

INCH-POUND  
MIL-C-13931H

~~11 February 1991~~  
SUPERSEDING  
MIL-C-13931G  
1 April 1987

## MILITARY SPECIFICATION

### CANNON: GENERAL SPECIFICATION FOR

This specification is approved for use by the Department of the Army and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification supports the acquisition of: gun and howitzer cannon; mortar cannon, mounts, and baseplates; recoilless rifles and mounts; and related equipment. This specification includes the minimum essential Engineering and Packaging Requirements and the necessary Quality Assurance Provisions to determine that these requirements have been met.

#### 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 specification 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Armament Research, Development and Engineering Center, US Army Armament Munitions and Chemical Command, ATTN: SMCAR-CCB-SS, Watervliet, N.Y. 12189-4050 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 10GP

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## SPECIFICATIONS

MILITARY

- MIL-P-116 - Preservation, Methods of
- MIL-L-3150 - Lubricating Oil, Preservative, Medium
- MIL-I-8574 - Inhibitors, Corrosion, Volatile, Utilization of
- MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys
- MIL-G-10924 - Grease, Automotive and Artillery
- MIL-S-13572 - Springs, Helical, Compression and Extension
- MIL-L-14107 - Lubricating Oil, Weapons, Low Temperature
- MIL-F-18264 - Finishes: Organic, Weapons System, Application and Control of
- MIL-I-45177 - Instruments, Tracer, Surface Roughness
- MIL-I-45208 - Inspection System Requirements
- MIL-I-45607 - Inspection Equipment, Acquisition, Maintenance and Disposition of

## STANDARDS

FEDERAL

- FED-STD-H28 - Screw Thread Standards For Federal Services
- FED-STD-66 - Steel, Chemical Composition and Hardenability

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-130 - Identification Marking of US Military Property
- MIL-STD-1190 - Minimum Guidelines for Level C Preservation, Packing and Marking
- MIL-STD-2073-1 - Procedures for Development and Application of Packaging Requirements

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MIL-STD-45662 - Calibration Systems Requirements

## HANDBOOKS

FEDERAL

Cataloging - Commercial and Government Entity (CAGE) Publication  
 Handbook H4/H8 (United States and Canada) Name to Code  
 Section A

Cataloging - NATO Commercial and Government Entity Code  
 Handbook H4/H8 (Excluding United States and Canada) Name to Code  
 Sections C&D

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

2.1.2 Government drawings. The following Government drawings form a part of this specification to the extent specified herein. Unless otherwise specified in the solicitation, the issues are those cited in the solicitation.

DRAWINGS (see 6.5)U.S. Army Armament, Research, Development and Engineering Center (ARDEC)

- A7309998 - General Data Governing Protective Finish (Springs)
- B8769390 - General Data Governing Interpretation of Limits
- B8769470 - General Data Governing Application of Solid Film Lubricants
- B8769082 - General Feature Control Tolerances for Drawings

(Copies of 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 the Procuring Contracting Officer.)

2.2 Non-Government publications. The following documents 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.

## American Welding Society (AWS)

AWS A2.4 - Symbols for Welding and Nondestructive Testing

AWS A3.0 - Welding Terms and Definitions

(Application for copies should be addressed to the American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, FL 33135).

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American National Standards Institute (ANSI)

ANSI/ASME B46.1 - Surface Texture

ANSI Y14.5-1973 - Dimensioning and Tolerancing for Engineering Drawings

ANSI Y14.5M-1982 - Dimensioning and Tolerancing for Engineering Drawings

ANSI Y14.6 - Screw Thread Representation

ANSI Y14.6AM - Screw Thread Representation

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

American Society of Testing and Materials (ASTM)

ASTM D3951 - Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103-1137).

(Non-government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services).

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 General requirements. The individual item requirements shall be in accordance with the applicable contract, drawings, and specifications. Any conflicts are to be resolved by means of the order of precedence (see 2.3). Any items the contractor considers ambiguous shall be clarified with the Procuring Contracting Officer.

