INCH-POUND

MIL-P-70524 (AR)

29 OCTOBER 1990

MILITARY SPECIFICATION

PROJECTILE, 105MM, HE, RA, XM913/XM927
WARHEAD INSULATION ASSEMBLY FOR

This specification is approved for use by the U.S. Army Armament, Munitions and Chemical Command, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification contains requirements and quality assurance provisions for the fabrication and packaging of the warhead body, insulator and warhead insulation assembly for 105MM, HE, RA, Projectile XM913 and XM927 (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

FEDERAL

TT-C-490	-	Cleaning Methods and Pre-treatment of Ferrous Surfaces for Original Coatings

MILITARY

MIL-A-48078	-	Ammunition, Standard Quality Assurance Provisions, General Specification for
MIL-S-50783	-	Steel Alloy, Special Purpose for Ammunition Components (HF-1)

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

AMSC N/A

FSC 1315

STANDARDS

FEDERAL

FED-STD-141	-	Paint, Varnish, Lacquer and Related Materials; Method of Inspection and Testing

MILITARY

MIL-STD-410	-	Nondestructive Testing Personnel Qualification and Certification
MIL-STD-1168	-	Lot Numbering of Ammunition
MIL-STD-1169	-	Packaging, Packing and Marking for Shipment of Inert Ammunition Components
MIL-STD-1459	-	Macrograph Standards for Steel Bars, Billets and Blooms for Ammunition Components

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from: Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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

DRAWINGS

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

PRODUCT AND PACKAGING DRAWINGS

9381144	-	Warhead Insulation Assembly

INSPECTION EQUIPMENT DRAWINGS

9280384	-	Envelope Drawing Ultrasonic Inspection Equipment for 105MM HERA XM913 Warhead Body
9280389	-	Ultrasonic Inspection Standard 105MM HERA XM913 Warhead Body

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

Initiate a unit shutdown if a no-flow condition is noted.

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS

E8	-	Tension Testing of Metallic Materials
E10	-	Brinell Hardness of Metallic Materials
E103	-	Rapid Indentation Hardness Testing of Metallic Materials

(Copies may be purchased directly from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa 19103.)

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

3. REQUIREMENTS

3.1 Material. Materials shall be in accordance with applicable drawings and specifications.

3.2 Warhead insulation assembly. The warhead insulation assembly and components shall comply with all requirements specified on Drawing (dwg.) 9381144 and with all the requirements specified in a applicable specifications.

3.3 Heat treatment or stress relief. Heat treatment or stress relief applied shall be uniform throughout each lot of warheads and shall be so performed and controlled as to produce in the warhead the mechanical properties specified on the applicable drawing. No warhead shall be reheat treated if it fails to meet the applicable drawing requirements without Government approval.

3.4 Hydrostatic test. The warhead shall withstand an internal hydrostatic pressure in accordance with requirements specified on drawing 9381141 without evidence of leakage, cracks, ruptures or permanent distortion when tested as specified in 4.5.1.

3.5 Proving ground. There shall be no break-up or separation of metal parts in the gun bore or in flight, when tested as specified in 4.5.8.

3.6 Warhead material defects.

3.6 Warhead material defects.

3.6.1 Warhead body. The warhead body, including the cavity shall be free from cracks, splits, bursts, cold shuts, pipes, porosity, inclusions, folds, seams and other metal defects.

3.6.2 Warhead cavity. In addition to the requirements of 3.6.1 the warhead cavity shall be free from scale, fins, burrs, draw marks, laminations, imbedded foreign matter, pits and all surface discontinuities which have a radius smaller than .030 inches.

3.6.3 Visual standards. Visual standards for evaluation of metal defects will be established for each contract after the first months production. However, establishment of visual standards will not waive the requirements for compliance with 3.6.1 and 3.6.2 (see 6.5).

3.7 Insulation. The insulation shall be free from cracks, seams, porosity, cavities and other defects.

3.7.1 Bonding assembly pull test. The warhead insulation shall be capable of withstanding a pull test of 100 pounds minimum.

3.8 Ultrasonic inspection. Warheads shall be free of any discontinuities equal or in excess of the inspection criteria within their respective zones when tested in accordance with 4.5.6. The inspection criteria are notches and holes in standards (see 9280384 and 9280389) which simulate larger actual cracks and piping flaws.

3.9 Interior cavity finish. The interior cavity after painting shall be free from bare spots, blisters, grease, dirt and other foreign matter. There shall be no pool of paint in the bottom of the cavity.

3.10 Surface finish. The requirements for surface finish are as detailed on the applicable drawing. The roughness comparison specimens shall be used as a basis for surface roughness determination.

3.11 Slow bend precracked charpy test. The nominal crack strength shall be 25 KSI $\sqrt{\text{in.}}$ test as a minimum.

3.12 First article inspection. This specification makes provisions for first article inspection. Requirements for the submission of first article sample by the contractor shall be specified in the contract.

3.13 Steel quality. Steel supplied shall comply with MIL-S-50783, except that macroetch quality shall be per MIL-STD-1459. The quality of the steel as indicated by the macroetch results shall be equal to, or better than A5, B3 and C8 with defects D1, D3, D4, D5, D6, D7 or D8 unacceptable. Manufacturer shall provide a certification that the applicable MIL-S-50783, and macroetch requirements have been met.

3.14 Workmanship. The requirements for workmanship are as shown on the applicable drawing, in the applicable specifications and the following:

3.14.1 Surface preparation. Preparation of metal surfaces shall be as specified on the applicable drawings and in the applicable specifications referenced thereon. Where cleaning and preparation are required by component details, the finish specified shall apply to indicated surfaces regardless of contour configuration.

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

3.14.3 Threads. Threads shall be full and undamaged for the entire minimum length or depth as specified on the applicable drawing.

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

3.14.5 Foreign matter. No part or assembly shall contain dirt, grease, chips, rust, corrosion or other foreign matter.

4. QUALITY ASSURANCE PROVISIONS

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

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

4.2 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 Inspection and tests (non ballistic).

