of three hours or more. If it has been found that the equipment is out of calibration in such a direction that the pressure was actually lower than required by the test, the bodies tested since the last satisfactory calibration shall be retested after the calibration error has been corrected. Projectile rupture, cracking, leakage, or bulging during the test shall be cause for rejection of the body. The test fixture shall not restrict the projectile body from expanding longitudinally or radially under pressure. Protective barriers should be installed where applicable to shield operators and material from metal fragments that may come from defective projectiles that fail the test. If threads are engaged, the hydrotest plug should be designed with a one quarter inch minimum thread relief, to prevent loading of initial threads on the projectile body. Examination should be made of all hydrotest plugs after projectile is blown during testing. Badly nicked or damaged plugs may cause destruction of acceptable items.

5. PREPARATION FOR DELIVERY

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.1). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

6.1 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Requirements for First Article (see 4.3).
- d. Requirements for acceptance inspection equipment (AIE) designs (see 6.2).
- e. Requirements for Ammunition Data Cards (see 6.7).
- f. Certificate of Conformance requirement for each lot of material and each lot or shipment of product.
- g. Requirements for the establishment of visual standards at First Article and whenever anomalies occur during production.
- h. Requirements for operator qualification (see 6.8).

6.2 Submission of contractor inspection equipment designs and procedures for approval. Contractor inspection equipment designs

shall be submitted for Government approval as specified in the contract. Designs that provide variable measurements instead of attributes data are preferred in order to facilitate the use of statistical process control. Calibration of the furnaces by an independent method shall be performed every eight (8) hours or at intervals approved by the Government, to ensure adequate control of temperature fluctuations and time at temperature. Monitoring of the charts on each furnace used for heat treatment or stress-relief shall be performed hourly. Prior to initiation of ultrasonic inspection, the contractor shall submit one copy of his proposed procedures for written approval including a description of the equipment (contractor design) and operation procedures. No change to the procedures shall be made after the original approval without submission and approval of the proposed changes. Submit copies of designs and procedures as required to:

Commander
U.S. Army TACOM-ARDEC
ATTN: AMSTA-AR-QAA-C
Picatinny Arsenal, NJ 07806-5000

6.3 Visual examination qualifications. When compliance with the applicable classification of defects is in doubt as a result of visual examination, this characteristic may be measured or gaged to determine acceptability. The roughness comparison specimens prescribed by ANSI-B46.1 may be used as a basis for surface roughness determination when applicable.

6.4 Visual standards. Visual standards to be established at contractor's plant in accordance with 3.4.

6.5 Calculation of sample standard deviation. The sample standard deviation will be calculated using the following formula or its equivalent:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

\bar{x} = Average value for the sample mean
 x = Numerical value for individual operations
 s = Sample standard deviation
 n = Sample size

6.6 Submission of first article sample. Instructions as to the location for evaluation of the first article sample shall be obtained from the contracting officer. Upon receipt of each request, the contracting officer shall advise ARDEC and instructions will be issued accordingly. All inquiries should be forwarded to:

Commander
ARDEC
ATTN: AMSTA-AR-QAW
Building 62
Picatinny Arsenal, NJ 07806-5000

6.7 Ammunition lot numbers and data cards. Ammunition lot numbers and Ammunition Data Cards shall be in accordance with MIL-STD-1168.

6.8 Operator qualification. Personnel performing the ultrasonic inspection shall be certified in accordance with NAS-410 with the following exception: each facility shall have a minimum, an individual who qualifies as a Level II inspector in all respects other than experience. Operators shall be Level I certified, Level II for set-up and calibration, and Level III for approving written procedures.

6.9 Qualification of UT standards. The government shall verify all inspections performed on the UT standards (see 4.5.2.1.3).