3.2 Material. When a drawing permits a choice of type, form, grade, condition or other classification of materials, the finished part shall comply with the individual cannon specification and this specification, as well as the applicable drawing.

3.2.1 Material, Steel. Wrought standard steels selected must conform to FED-STD-66. Merchant quality, leaded, resulphurized and rephosphorized steels are not acceptable (See 6.3). Unless otherwise specified, castings are not acceptable. A list of suggested steels based on drawing callouts has been provided for informational purposes only (see 6.5).

3.2.2 Material soundness. Parts shall be free from cracks and fractures as determined by the specified examination or test (see 4.5.22 and 4.7.3).

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3.2.2.1 Magnetic-particle indication. Magnetic-particle indications shall be defined as lineal discontinuities.

3.2.3 Strategic storage material.

3.2.3.1 Corrosion protection of surface. Forgings and castings procured for strategic storage shall have a preservative material applied to all surfaces to minimize corrosion during the period of storage.

3.2.3.2 Rotation of stored material. Forgings and castings in strategic storage should be periodically withdrawn to fill current cannon manufacturing requirements and replaced by newly procured material.

3.3 Design.

3.3.1 Dimensions. If dimensions additional to those specified on the applicable drawings are considered by the contractor to be required, or if two or more dimensions appear to be in conflict, the contractor shall request clarification from the Procuring Contracting Officer. Drawings shall not be scaled to obtain dimensions.

3.3.1.1 Interpretation. The significance of dimensions and tolerances shall be as stated in ANSI Y14.5-1973 for drawings dated prior to 1 July 1983, unless otherwise noted on the drawing. When specified, the significance of dimensions and tolerances shall be as stated in ANSI Y14.5M-1982 for drawings originally dated after 1 July 1983. Where a unilateral tolerance is specified without showing that the variation in the other direction is zero (ex. 0.123 + .004) the general tolerance shall not apply. Where features are not controlled in accordance with the applicable ANSI Y14.5 and where features on the drawing are constructed about a common centerline, center plane or axis, and geometric tolerances are not specified for the characteristics of concentricity, parallelism, symmetry, the limits for these characteristics shall be interpreted as described on drawings B8769390 and B8769082. When drawings are interpreted in accordance with drawings B8769390 and B8769082, surfaces depicted as having a common centerline shall not be eccentric or unsymmetrical relative to each other by more than one-half of the sum of the differences between the actual measured dimensions and maximum material condition specified by drawing dimensions. [Half the sum of the difference represents half of the allowable Full Indicator Movement (FIM)]. All surfaces depicted as symmetrical about the center-line without locational dimension are considered to have a common centerline.

3.3.1.2 Dimension to coated surfaces. The dimensions and tolerances for coated surfaces given on the applicable drawings shall apply as follows:

- a. Organic coatings (paint, varnish, lacquers, etc.,) Phosphate coatings, and Solid Film Lubricant Coatings - Dimensions and tolerances shall apply without coating.
- b. Black Oxide, Metallic Plated Surfaces (Chromium, Cadmium,) and Anodic Coatings - Dimensions and tolerances shall apply with coating.

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3.3.1.3 Corners and edges. Corners and edges shall be beveled or rounded as indicated on the applicable drawings. Where designated as "sharp", the edges shall be left as machined, with only deburring required. When no requirement is specified on the drawing, external edges shall be broken 0.015 inch maximum and internal edges shall have a 0.010 to a 0.020 inch radius that blends with the adjacent surfaces without undercutting. When a 45 degree angle without a tolerance is specified to break an edge the tolerance shall be  $\pm 5$  degrees.

3.3.1.4 Screw threads. The dimensions of all screw threads shall conform to the limits specified in FED-STD-H28. Terms and symbols shall be in accordance with ANSI Y14.6 and Y14.6M. Threads shall be chamfered or countersunk to eliminate any protrusion or any sharp edge formed by the incomplete thread. The countersink shall not exceed the major diameter of an internal thread. The chamfer shall not exceed the minor diameter of an external thread.