4.3.1.1 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 the following items in sample quantities as indicated:

Part Description	Drawing	Quantity
Warhead Insulation Ass'y	9381144	25
Warhead (Unpainted Metal Parts)	9381141	25
Warhead (Prior to Knurling and Threading Base)	9381141	25
Insulation	9381142	10 Consecutively produced from each cavity off each mold

All assemblies and components shall have been produced by the contractor or furnished by a supplier and shall have been manufactured using the same production processes, procedures and equipment which will be used in fulfilling the contract. All parts and materials, including packaging and packing, shall be obtained from the same source of supply as will be used in regular production. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample including statements of findings for materials, processes and tests. A sample containing known defects will not be

submitted unless specifically authorized, by the contracting officer. A first article sample, or portion thereof, as directed by the contracting officer, shall also be submitted whenever there is a lapse in production for a period in excess of 90 days or whenever a change occurs in manufacturing process, material used, drawing or specification such as to significantly affect product uniformity as determined by the Government.

4.3.2 Inspections to be performed. See MIL-A-48078 and Table I specified herein.

4.3.2.1 Ballistic tests.

4.3.2.1.1 Submission. Twenty complete assemblies packed in the form that will be used for shipping of the regular production quantity shall be submitted to a Government installation designated by the Contracting Officer for loading and ballistic testing. Unless otherwise directed by the Contracting Officer, the assemblies shall not be submitted prior to the acceptance of the sample submitted to the Government for examination (see 4.3.1) and shall consist of twenty assemblies.

4.3.1.2 Tests to be performed and acceptance criteria. Proving ground tests will be performed on ten (10) assemblies in accordance with 4.4.3.1.1, utilizing the procedures of 4.5.8 to determine compliance with 3.5.

4.3.3 Rejection. See MIL-A-48078.

TABLE I. First article inspection

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE Warhead Insulation Assembly and Components	SHEET 1 OF 1	DRAWING NUMBER See below NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH / INSPECTION METHOD REFERENCE
	Warhead Insulation and Assy (dwg. 9341144)		
	Examination for Defects	25; 100%	3.2 / 4.4.2.4/4.4.2.7
	Warhead Unpainted Metal Parts (dwg. 9381141)		
	Examination for Defects	25; 100%	3.2 / 4.4.2.3
	Visual Inspection	25; 100%	3.6.3 / 4.5.2
	Mechanical Properties Test	2; 100%	3.3 / 4.5.3/4.4.3.1
	Radius of Base Cavity Test	2; 100%	3.2 / 4.5.4
	Slow Bend Precack Charpy	1; 100%	3.11 / 4.5.3.3/4.4.3.1.4
	Warhead (prior to Knurling and Threading) (dwg. 9381141)		
	Examination for Defects	25; 100%	3.2 / 4.4.2
	Hydrostatic Test	25; 100%	3.4 / 4.5.1
	Ultrasonic Inspection	25; 100%	3.8 / 4.5.6
	Insulation (dwg. 9381142)		
	Examination for Defects	10/mold;100%	3.2 / 4.4.2.5
	Bonding Assembly Pull Test	25; 100%	3.7.1 / 4.5

NOTES:

4.4 Quality conformance inspection.

4.4.1 Inspection lot formation. Inspection lots shall comply with the formation provisions of MIL-A-48078 and the following:

4.4.1.1 Heat treatment inspection lot. Heat treatment inspection lots shall not exceed one mill heat of steel or 500 components, whichever is smallest. Whenever a break in heat treating of eight (8) hours or more occurs or a furnace is shut down for any length of time, the heat treatment inspection lot will be terminated and a new lot shall start. Additionally, heat treatment inspection lots shall be restricted to components heat treated in the same heat treating equipment, at the same temperature, for the same length of time and in one unchanged process. When a batch type furnace is used, the heat treatment inspection lot shall be further restricted to those components heat treated at the same time in one batch. Batches may be combined into larger heat treatment inspection lots after qualifying with individual batches provided qualifying procedures are submitted to and approved by the Government and provided all other restrictions detailed above are met. Test samples shall be selected from the heat treatment inspection lot after final heat treatment. Components in heat treatment inspection lots shall remain grouped together and identified by inspection lot until mechanical property tests have been completed. Components from heat treatment inspection lots which comply with applicable requirements may be subsequently regrouped into final assembly lots.

4.4.2 Examinations and tests.

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

TABLE II Q-1 ATTRIBUTE PLANS

Lot Size	INSPECTION LEVELS					
	I	II	III	IV	V	VI
2 to 8	*	*	*	*	5	3
9 to 15	*	*	*	13	5	3
16 to 25	*	*	*	13	5	3
26 to 50	*	*	32	13	5	3
51 to 90	*	*	32	13	12	4
91 to 150	*	125	32	13	12	5
151 to 280	*	125	32	30	14	6
281 to 500	*	125	32	30	17	7
501 to 1200	*	125	74	35	20	9
1201 to 3200	1250	125	74	43	24	10
3201 to 10000	1250	125	87	50	30	10
10001 to 35000	1250	296	109	61	36	10
35001 to 150000	1250	296	124	74	40	10

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

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

QUALITY CONFORMANCE INSPECTION

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CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET	DRAWING NUMBER
4.4.2.1	Warhead, Prior to Nosing	1 OF 1	9381141
			NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Special 1	Material defects	100%	3.6.3	4.5.2/Visual
Major	None Defined			
Minor 201	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

AMSMC Form 1570b, 1 Jul 89

Replaces 1570, 1 Feb 85, which may not be used.

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

MIL-P-70524 (AR)

PARAGRAPH	TITLE	SHEET	DRAWING NUMBER
4.4.2.2	Warhead, Prior to Threading and Knurl	1 OF 1	9381141
			NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical				
1	Hydrostatic test	100%	3.4	4.5.1
2	Ultrasonic test	100%	3.8	4.5.6
Special				
1	Precracked Charpy test	4.4.3.1.4	3.9	4.5.3.3
Major				
101	Mechanical Properties test	4.4.3.1	3.2	4.5.3
102	Radius at base of cavity	4.4.3	3.2	4.5.4
Minor	None defined			

NOTES:

AMSMC Form 1570b, 1 Jul 89

Replaces 1570, 1 Feb 85, which may not be used.