6.10 Definitions. The following definitions are provided:

- a. A Critical I defect is a characteristic that judgment and experience indicate must be met to avoid hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product, or that judgment and experience indicate must be met to assure performance of the tactile function of a major item such as a ship, aircraft, tank, missile, or space vehicle.
- b. A Critical II defect is a defect, other than Critical I, that judgment and experience indicate may, depending on the degree of variance from the design requirement:
 - 1) Result in hazardous or unsafe conditions for the individuals using, maintaining or relying upon the product; or
 - 2) Prevent performance of the tactile function of a major end item.
- c. A blister refers to an unbroken area of paint with a bubble-like appearance, whereas "pits" or "spots" are exposed phosphate pretreatment or bare metal visible through holes in the paint.
- d. Embedded: Firmly implanted in the surrounding metal matrix.

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

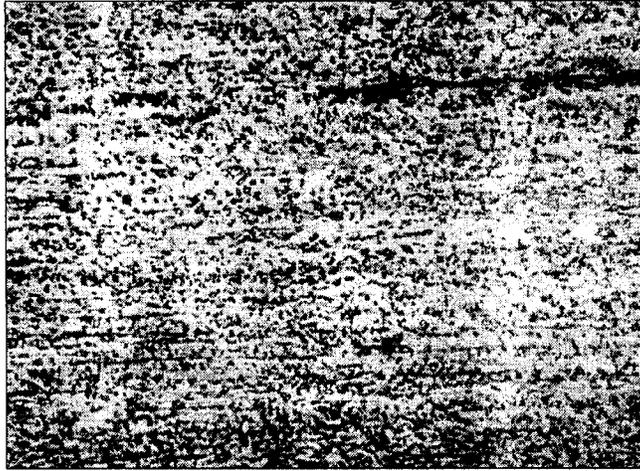


Figure 1 - Complete Spheroidization

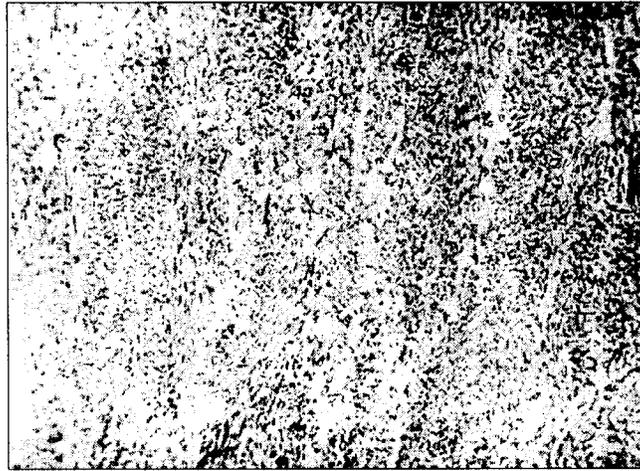


Figure 2 - 90% Spheroidization (minimum)

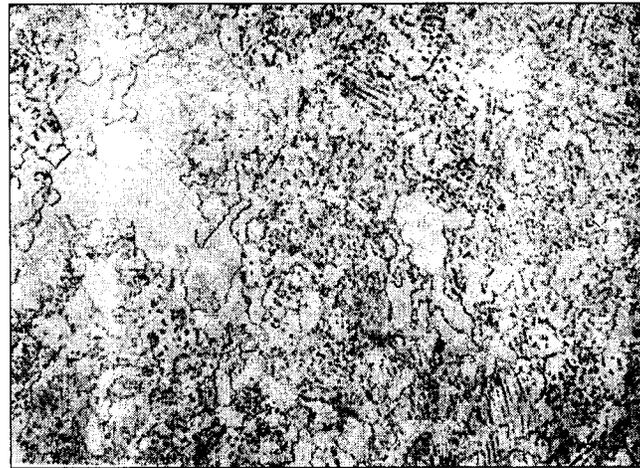
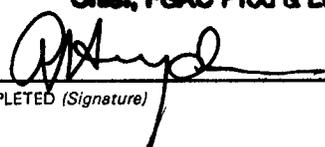