3.3.1.5 Blend. When specified on drawings (such as tube forging drawings), a blend shall be defined as a smooth transition from one specified dimension to another such that the resulting configuration does not violate any other drawing requirements and within tolerance zone defined by maximum and minimum material limits.

3.3.2 Surface texture. The roughness, waviness and lay of surfaces shall comply with the drawings and ANSI B46.1.

3.3.2.1 Knurls. Knurling shall comply with the drawings and ANSI Y14.5.

3.3.3 Springs. Unless otherwise specified on the applicable drawing, helical compression and extension springs shall conform to Grade B, MIL-S-13572 and A7309998. The springs shall withstand the required loads, at the specified height or length, and still move freely in the envelope specified on the drawing.

### 3.4 Construction.

3.4.1 Protection. All surfaces shall be protected against corrosion and physical injury during manufacture, assembly and delivery.

#### 3.4.2 Machining.

3.4.2.1 Cannon tubes. Cannon tubes shall be machined so as to minimize distortion caused by residual stresses.

3.4.2.1.1 Straightening of tubes. Unless otherwise specified, tubes may be cold-straightened to reduce bends induced by machining, to comply with the limit of allowable bend specified on the finish machined drawing, but not after final machining or rifling. (Bend definition see 6.3.4). Straightening shall be done at the option and risk of the machined tube contractor.

3.4.2.2 Breech recesses. Recesses in breech structures for housing breechblocks or supporting obturating parts, and other recesses requiring resistance to firing pressure shall be free from scratches, visible steps, scores or nicks.

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3.4.3 Autofrettaged cannon tubes. When autofrettage (see 6.3) is specified for cannon tubes, approval of the procedure to be used shall be obtained from the responsible Government design activity before the start of operation.

3.4.4 Joining processes.

3.4.4.1 Welding. Welding is only permitted as specified on applicable engineering drawings unless written approval is obtained from the Procuring Contracting Officer and the government design activity. The welding terms and symbols used on the drawings shall be in accordance with AWS A2.4 and AWS A3.0. The preparations for welding specified on a drawing may be modified subject to approval of the responsible Government design activity. Weldments that are not machined after welding shall not be distorted beyond the dimensional limits specified on the individual part detail drawings or weldment drawing. Spatter and similar excess shall be removed. Unless otherwise specified on the drawing, contours of deposited metal in joints shall not be altered.

3.4.4.2 Riveting. Wherever practical, rivets shall be machine driven and by a pressure method rather than by impact. The rivets shall completely fill the holes, effect firm contact between the joined surfaces and shall have full-formed heads concentric with the body. Steel rivets over 3/16 inch in diameter shall be driven hot; 3/16 inch and smaller in diameter may be driven cold. Nonferrous rivets shall be driven cold.

3.4.4.3 Staking. Staking (see 6.3.5) shall comply with the drawings.

3.4.5 Protective finishes.

3.4.5.1 Anodic coating. Anodic coatings shall comply with MIL-A-8625 or the applicable specification shown on the drawing.

3.4.5.2 Chromium plating. When chromium plating is specified, the following shall apply:

3.4.5.2.1 Plating process. Prior to production plating, the contractor shall submit the details of the plating process to be used to the Procuring Contracting Officer for approval by the responsible Government design activity. The procedures shall include information on:

- a. The cleaning before plating, including the degreasing method, the materials, and the rinse after blasting.
- b. The anode placement procedure.
- c. The reverse etch cycle, including the current and temperature control, the time of the cycle, and the chemical solution.
- d. The plating cycle, including the current and temperature control, the chemical solution, and the after-plate rinse.
- e. The plating solution control including the filtering and chemical analysis schedule.