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

MIL-P-70524 (AR)

PARAGRAPH	TITLE	SHEET 1 OF 4	DRAWING NUMBER 9381141
4.4.2.3	Warhead, Prior to Painting		NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Special				
1	Hydrostatic test stamp missing	100%	3.2	Visual
2	Ultrasonic test stamp missing	100%	3.2	Visual
Major				
101	Base thread pitch diameter, min	100%	3.2	Gage
102	Base thread major diameter, min	Level III	3.2	Gage
103	Runout of base thread (at 2 locations) including seating of gage	Level III	3.2	Gage
104	Nose thread pitch diameter	Level III	3.2	Gage
105	Nose thread minor diameter	Level III	3.2	Gage
106	Runout of nose thread (at 2 locations) including seating of gage	Level III	3.2	Gage
107	Bourrelet diameter, min	Level III	3.2	Gage

NOTES:

PARAGRAPH	TITLE	SHEET 2 OF 4	DRAWING NUMBER 9381141
4.4.2.3	Continuation		NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
108	Location of forward ogive basic diameter	Level III	3.2	Gage
109	Location of aft ogive basic diameter	Level III	3.2	Gage
110	Forward runout of ogive	Level III	3.2	Gage
111	Aft runout of ogive	Level III	3.2	Gage
112	Wall thickness of ogive (2 places)	Level III	3.2	Gage
113	Wall thickness variation of ogive (2 places)	Level III	3.2	Gage
114	Forward bourrelet wall thickness	Level III	3.2	Gage
115	Forward bourrelet wall thickness variation	Level III	3.2	Gage
116	Aft bourrelet wall thickness	Level III	3.2	Gage
117	Aft bourrelet wall thickness variation	Level III	3.2	Gage

NOTES:

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 3 OF 4	DRAWING NUMBER
4.4.2.3	Continuation		9381141
			NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
118	Effective depth of nose thread	Level III	3.2	Gage
119	Location of aft shoulder	Level III	3.2	Gage
120	Width of base thread undercut, min	Level III	3.2	Gage
121	Diameter of base thread undercut, min	Level III	3.2	Gage
122	Runout of base thread undercut	Level III	3.2	Gage
123	Surface finish of base thread	Level III	3.2	Visual/ Comparison Blocks
124	Base thickness, min	Level III	3.2	Gage
125	Weight	Level III	3.2	Scale
Minor				
201	Warhead length	Level V	3.2	Gage
202	Diameter of insulator cavity	Level V	3.2	Gage
203	Depth of insulator cavity	Level V	3.2	Gage

NOTES:

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 4 OF 4	DRAWING NUMBER 9381141
4.4.2.3	Continuation		NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
204	Base thickness, max	Level V	3.2	Gage
205	Exterior surface finish	Level V	3.2	Visual/ Comparison Blocks
206	Nose or base thread lead bevels missing	Level V	3.2	Visual
207	Pitch diameter of base thread, max	Level V	3.2	Gage
208	Major diameter of base thread, max	Level V	3.2	Gage
209	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE	SHEET 1 OF 2	DRAWING NUMBER
4.4.2.4	Warhead body		9381141
			NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Special				
1	Interior surface defects (after phosphate and prior to paint or prime)	100%	3.5	Visual
2	Pool of paint in bottom of cavity or blisters	100%	3.7	Visual
Major				
101	Diameter of bourrelet, max (after painting)	100%	3.2	Gage
102	Knurl missing, incomplete, inadequate or contaminated by paint or foreign matter	100%	3.2	Visual/Standard
103	Interior protective coating inadequate including bare spots, grease, dirt or other foreign matter	100%	3.7	Visual

NOTES:

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

MIL-P-70524 (AR)

PARAGRAPH	TITLE	SHEET 2 OF 2	DRAWING NUMBER 9381141
4.4.2.4	Continuation		NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
104	Salt spray test	4.4.3.3	3.2	4.5.5.1
105	Protective coating thickness	4.4.3.4	3.2	4.5.5.2
Minor				
201	Painted surface with total exposed or damaged area in excess of 1/4 sq. in.	Level V	3.2	Visual
202	Marking missing, misleading or unidentifiable	Level V	3.2	Visual
203	Compound missing from threads	Level V	3.2	Visual
204	Minor diameter of nose thread, min	Level V	3.2	Gage
205	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

AMSMC Form 1570b, 1 Jul 89

Replaces 1570, 1 Feb 85, which may not be used.

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

MIL-P-70524 (AR)

PARAGRAPH	TITLE	SHEET 1 OF 1	DRAWING NUMBER
4.4.2.5	Insulation		9381142
			NEXT HIGHER ASSEMBLY 9381144

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Major				
101	Thickness of hub	Level III	3.2	Gage
102	Diameter of hub	Level III	3.2	Gage
103	Outside diameter	Level III	3.2	Gage
104	Thickness	Level III	3.2	Gage
Minor				
201	True position of hub	Level V	3.2	Gage
202	Flatness	Level V	3.2	Gage
203	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET	DRAWING NUMBER
4.4.2.6	Warhead, prior to installing insulation	1 OF 1	9381144
			NEXT HIGHER ASSEMBLY

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Major				
101	Warhead base improperly finished	Level III	3.2	Visual
102	Warhead base not clean or dry	Level III	3.2	Visual
Minor				
201	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

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PARAGRAPH	TITLE	SHEET	OF	DRAWING NUMBER
4.4.2.7	Warhead, After Assembly of Insulation	1	1	9381144
				NEXT HIGHER ASSEMBLY

CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
Critical	None defined			
Major				
101	Insulation of adhesive above minimum recess	Level III	3.2	Gage
102	Adhesive not present 360° around insulation	100%	3.2	Visual/ Ultraviolet Light
Minor				
201	Closure plug missing	Level V	3.2	Visual
202	Evidence of poor workmanship	Level V	3.14	Visual

NOTES:

4.4.3 Testing.

4.4.3.1 Mechanical properties.

4.4.3.1.1 Hardness. Each final heat treated warhead from a heat treated lot shall be identified and subjected to a hardness test on the surface indicated. Three (3) hardness readings shall be taken approximately 120 degrees apart. The three hardness readings thus obtained shall be averaged and used as the basis for selecting the tension test samples of paragraph 4.4.3.1.2.

4.4.3.1.2 Tension (see dwg. 9381141). Two final heat treated warheads from a heat treated inspection lot shall be selected for the tension test. The warheads selected shall be those which have the highest and the lowest hardness reading from 4.4.3.1.1. From each of these warheads two specimens shall be tested in accordance with 4.5.3.