Figure 3 - Unacceptable Spheroidization

NOTICE OF REVISION (NOR) THIS REVISION DESCRIBED BELOW HAS BEEN AUTHORIZED FOR THE DOCUMENT LISTED		1. DATE (YYMMDD) 03 03 12	Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington DC 20503. PLEASE DO NOT RETURN YOUR COMPLETED FORM TO EITHER OF THESE ADDRESSES. RETURN COMPLETED FORM TO THE GOVERNMENT ISSUING CONTRACTING OFFICER FOR THE CONTRACT/PROCURING ACTIVITY NUMBER LISTED IN ITEM 2 OF THIS FORM.			2. PROCURING ACTIVITY NO. R2J2024
			3. DODAAC
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code)	5. CAGE CODE	6. NOR NO.
a. TYPED NAME (First, Middle Initial, Last) MICHAEL B. VOIT	US Army - ARDEC AMSTA-AR-QAA-C PICATINNY ARSENAL, NJ 07806-5000	19200	R2J2024
		7. CAGE CODE	8. DOCUMENT NO.
		19200	QAP 11751150
9. TITLE OF DOCUMENT	10. REVISION LETTER		11. ECP NO.
QAP 11751150 (FOR PROJECTILE, 60MM, HE, M720 OR M888 METAL PARTS ASSEMBLY)	a. CURRENT	b. NEW	R2J2024
		BASIC	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES BODY, 60MM, HE, M720 OR M888			
13. DESCRIPTION OF REVISION Add QAP 11751150. See attached.			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	(1) Existing document supplemented by this NOR may be used in manufacture.		
<input checked="" type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.		
<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.		
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT TACOM/ARDEC, AMSTA-AR-FBA-R		c. TYPED NAME (First, Middle Initial, Last) ARTHUR J. HEYDERMAN Chief, FSAC Prod & Log Eng Spt Team	
d. TITLE	e. SIGNATURE	f. DATE SIGNED (YYMMDD)	
		2003 03 19	
15.a. ACTIVITY ACCOMPLISHING REVISION	b. REVISION COMPLETED (Signature)	c. DATE SIGNED (YYMMDD)	

QUALITY ASSURANCE PROVISIONS (QAP)
(DARCOM-R-702-10)

1. **COMMAND AGENCY:**
U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER
PICATINNY ARSENAL, NJ 07806-5000

2. **THESE QAP'S FORM PART OF DRAWING/SPECIFICATION 11751150 AS SPECIFIED IN THE CONTRACT. INSPECTION SHALL BE CONDUCTED AS SPECIFIED HEREIN AND IN ACCORDANCE WITH REFERENCED DOCUMENTS.**

3. **PART I. LIST OF APPLICABLE DOCUMENTS**

DRAWINGS

- 11751150 - Projectile, 60mm, HE, M720 or M888 Metal Parts Assembly
- 11751151 - Body
- 13001319 - Longitudinal Test Standard for Ultrasonic Inspection of Projectile Body, 60mm
- 13001320 - Circumferential Test Standard for Ultrasonic Inspection of Projectile Body, 60mm
- 13001321 - Ultrasonic Inspection Equipment and Procedure for Body, 60mm, M720/M888 (Envelope Drawing)

STANDARDS

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

SPECIFICATIONS

MIL-P-48400 Projectile, 60mm, HE, M720 Metal Parts Assembly

NON-GOVERNMENT DOCUMENTS

AIA/NAS NAS 410 NAS Certification & Qualification of Nondestructive Test Personnel

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

PART II. CONFORMANCE PROVISIONS

1. General provisions. This QAP supplements MIL-P-48400 in the areas of ultrasonic inspection and ballistic sample size. This QAP will only apply at the direction of PCO or Contract. When directed by PCO or specified in the contract, the supplementary requirements contained in this QAP shall take precedence.

1.1 Classifications of characteristics. There are four Classes of Characteristics covered in this QAP. These are: Critical I and Critical II characteristics as defined in MIL-P-48400 and Major and Minor characteristics as defined in MIL-STD-1916.