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3.4.5.2.2 Surface conditions before plating. The machined surfaces shall conform to the applicable drawings and specifications. If residual magnetism is present (from magnetic-particle inspection or other causes), the part shall be demagnetized before plating. An aluminum oxide cloth of 150 or finer grit may be used for final surface treatment, provided it is followed by an adequate cleaning procedure such as by water rinsing and swabbing with a hot alkali cleaner.

3.4.5.2.3 Plating application. The surfaces to be plated shall be mechanically and chemically clean. The chromium shall be deposited directly on the base metal and shall be free of frosty (orange peel) areas. Surfaces shall be plated to the specified dimensions and surface texture shown on the drawings.

3.4.5.2.4 Thermal treatment after plating. The thermal treatment after plating shall be in accordance with the applicable component drawing.

3.4.5.2.5 Polishing of chromium plated parts. After plating, parts shall be mechanically honed, ground, lapped or polished, if necessary, to obtain the dimensional requirements and the finish (surface texture) specified on the applicable drawing, and to remove any surface irregularities.

3.4.5.2.6 Visible plating defects. The chromium deposit shall be smooth and free from visible defects such as unplated areas, blisters, flaking, peeling, frost, nodules, and pits. The following exceptions apply to tubes only.

- a. Nodules are acceptable on the rifling surfaces (lands and grooves) providing the size and density do not exceed that shown in photograph 1a (see 6.2.). Also available as aids to identification are photographs 1b, 2a, 2b, and 2c. Photographs 1b, 2a, 2b, and 2c shall not be used as criteria for nodule sizes and density.
- b. Pits that result from nodule removal are acceptable.
- c. The gas check seat surface shall not contain pits.
- d. Pits are acceptable elsewhere on the chamber surfaces providing the size and density do not exceed the following criteria.
  - (1) 1/32 inch in diameter.
  - (2) 25 per square inch density.
  - (3) 200 per chamber total.

Any condition exceeding these criteria shall be reported as nonconforming material.

3.4.5.2.7 Visible plating defects after proof-firing. Unless otherwise specified by the specific cannon specification, the following applies: After proof-firing, there shall be no defects in the gas check seat zone. The remainder of the plated surface in a tube shall be free from any visible spalled depressions (see 6.3.2) in excess of 4 inches cumulative length, and chipped areas (see 6.3.3) in excess of 16 inches cumulative length.

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3.4.5.2.7.1 Dimensional limits of spalled depressions. The overall length of a spalled depression in a tube, measured parallel to the bore axis, shall not exceed two inches. The overall width of a spalled depression, measured at right angles to the length, shall not exceed the sum of the widths of two lands and one groove.

3.4.5.2.7.2 Dimensional limits of chipped areas. The length of a chipped area in a tube, measured parallel to the bore axis, shall not exceed four inches. The width, measured at right angles to the length, shall not exceed the sum of the widths of one land and one groove. The length or width is the distance between the outer edges of the outermost cavities.

3.4.5.3 Coating materials. Coating materials shall comply with the applicable engineering drawings, the applicable specifications, and the following:

3.4.5.3.1 Mixing. Coating materials shall be prepared for application under clean conditions with clean equipment. Materials shall be allowed to warm to room temperature before mixing. Skins, if present, shall be carefully removed from the material. The materials shall be thoroughly stirred or shaken prior to thinning and application. To avoid problems of incompatibility in the liquid and drying phases, mixing of paints of the same specification but supplied by different manufacturers is prohibited. Every effort shall be made to assure that a primer of a single manufacturer is used on the item to be finished and similarly the top coat should be restricted to a product of a single manufacturer.

3.4.5.3.2 Selection of thinners. The thinner recommended on the package label or in the applicable process specifications shall be employed. Other thinners as recommended by the paint manufacturer for his particular product may be used.