4.4.3.1.3 Retest. In the event of rejection, new samples of higher or lower hardness values or both, as applicable, may be selected and tested in accordance with 4.4.3.1.2 in order to establish an acceptable hardness range. Once this range has been established, all warheads whose hardness values fall outside the range shall be rejected or subjected to retemper or heat treat cycle if approved by the Government. An acceptable hardness range is one which will provide acceptable yield and elongation results.

4.4.3.1.4 Slow bend precracked charpy test. Beginning with the first heat lot produced and continuing until three consecutive heat treat lots have complied with the applicable minimum requirement specified, one final heat treated warhead from each heat treated lot shall be subjected to the precrack charpy test. The warhead selected shall be of the highest hardness reading from 4.4.3.1.1 and may be the same as used in 4.4.3.1.2. Two specimens shall be tested, with acceptance based on the average fracture toughness. In addition, no individual fracture toughness shall be less than 25 KSI $\sqrt{in}$. If one test is invalid, acceptance may be based on the fracture toughness of the valid sample, or another sample from the same warhead may be tested. If either the average or individual fracture toughness is below the minimum allowable, the heat treated lot represented shall be rejected, or subjected to retemper and retest, for all mechanical properties, if approved by the Government. After three consecutive heat treated lots have been accepted, the test shall be discontinued. The test shall be reinstituted, until three consecutive heat treated lots have complied with the applicable requirements, if any of the following occur:

a. Steel is procured from a different producer, or from a substantially different process as determined by the Government.

b. Forgings are procured from a different producer.

c. A substantial change is made in the forging process or configuration, as determined by the Government.

d. A change is made in heat treatment contractors.

e. A substantial change is made in the heat treatment process, as determined by the Government.

4.4.3.2 Molded components. The first ten (10) warhead insulations consecutively produced from each cavity of each mold shall be inspected for all drawing dimensions. In addition, ten (10) consecutive sample pieces shall be selected and inspected after a maximum of 5,000 pieces have been produced. If any part fails to meet all drawing requirements, production shall be stopped and the mold corrected. Deviations or suspected deviations in product shall be examined to determine if corrective action is required.

4.4.3.3 Salt spray. After qualification in accordance with TT-C-490, two (2) salt spray samples shall be taken each week, one during the first 30 minutes of production and a second at any other time. Failure to comply with the requirements of the applicable drawing shall be cause for taking the corrective action prescribed in TT-C-490.

4.4.3.4 Protective coating - thickness. Two samples shall be selected at random to represent each four hour period, or less, of continuous paint production. The sample warheads shall be inspected for paint coating thickness at a minimum of four separate locations on each warhead. Any warhead failing to meet the applicable requirements shall be classed defective and every warhead painted since the last acceptable sample shall be rejected.

4.4.4 Inspection equipment. The contractor shall submit for approval inspection equipment designs in accordance with the terms of the contract. See Section 6 of MIL-A-48078 and paragraph 6.3 herein.

4.4.5 Proving ground. Security. Testing shall be performed as specified in 4.5.8.

4.4.5.1 Initial inspection. Beginning with the first lot produced and continuing until three consecutive lots have complied with all of the applicable requirements specified, 20 sample warheads shall be randomly selected for this test, 20 sample warheads shall be observed for security of parts when tested in accordance with 4.5.8. If any sample warheads fail to comply with the requirements for security of parts, the lot shall be rejected.

4.4.5.2 Reduced inspection. After three consecutive lots have complied with 4.4.5.1, 10 sample warheads shall be randomly selected from each lot for this test. The 10 sample warheads shall be observed for security of parts. If any of the sample warheads fail to comply with the requirement for security of parts, the lot shall be rejected. If the lot is rejected the inspection criteria reverts back to paragraph 4.4.5.1.

4.5 Methods of inspection.

4.5.1 Hydrostatic test. The unpainted warhead shall be mounted in a suitable test fixture and be subjected to the pressure specified on the applicable drawing. Any warhead which fails to comply with the applicable requirements shall be classed defective and removed from the lot.

4.5.2 Visual examination. The internal cavity of the warhead shall be inspected visually prior to nosing using peripheral lighting to assure conformance with the applicable requirements. Visual standards in accordance with 3.5.3 shall be set up for use during this inspection. Any warhead failing to meet the applicable requirements of 3.5 shall be classed defective and removed from the lot.

4.5.3 Mechanical properties.

4.5.3.1 Hardness. The hardness test shall be conducted in accordance with ASTM Method E 103 and the following:

a. The surface of the body in the area to be hardness tested shall be prepared by machining to a sufficient depth, 0.015 inches minimum, to remove scale and get below the decarburization zone. The preparation process to be used shall require Government approval. Manual grinding shall not be used. The surface preparation requirement may be eliminated if the following conditions are met:

(1) Lab results confirm that current production process produces a decarburized zone of 0.003 inches maximum in the test area. The contractor shall provide samples, or photo-micrographs, of high and low hardness samples to the Government for approval. Samples may be the same as for 4.5.3.2 below.

(2) A controlled atmosphere is maintained in the austenitizing furnace.

(3) Depth of decarburization shall be reverified whenever precrack charpy testing is required (see 4.4.3.1.4), but only for the first heat treat lot.

b. Hardness tester periodic verification shall be performed using Brinell test standards manufactured in accordance with ASTM Method E-10 in lieu of production samples.

c. All hardness test measurements shall be automatically displayed.

d. The hardness tester shall use a standard 10mm Brinell ball. The body shall be securely supported so that no rocking or shifting of the body will occur during the test. The tester shall apply a preload followed by application of the full load. The preload shall not exceed 10% of the major load of 3000kg. The amount of penetration of the indentor (10mm ball) during that time period when the major load is applied including the dwell time at the end of the load application shall be automatically measured. The tester shall be provided with a means to compensate for any flexing of the test item that may occur during application of the major load. The hardness number will be displayed at the conclusion of the test.

e. Three hardness readings shall be taken 120 degrees apart.