1.2 Workmanship. The requirements for workmanship are as shown on the drawing and specification.

4. RELEASE NUMBER														
5. DATE	030312													
4. RELEASE NUMBER														
5. DATE														
REVISION STATUS OF SHEETS	6. REVISION	-	-	-	-									
	7. SHEET	1	2	3	4									
	8. REVISION													
	7. SHEET													
8. QAP FOR:	Projectile, 60mm, HE, M720 or M888 Metal Parts Assembly										ORIGINAL CAGE CODE	CURRENT CAGE CODE		
											19200			
9. SUBMITTED BY:	Michael B. Voit / AMSTA-AR-QAA-C										10. QAP NO.:	11751150		
11. DATE:	12. APPROVED:			13. RELEASE NO.:			14. PAGE NO.:		15. NO. OF PAGES:					
							1		4					

QUALITY ASSURANCE PROVISION (QAP)
(DARCOM-R-702-10)

3.

1.3 Certification provisions.

1.3.1 Certified test reports (CTR). When specified in the contract or in documents reference therein, the contractor shall make available to the Government a CTR for each lot of parts, assemblies, subsystems and systems by lot number prior to acceptance. This test report is in addition to, and not in lieu of, any rights of the Government under this contract or law. A CTR may be used as an element incident to, but shall not be used as the sole basis for, Government acceptance of the contract item(s) unless so indicated in the technical documentation or contract. As a minimum, the report shall contain the following:

- a. Name of company and date.
- b. Contract number or purchase order number, national stock number and drawing number.
- c. Complete nomenclature of supplies together with lot number or other identification. The quantity in each lot or shipment shall be given.
- d. All inspections and test required buy contract (i.e., material, processes, performance, functional, etc.) shall be recorded in test reports. These reports shall identify each lot submitted for acceptance by lot number, the specification or drawing, revision and date, grade or type as applicable, number of specimens tested, specified characteristics and requirements, and actual results obtained.
- e. Reports of the raw material producer's chemical, mechanical and physical analysis.
- f. A statement as follows, certifying that material meets all requirements of the contract:

"The undersigned, individually, and as the authorized representative of the contractor, warrants and represents that: All the information supplied above is true and accurate; the material covered by this certificate conforms to all contract requirements (including but not limited to the drawing and specifications); the inspection and test results, and the analysis appearing herein are true and accurate; and this certificate is made for the purpose of inducing payment and with knowledge that the information and certification may be used as a basis for payment."

- g. Signature and title of certifying official.

2. First article.

2.1 Submission. Unless otherwise specified, a first article sample consisting of the sample items in quantities as specified herein shall be submitted for inspection and approval in accordance with the terms of this contract. The sample items will be subjected to any or all of the conformance inspections listed in Part III of this QAP and may be inspected for compliance with any or all of the requirements of the applicable drawing(s) specifications(s). The certification requirements of Part IV apply.

<u>Sample Items</u>	<u>Drawings</u>	<u>Sample Quantity</u>
M720/M888 Body (prior to phosphating)	11751151	5
*M720/M888 Body Assembly, after painting	11751150	15

*Same body assemblies to be used for inspection and ballistic testing.

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QUALITY ASSURANCE PROVISION (QAP)
(DARCOM-R-702-10)

3.

2.2 Rejection. If any sample item fails to comply with any of the applicable requirements, the first article sample shall be rejected. The lot will be rejected should a premature burst, metal parts breakup or a short round occur during maximum average pressure testing. The Government reserves the right to terminate inspection upon any failure to comply with any of the requirements.

3. Verification. Verification inspection shall consist of inspection of all conformance characteristics contained in Part III, Inspection Requirements and Part IV, Certification Provisions, of this QAP. Failure to comply with the conformance criteria specified shall be cause for rejection of the lot or quantity represented. All other characteristics of the projectile, which are not specifically listed herein, are subjected to control under the contractor's quality program or inspection system.