3.4.5.3.3 Aged materials. Wash primers which are more than one year old, primer paint which is more than two years old, and top coat paint which is past the shelf life expiration date, all times being determined from the date of manufacture, shall not be released for production use on exterior surfaces of cannon until they have been subjected to all the inspection tests of the applicable material procurement specification, including both the large scale panel spray tests and the scratch wet tape adhesion test specified in MIL-F-18264. If the tests indicate the material to be satisfactory for use, it shall be consumed within six months from date of completion of tests; otherwise the unused material shall be retested similarly.

### 3.4.6 Assembly.

3.4.6.1 Preparation for assembly. All parts shall be free of metal chips, dirt and other foreign material, and shall be properly lubricated at the time of assembly.

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3.4.6.2 Fitting. All parts shall assemble readily; however, some force may be necessary due to "FREE STATE VARIATION" permitted on drawings. Parts to be fastened together by rivets, bolts, welding or similar means, shall fit each other properly before assembly and shall not be drawn or drifted to a fit by bolts, rivets or other means of strain. With the exception of surfaces where uniform contact or bearing is specified, parts shall not be filed, scraped or otherwise altered to obtain proper fitting. If metal removing operations are required during assembly, all parts contaminated with metal chips or foreign matter shall be cleaned, refinished (if necessary), relubricated and reassembled.

3.4.6.3 Reduction of chamber and tube diameters. When hoops are specified for cannon tube assembly, reduction of the chamber and bore across diameters due to heat shrinkage of the hoop shall be limited to .002 inch. This reduction shall apply for the length of each hoop including any transition zones.

3.4.6.4 Functioning. Assembled items shall function smoothly without interference. Any defects in operation due to defective parts or incorrect assembly shall be corrected by the supplier.

3.4.6.4.1 Obturator surfaces. The surfaces of obturator pads and the metal surfaces against which the pad seats shall be free from oil and grease. When metallic-ring breech seals are prescribed, the sealing surfaces and mating seats shall be free from any foreign matter.

3.4.6.4.2 Bearing of obturator parts. When the breech is closed each outer split ring shall have 360 degrees of contact with the seating surface in the tube, with not less than 80 percent of the seating area of each ring in contact with the tube. Metallic-ring breech seals shall have 360 degrees of contact with the mating seating surfaces.

3.4.6.5 Lubrication.

3.4.6.5.1 Mating surfaces. All contact surfaces of metal parts, except surfaces on which freedom from lubricant is specified and bearing surfaces for hot rivets or fused joints, shall be coated immediately before assembly with a film of preservative lubricating oil conforming to MIL-L-3150.

3.4.6.5.2 Threaded joints. Threaded joints larger than one inch diameter shall be coated to fill the thread clearance with grease conforming to MIL-G-10924. This requirement shall apply to the mating threads of the following:

- a. Breech ring and breech bushing.
- b. Tube and breech ring or corresponding part.
- c. Tube and supporting rings or muzzle attachments.
- d. Intermediate or locking parts included in a., b. or c.

3.4.6.5.3 Breechblock counterbalances. Before being assembled, all parts of counterbalances shall be cleaned of all metal chips and foreign matter and coated with grease conforming to MIL-G-10924.

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3.4.6.5.4 Automatic cannon. Unless otherwise specified, automatic cannon shall be lubricated with oil conforming to MIL-L-14107.

3.4.6.5.5 Solid-Film lubricants. Unless otherwise specified, cannon parts coated in conformance to B8769470 shall not be coated with other lubricants.

3.4.7 Marking. Parts and assemblies shall be clearly and legibly identified in accordance with the requirements of the applicable detail drawings, MIL-STD-130, and this specification.

3.4.7.1 Size of marking. The size of characters shall be a minimum of 1/8 inch high. Where area available is too small, then the largest characters consistent with the area shall be used.

3.4.7.2 Type of marking. Letters shall be without serifs (sans-serifs) such as "Gothic" or "Futura" capitals, and the numerals shall be Arabic.