4.5.3.2 Tension. The two warheads selected for testing shall have two specimens taken from each and tested as follows:

a. Base section. The base section tensile specimen shall be taken transversely. Failure to meet the yield strength or elongation requirements of dwg. 9381141 shall require a retest from the remaining portion of the base. Results of the retest specimen and the first failing specimen shall be averaged to determine compliance with the applicable drawing requirement. Failure of the average results to meet the drawing requirement shall be cause for rejection of the heat treated inspection lot. In addition, failure of either individual test specimen to meet 130,000 psi minimum yield strength and 3% minimum elongation shall be cause for rejection of that heat treatment inspection lot represented by the sample.

b. Side wall. One specimen shall be taken from the sidewall. The gage length shall be between station T and two inches forward thereof. Failure of any specimen to comply with the applicable drawing requirement shall be cause for rejection of the heat treated inspection lot.

Testing shall be conducted in accordance with American society for Testing and Materials, Method E8 with the largest substandard size round specimen possible.

4.5.3.3 Slow bend precrack charpy. The two specimens shall be taken from locations C1 and C2 on Figure 1. The test shall be conducted at a specimen temperature of -65 degrees Fahrenheit (^{o}F). The test shall be conducted in accordance with the procedure defined in the Appendix of this specification with the notches machined across the rear face of the specimen. Locations C3 and C4 on Figure 1 shall be used for replacement specimens for locations C1 and C2 respectively.

4.5.4 Radius of base cavity. (See dwg. 9381141). The warheads used in 4.4.3.1.2 shall be gaged for proper radius when the warheads are cut for tension specimens. If any warhead fails to comply, the heat treated inspection lot shall be rejected.

4.5.5 Protective coating. The procedures for testing the cleaning of components and the application of protective coating shall be in accordance with the requirements of the applicable drawing and the specification listed thereon.

4.5.5.1 Salt spray testing. Salt spray testing shall be accomplished on production warheads or sectioned warheads that were acceptable at the time of painting and were sectioned subsequent to painting. If sectioned warheads are used, sectioning shall be accomplished to allow testing of all major areas of the warheads on an alternating basis. The salt spray test shall be performed utilizing the equipment and procedures specified by Federal Test Method Standard No. 141 and TT-C-490 with the exception that test samples shall be selected in accordance with 4.4.3.3.

4.5.5.2 Protective coating - thickness. Protective coating thickness shall be accomplished using commercially available equipment.

4.5.6 Ultrasonic inspection. The warheads shall be ultrasonically inspected prior to threading using equipment and procedures in accordance with 4.5.6.1. The warhead shall be inspected with ultrasonics. Ultrasonic energy shall be used at right angles to assure that orientation does not prevent detection of a defect. A standard, in accordance with 4.5.6.3, shall be used to check the effectiveness of the inspection process. Any warhead failing to meet the requirements of 3.13 shall be classed defective and removed from the lot.

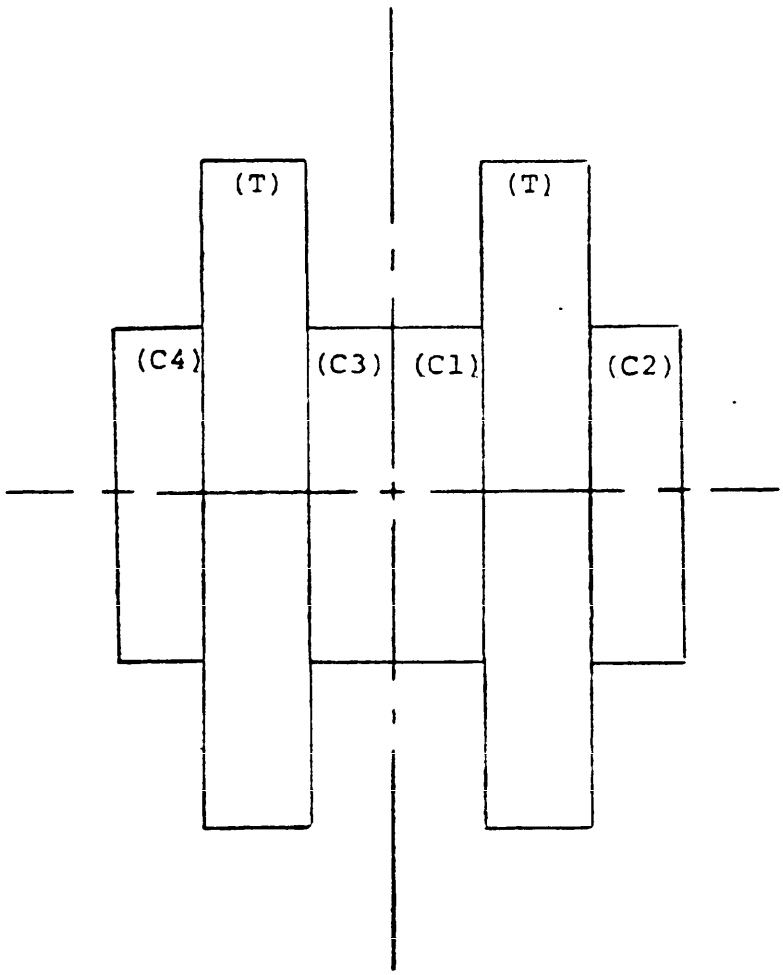


FIGURE 1. APPROXIMATE LOCATION OF TENSION AND CHARPY BASE SPECIMENS (T-TENSILE, C-CHARPY)

4.5.6.1 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 separate sources of ultrasonic energy. This means that in the base and bourrelet regions, ultrasonic regions, ultrasonic energy shall move within the walls of the warhead 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 grooves which simulate actual larger cracks. Details are contained on drawing 9280389.

All grooves machined on the standard are targets for rejection. That is, any warhead that sends back an echo signal that is greater than or equal to the signal from the standard shall be rejected. Relief portions of radially oriented grooves where the full depth approaches the surface are not inspection criteria.

4.5.6.2 Calibration and operation procedures and equipment. Prior to initiation of ultrasonic inspection, the contractor shall submit for written approval one copy of his proposed procedures, including descriptions of equipment (contractor design) and operation procedures (see 6.3). No change to the procedure shall be made after the original approval without submission and approval of the proposed changes. as a minimum, the adequacy of the inspection process shall be checked by using the standard at the start and finish of each production shift or change in operator, as well as at four (4) hour intervals during production. All channels shall properly indicate a rejection signal when encountering the notches mentioned in 3.13. 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. A log book shall be maintained by the operator of each system which is a minimum, documents the use of standards, transducers, instrumentation, repairs, reasons for equipment breakage, if any, and changing of qualified operators or inspectors. This log book shall be made available when requested for Government review.