3.1 Lot formation. Inspection lots shall comply with the lotting requirements of MIL-STD-1916, paragraph 4.2.

3.2 Attributes sampling inspection. The provisions/procedures of MIL-STD-1916 are applicable to this QAP. Unless otherwise specified, attributes sampling for the conformance characteristics listed in Part III herein shall be in accordance with MIL-STD-1916, Table II, using the verification level cited in the conformance criteria columns of Part III. The sample size for maximum average pressure shall be fifteen (15) projectiles for the First Article sample and for all production lots.

3.3 Alternative verification provisions. Unless otherwise specified, alternative verification provisions, such as statistical process control (preferred), variables or continuous sampling plans, may be used by the contractor in lieu of the inspection provisions contained herein when such alternatives(s) provide an equivalent or better level of quality, and provided they have been described in a written proposal which has been approved by the Government.

3.4 Inspection equipment. All critical inspection equipment shall be approved by the government (see note 1.), certified by a Level III. All acceptances of critical inspections will be certified by a Level II.

3.5 Components and assemblies. None

PART III. INSPECTION REQUIREMENTS

1. Classification of Conformance Characteristics.

a. Body. Drawing 11751151.

<u>CLASS</u>	<u>CHARACTERISTIC</u>	<u>CONFORMANCE CRITERIA</u>	<u>INSPECTION METHOD</u>
<u>CRITICAL I:</u>	None.		
<u>CRITICAL II:</u>			
A.	Ultrasonic Test	100%	Gage
<u>MAJOR:</u>	None.		
<u>MINOR:</u>			
201.	Workmanship	VL-IV	Visual

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							10. QAP NO. 11751150
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QUALITY ASSURANCE PROVISION (QAP)
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3.
b. Projectile, 60mm HE, M720 or M888 Metal Parts Assembly. Drawing 11751150.

<u>CLASS</u>	<u>CHARACTERISTIC</u>	<u>CONFORMANCE CRITERIA</u>	<u>INSPECTION METHOD</u>
<u>CRITICAL I:</u> I.	Proving ground (Maximum average pressure) test	100% 1/	Test
<u>CRITICAL II:</u>	None.		
<u>MAJOR:</u>	None.		
<u>MINOR:</u> 201.	Workmanship	VL-IV	Visual

Note 1/ 15 rounds shall be tested per lot.

PART IV. CERTIFICATION REQUIRMENTS

401. Personnel qualifications. UT operators will be qualified in accordance with AIA/NAS NAS 410.

PART V. TEST METHODS AND PROCEDURES

1. Ultrasonic test.

1.1 Operation. If the stop button on the automated system is engaged for a questionable indication or system malfunction, then all subsequent parts that are examined by the system until the end of the run shall be re-inspected after the condition has been corrected and recalibration has been performed.

1.2 Log book. The system operational manual or procedure shall include a tabulated set of values connecting the scan speed, rotational speed, and pulse repetition rate required to intersect the sound beam for at least two full engagements with each standard notch during the inspection cycle and also provide a scan speed that is adequate to meet the required inspection speed. This provides a quick and easy reference for the operator that can of course be verified by the system performance.

1.3 Adjustments. Any change or adjustments in the procedure or equipment must be entered in the logbook. The reasons for changes must be clearly stated and signed off and dated by the individual making the changes and the individual authorizing the changes. All calibrations shall be entered into the logbook, signed, and dated by the operator. The maintenance of calibration shall not be determined totally by the automated monitoring of system components. Periodically, both longitudinal and circumferential standards shall be introduced in the production or manual run to provide a blind test of the system.

1.4 Documentation. There must be complete documentation of the system. An operational manual must be available with a procedure clearly stated that the operator is to follow in all circumstances. There must be a maintenance manual to indicate trouble-shooting techniques that either a Level III or Level II operator would follow to correct problems with the system. In addition a complete description of work performed must be entered into the logbook, signed and dated. Any "Permanent" system parameters embedded in the software must be accessible for adjustment as required by a Level III without rewriting and software code.

PART VI. NOTES

1. Acceptance inspection equipment. Will be approved by AMSTA-AR-QAA-C, Picatinny Arsenal, NJ 07806-5000.

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