3.4.7.3 Methods of application. Marking shall be directly applied to the surface of the item by metal stamp, embossing, engraving, forging, casting, molding, electrochemical etch; electric arc pencil, or laser marking. When these methods are not possible, because of potential damage to the item or nonlegibility of the marking, the marking shall be directly applied on the item by environmentally protected decalcomania transfer, metal or plastic wrap around tag, stencil, silk screen, identification plate, tag, or indelible ink stamp. When the item cannot be marked on its surface or tagged, the item shall be placed in a unit container (bag, etc.) with the identification marking located on the unit container in addition to, or in combination with the marking information specified in MIL-STD-129.

3.4.7.3.1 Caution. Identification marking of items shall not affect the life and utility of the item. Marking materials creating hazardous conditions shall not be used.

3.4.7.4 Location, legibility and permanency. Location shall be as specified on the drawing or in the contract. Legibility shall be such as to be readily readable. Identification marking on identification plates shall be of a contrasting color to the plate surface. Marking shall be of a permanency to prevent obliteration or obscuring through wear, climatic exposure and normal cleaning processes.

3.4.7.5 Time of marking. Marking involving alteration of the item surface (stamping, engraving, embossing and the like) shall be done before application of any specified protective coating (anodize, phosphate, oxide, paint, etc.) and shall be legible after application of the coating. Items showing marking requirements at assembly (weldments, sheet metal fabrications, and like assemblies) may have the marking applied to the detail part before assembly to facilitate manufacture.

3.4.7.6 Detailed identification.

3.4.7.6.1 Specification control drawings. The identification marking for items depicted on specification control drawings shall consist of the manufacturer's identification and the manufacturer's part number.

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3.4.7.6.2 Source control drawing. The identification marking for items depicted on source control drawings shall include letters "SOCN" between the design activity code and part (drawing) number. In addition, the manufacturer's identification and manufacturer's part number shall be marked below the source control number.

Example: "19206 SOCN 1234567

MFR 54321-9876543"

3.4.7.6.3 Altered items. When an item is altered, the identification number assigned by the activity specifying the alteration shall be marked on the item, and the original identification shall be obliterated without damaging the item.

3.4.7.6.4 Manufacturer's identification. All parts and assemblies requiring marking shall be identified with the manufacturer's code identification (CAGE) number, name or registered trademark prefixed by "MFR" and located below the design activity code identification and part numbers. Manufacturer's code numbers are listed in Cataloging Handbook H4/H8. Directions for obtaining numbers are as specified therein.

Part

Example: 19206-1234567

MFR 54321

Assembly

Example: 19206 ASSY 1234567

MFR 54321

3.4.7.6.5 Serial numbers. Serial numbers, when assigned by the Procuring Contracting Officer, shall be applied as specified on the applicable drawings or in the contract.

3.4.7.7 Functional markings. Markings specified for operation, handling, adjustment or assembly shall be in accordance with the applicable drawing.

3.4.7.8 Inspection approval stamp. When the marking requirements on a drawing include the term "INSP", the Department of Defense complete inspection approval stamp shall be applied in the space following this term. The Government representative shall control the stamp and observe the stamping operation as required to assure successful completion of all required examinations and tests.

3.5 Proof-testing. Proof-testing shall comply with requirements stated in the applicable individual cannon specification and this specification.

3.6 Workmanship. Surfaces shall be free from visible irregularities or defects that may adversely affect function, strength, serviceability or detract from good appearance. Fins, burrs, and other excess metal shall be removed. Unless otherwise specified on the drawing, lathe centers shall be removed. Salvage operations such as repair by welding or hammering to shape shall not be done without approval of the Procuring Contracting Officer.

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## 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 assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must 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 this specification shall not relieve the contractor of his 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 Terms and definitions. The quality assurance terms and definitions used in this specification and in the individual cannon specifications are in accordance with MIL-STD-109.

4.3 Lot inspection.

4.3.1 Lot formation. The formation, size and presentation of lots for inspection shall be in accordance with MIL-STD-105, and subject to approval by the Government representative.