4.5.6.3 Ultrasonic standards. The ultrasonic inspection standard shall be provided by the contractor for use during the ultrasonic inspection. The standard shall be machined from an acceptable warhead in accordance with drawing 9280389 and shall be inspected for all drawing requirements to determine their acceptability for use. Government verification of all inspections performed on the standard is required. In addition, a certificate of conformance for the standard shall be submitted prior to use of the standard.

4.5.6.4 Operator qualification. Personnel performing the ultrasonic inspection shall be certified in accordance with MIL-STD-410 with the following exception:

Each facility shall have as a minimum an individual who qualified as a Level II inspector in all respects but need not include experience.

4.5.7 Bonding assembly pull test fixture. A fixture using either suction or vacuum cups capable of exerting a minimum of 100 pounds pull on the insulator shall be used for the test. The fixture is to be designed in accordance with 4.4.4.

4.5.8 Proving ground. These tests shall be performed at a Government proving ground in accordance with the applicable acceptance test procedure. The sample warheads selected in accordance with 4.3.1.2 shall be inert loaded and assembled and fired at ambient temperature in a M119 series howitzer using a PXR200 propelling charge. The propelling charges shall be uniformly temperature conditioned to $70^{o} \pm 2.5^{o}F$ prior to test. Photographic and instrumental coverage shall be provided to assure compliance with 3.13. Range and deflection shall be recorded for informational purposes only. In the event of any abnormal condition, as observed by personnel or instrumentation, an attempt shall be made to recover and examine the metal parts for informational purposes only.

5. PACKAGING

5.1 Packaging, packing and marking. Packaging, packing and marking shall be in accordance with MIL-STD-1169.

6. NOTES

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

6.1 Intended use. The warhead covered by this specification is intended for use on the Projectile, 105MM, HE, RA, XM913. This specification contains requirements suitable for production.

6.2 Aquisition requirements. See MIL-A-48078 (AR).

6.3 Submission of inspection procedures and equipment designs for approval. (See MIL-A-48078) Submit equipment designs, as required, to Commander, ARDEC, ATTN: AMSMC-QAR-I (D), Picatinny Arsenal, NJ 07806-5000. This address will be specified on the Contractor Data Requirements List, DD Form 1423 in the contract. Unless otherwise specified, data item DI-R-1714 will apply.

6.4 Inspection lots. It is noted that the size of inspection lots of components, assemblies or items of delivery may differ from the actual quantities contractually scheduled for delivery. However, in order to facilitate scheduling of tests or deliveries, inspection lots of items of delivery may be equivalent to such contract quantities provided all of the lot formation criteria per MIL-STD-1168 and sampling provisions of this specification are maintained.

6.5 Visual examination qualification. When compliance with the applicable requirement is in doubt as a result of visual examination the characteristic may be measured or gaged to determine acceptability.

6.6 Proving ground test summary.

Test	Sample size (see 4.4.3.3)	Requirements
Security	*20 10	No breakup or metal parts separation (see 3.6)

* Applicable only for First Article Test and first three lots.

6.7 Submission of ballistic test data and ammunition data cards. In addition to the normal distribution of records for items procured by the Department of the Army, two copies of all ballistic test data and ammunition data cards shall be forwarded to Commanding Officer, AMCCOM, Picatinny Arsenal, NJ 07806-5000, ATTN: AMSMC-QAR-Q (D) and SMCAR-FSA-IM.

6.8 Visual standards. Visual standards to be established at contractors plant in compliance with 3.6.3.

6.9 Data requirements. Deliverable data required by this specification is cited in the following paragraph:

Paragraph	Data Requirements	Applicable DID
4.5.2	Test Report	DI-T-1906
4.5.3	Test Report	DI-T-1906

(Copies of data item descriptions required by the contractors in conjunction with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

6.10 Process notes. The following notes are provided for information only:

a. Heat treat - Austenitize - 1475° to 1550°F for one hour minimum.

- Oil Quench - 110°F to 140°F
- Temper - 1040°F min. for 1 hr. min.

b. Cooling of forgings should not be retarded. Slow cooling can cause the formation of carbides.

c. Spheroidizing after forging can be beneficial in rough machining, nosing and heat treatment.

d. Nosing should be performed in a minimum of two steps.

e. The "As Forged" base thickness should be 0.9" maximum to assure adequate working of the base.

f. Quenching over spuds is recommended to assure adequate quenching of the base.

g. The hydrotest plug should be designed with a one quarter inch, minimum thread relief to prevent loading of initial threads on the warhead.

h. Examination should be made of all hydrotest plugs after a warhead is blown during testing. Badly nicked or damaged plugs may cause destruction of all acceptable items.

6.11 Subject term (keyword) listing.

Hydrostatic test
Molded components
Reduced inspection
Salt spray
Slow bend precracked Charpy test
Ultrasonic test
Warhead

APPENDIX

A PRECRACKED CHARPY FRACTURE TOUGHNESS METHOD FOR HF-1 STEEL

10. SCOPE

10.1 Scope. This test method covers the determination of a fracture toughness, Kq, of a Charpy-type specimen (see Fig. 3) containing a fatigue crack tested in slow bending. This test method will be applicable for HF-1 steel only.

This fracture toughness will be sensitive to changes in the plane-strain fracture toughness providing the strength of the specimen is determined primarily by crack propagation and not by plastic instability in the Charpy-type specimen.

20. APPLICABLE DOCUMENTS

20.1 ASTM Standards:

E-4 Practices for Load Verification of Testing Machines
E-8 Methods of Tension Testing of Metallic Materials
E-23 Methods for Notched Bar Impact Testing of Metallic Materials
E-139 Practice for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
E-399 Test Method for Plane-Strain Fracture Toughness of Metallic Materials
E-812 Crack Strength of Slow-Bend Precracked Charpy Specimens of High-Strength Metallic Materials

30. SUMMARY OF METHOD

30.1 Summary of method. This test method employs a Charpy specimen provided with a sharp notch terminating in a fatigue crack tested in three-point bending using fixtures that minimize the contribution of friction forces to the measured applied load. The maximum load in the test is recorded and the fracture toughness is determined from this value and the original dimensions of the specimen.

40. PRECAUTIONARY NOTES

40.1 Precautionary notes. When preparing specimens and testing for fracture toughness, it is important that certain precautions be kept in mind.

40.1.1 Toughness. The fracture toughness of some materials will be sensitive to the rate of loading and loading rates should be confined to the range given in 80.3.2.

40.1.2 Temperature. The fracture toughness will be influenced by the testing temperature and calibration relations may change with testing temperature.

50. DEFINITIONS

50.1 Fracture toughness, Kq. As determined by this method, the fracture toughness is defined as the nominal stress intensity in a notched and cracked bend specimen calculated on the basis of the length of the initial uncracked ligament and the maximum load sustained in the test.

50.2 The following symbols are used in this test method:

a - crack depth (machined notch plus fatigue crack) (in.)
B - specimen thickness (in.)
W - specimen width (depth) (in.)
f(a/W) - power series of ratio (a/W) from ASTM E-812
P_{max} - maximum load applied (lbf)
S - span between support rollers (in.)
K_f - maximum stress intensity factor during fatigue (KSI $\sqrt{in.}$)
K_q - fracture toughness obtained in the test (KSI $\sqrt{in.}$)
E - Young's modulus of elasticity (KSI)
T - test temperature (^oF)

60. APPARATUS

60.1 Tension-testing machine. Conform to the requirements of Practices E-4.

60.2 Bend-test fixture. The procedure involves testing of the specimen in three-point bending. The best test fixture should provide support rollers that are free to rotate and move apart slightly during loading (for example, see the Test Method E-399 bend test fixture for general principles of design). The nominal span between support rollers shall be 1.57 in. (between 1.50 in. and 1.65 in.). If the diameter of the support rollers is between 0.30 in. and 0.39 in. there will be negligible change in span during deformation of the specimen.

60.3 Temperature control. The testing temperatures shall be controlled by use of an integral temperature conditioning chamber as part of the testing apparatus. Any suitable method may be used to temperature condition the specimen providing the region including the notched and cracked section can be uniformly maintained within $\pm 2^oF$ of the desired test temperature.

60.4 Temperature measurement. The temperature of the specimen during testing shall be measured by means of two thermocouples attached on either side of the notched and cracked section. These thermocouples may be spot welded in place; however, the spot weld locations shall avoid the crack path. At the test temperature, the difference between the temperatures indicated by these two thermocouples shall not exceed 1 °F and the average of these two temperatures shall be within ± 2°F of the desired test temperature.

60.4.1 Thermocouple. Temperatures shall be measured with calibrated theromcouples used in conjunction with potentiometers or millivoltmeter. Such measurements are subject to various errors; reference should be made to ASTM E-139 for a discussion of errors.

60.4.2 Calibration. The temperature measuring apparatus shall be calibrated periodically against standards traceable to the National Bureau of Standards in order to ensure that the accuracy specified above can be achieved.

70. TEST SPECIMENS, DIMENSIONS, AND PREPARATION

70.1 Dimensions. The precracked Charpy bend specimen is shown in Fig. 3. The crack length, a, (starter notch depth + fatigue crack length) is nominally equal to one half the specimen width, W, and shall lie within the range between 0.45 and 0.55 W.

70.1.1 Crack starter. The crack starter shall consist of a V-notch having an included angle from 45 to 60 degrees provided with a small radius at its tip. Experience has shown that a notch radius of less than 0.003 in. is usually necessary in order to facilitate the initiation of a fatigue crack at a low-stress intensity level.

70.2 Fatigue cracking. In order to ensure a sufficiently sharp fatigue crack and to facilitate the production of this crack, the following procedure shall be followed:

70.2.1 Specimen condition. The fatigue cracking shall be conducted with the specimen in the condition of heat treatment in which it is to be tested.

70.2.2 Method. The method used for fatigue cracking shall be such that the crack extension direction is perpendicular to the notched face of the specimen. Cantilever bending or three-point bending may be used to produce fatigue cracks.

Cantilever bending facilitates completely reversed loading ($P_{min}/P_{max} = -1$) which aids in starting and propagating the crack. For practical purposes, the K calibration for three-point bending may be used to estimate the stress-intensity factors for the cantilever bending.

NOTE: The stress distribution at the crack tip in cantilever bending can be influenced by excessive clamping forces to the extent that the fatigue crack will deviate from a plane that is normal to the notched face of the specimen.

70.2.3 Crack. The fatigue crack shall extended at least 0.04 in. beyond the tip of the crack starter notch. During at least the last 0.02 in. of fatigue cracking the following will apply:

(1) The ratio of the maximum-stress intensity in fatique to Young's modulus, $K_f(max)/E$ shall not exceed 0.002 $in.^{1/2}$.

(2) The maximum stress intensity in fatigue shall be less than 60% of the stress intensity from the test, $K_{f(max)} < 0.6\ K_q$.

(3) The stress ratio P_{min}/P_{max} will fall between -1 and 0.1.

80. TEST PROCEDURE

80.1 Number of tests. Samples shall be selected as specified in the basic specification.

80.2 Specimen measurement. All specimen dimensions shall be within the tolerances shown in Fig. 3.

80.2.1 B and W. Measure the thickness, B, to the nearest 0.001 in. at not less than two positions between the fatigue crack tip and the unnotched edge of the specimen and record the average value. Measure the depth W to the nearest 0.001 in. at two positions, one on each side of the crack starter notch and record the average value.

80.2.2 a. After fracture measure the initial notch plus fracture crack length, a, to the nearest 0.5% at the following three positions: at the center of the crack front, a_3, and midway between the center and the intersection of the crack front with the specimen surfaces, $a_2$and a_4. Use the average of these three measurements, $(a_2 + a_3 + a_4)/3$, as the crack length in the calculation of K_q (see 90.1). If the difference between any two of the crack length measurements exceeds 10% of the average, or if part of the crack front is closer to the machined notch root than 5% of the average, the specimen shall be discarded. Also, if the length of either surface trace of the crack, a_1 and a_5, is less than 80% of the average crack length, as defined above, the specimen shall be discarded. Record these five crack lengths.

80.3 Bend testing. Set up the bend-test fixture so that the line of action of the applied load shall pass midway between the support roll centers within 0.04 in. Measure the span (distance between the support-roll centers) within 1% and record this value as S. This value should fall between 1.50 in. and 1.65 in.

80.3.1 Location. Locate the specimen with the crack tip midway between the roll centers to within 0.040 in., and square to the roll axes within 2 degrees. Check the parallelism between the top face of the specimen and the loading roller by sighting the gap between these surfaces just before contact is made. As a small load is applied, light in this gap should extinguish simultaneously across the thickness of the specimen. If this condition in not met, the loading roller shall be suitably adjusted.

80.3.2 Loading. Load the specimen at the rate between 700 lbf/minute and 3600 lbf/minute until the maximum load is reached, and record this value as P_{max}. Record the loading rate.

NOTE: It is desirable to follow the load change carefully because specimens having low toughness will break abruptly and no slow decrease in load beyond the maximum will be observed.

90. CALCULATION AND INTERPRETATION OF RESULTS

90.1 K. Calculate a tentative fracture toughness value in KSI in. from the measured value of P_{max} and the initial dimensions of the specimen as follows:

$$K = (P_{max}\ S/1000\ B\ W^{3/2})\ f(a/W)$$

90.2 Validity. Determine the validity of this tenative fracture toughness by checking the validity of the precracking (70.2.3), the shape of the crack front (80.2.2), and the bend test conditions (60.4, 80.3). If these requirements are met, this tentative value will be considered valid and will be reported as the fracture toughness, K_q, of the HF-1 steel.

90.3 Fracture appearance. The appearance of the fracture may furnish valuable supplementary information. A means for describing the fracture appearance of cracked bend specimen is given in Test Method E-399 and shall be used to characterize the fracture appearance of the precracked Charpy specimens.

100. REPORT

100.1 Report. The report shall include the following for each specimen tested:

100.1.1 All specimen dimensions (Section 80.2: B, W, a_1, a_2, a_3, a_4, a_5).

100.1.2 All test parameters (Section 80.3: S, Load Rate, P_{max}, temperature).

100.1.3 A check of all test validators:

100.1.3.1 Precracking.

A. $-1 \leq (P_{min}/P_{max}) \leq 0.1$

B. $K_{f(max)}/E > 0.002$ in.$^{1/2}$

C. $K_{f(max)} < 0.6\ K_q$

100.1.3.2 Crack length.

A. $a_{fatigue} \geq 0.04$ in. + a_{notch}

B. $.45W < a < .55W$

C. a_1 and $a_5 > 0.8\ a$

D. $a_i - a_j < 0.1\ a$; where i, j = 2, 3, 4

100.1.3.3 Test conditions.

A. 1.5 in.$< S < 1.65$

B. 700 lbf/minute < Load < 3600 lbf/minute

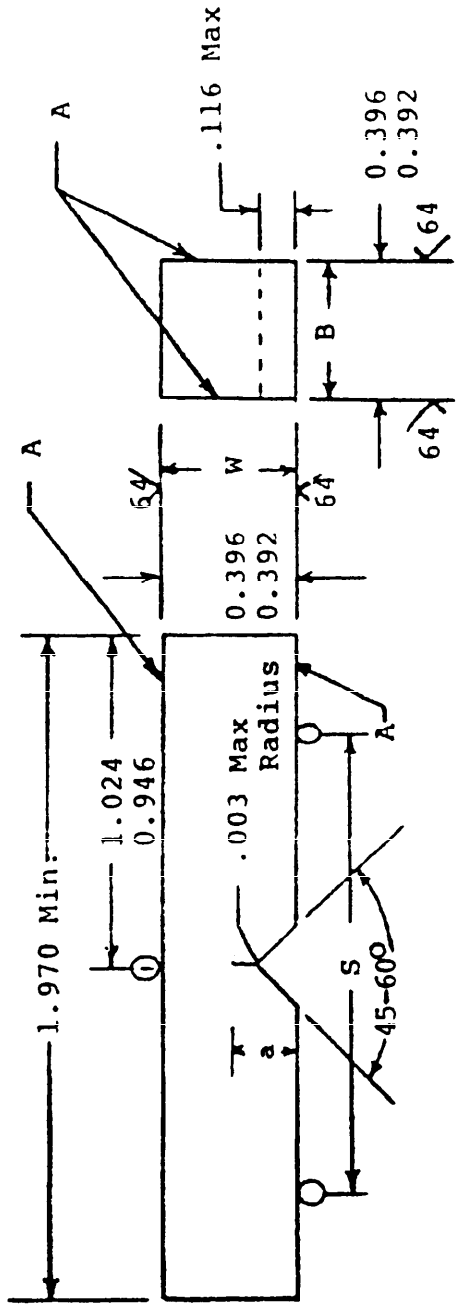
C. $T_{thermocouple} = T_{required} \pm 2\ ^{o}F$

100.1.4 The fracture toughness, K_q, for all valid tests.

100.1.5 Crack plane orientation (ASTM E-399).

100.1.6 Fracture surface appearance (ASTM E-399).

100.1.7 0.2% offset tensile yield strength (ASTM E-8).



NOTE 1. All dimensions in inches

NOTE 2. "A" surfaces shall be perpendicular or parallel as applicable to within 0.001 In.TIR

NOTE 3. Crack starter shall be perpendicular to specimen length and thickness to within ± 2 degrees.

FIGURE 3 Dimensions of precracked charpy specimens

Custodian:
Army - AR

Preparing activity:
Army - AR

(Project 1315-AC11)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-P-70524 (AR)	2. DOCUMENT DATE (YYMMDD) 29 October 1990

3. DOCUMENT TITLE
PROJECTILE, 105MM, HE, RA, XM913/XM927 WARHEAD INSULATION ASSEMBLY FOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME US Army ARDEC Standardization & Specification Office	b. TELEPHONE (Include Area Code) (1) Commercial: (201) 724-6671 (2) AUTOVON: 880-6671
c. ADDRESS (Include Zip Code) ATTN: SMCAR-BAC-S Picatinny Arsenal, NJ 07806-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340