4.3.2 One hundred percent inspection. When one hundred percent inspection is specified for certain characteristics, each unit shall be inspected for those characteristics and the defective pieces shall be removed. The Government reserves the right to inspect any unit of product for any requirements.

4.3.3 Sampling inspection. When sampling inspection is authorized, the procedures of MIL-STD-105 or any other approved system shall apply. Application for use of a substitute system shall be made to the Procuring Contracting Officer.

4.3.3.1 Rejected lots. Rejected lots shall be screened or reworked for the defective characteristics. Tightened inspection shall be used for the re-inspection of those characteristics which previously caused the rejection of the lot. If re-heat treating has been accomplished, the resubmitted lot shall also be reinspected for all other characteristics in accordance with the normal inspection procedure.

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4.3.4 Classification of characteristics and acceptable quality levels (AQLs). The classification of characteristics and acceptable quality levels are contained in the referenced specification or in the applicable QAP for a part, subassembly or assembly. The following provisions shall apply:

- a. MIL-STD-105, or other system approved by the Procuring Contracting Officer shall be used for all characteristics.
- b. The AQLs are specified as percent defective. Acceptance numbers for each AQL value apply to each characteristic separately.
- c. Grouping of requirements in a classification of characteristics shall not reduce the contractor's responsibility to follow the drawing requirements, nor remove the need for inspection of the requirement.

4.4 Inspection method. The following provisions shall be applicable to the prescribed inspection methods. Request for a method other than that specified shall be submitted to the Procuring Contracting Officer for approval.

- a. When Special Inspection Equipment (SIE) is specified, the characteristic shall be inspected with inspection equipment conforming to the specified drawing or approved equivalent.
- b. When Standard Measuring and Test Equipment (SMTE) is specified, the characteristics shall be inspected with commercial or standard measuring and test equipment, subject to the approval of the Government representative.
- c. When a Special Test Method (STM) is specified, the characteristics shall be subjected to the test method or procedure specified in the applicable QAP.
- d. When "visual" is specified, the characteristic, whenever possible, shall be compared with a specimen of known acceptable quality.
- e. When "manual" is specified, the sample shall be checked for tightness, protrusion, operation or similar condition, as applicable.

4.5 Inspection provisions.

4.5.1 Parts. Parts shall be inspected before assembly. Materials, protective coatings, threads, surface roughness, marking, and workmanship shall be inspected in accordance with the applicable drawings, QAPs, and this specification.

4.5.2 Control of purchased components. MS, commercial or special design components received from vendors in support of in-house manufacture or assembly shall be identified to the individual contractor (3.4.7.6.2) and contract number from the time received until used in manufacture or assembly. Components shall be issued from a single vendor lot until that lot is exhausted. Lots shall not be mixed.

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4.5.3 Shop and serial numbers. Where shop numbers are assigned, inspection records shall identify which shop numbers are assembled with the item serial number (3.4.7.6.5).

4.5.4 Chromium plating inspection. The chromium plating process including the cleaning prior to plating, reverse etch cycle, plating cycle and thermal treatment after plating, time and treatment at the temperature specified on the applicable drawing, shall be certified by the contractor or heat treating facility and made available for the Government representative upon request.

4.5.5 Welding. Welds shall be examined for completeness, appearance and conformance to welding requirements specified on the applicable drawing.

4.5.6 Assembled items. Assembled items shall be inspected, functioned and tested as provided for in the applicable individual cannon specification. If any defective parts are found they shall be replaced with conforming parts and segregated for disposition. Each assembled item shall be visually examined for completeness of assembly; for verification of markings, including serial numbers, weight, center of gravity, quarter lines and model designation; for freedom from chips, dirt and foreign matter; and for compliance with workmanship requirements.

4.5.7 Autofrettage. The autofrettage (see 6.3.7) process shall be under the surveillance of the Government representative. The Government representative shall observe any detail or operation and verify any measurement at any stage of the operation that is deemed necessary. From test results furnished by the tube forging contractor, the lowest yield strength test value obtained at the breech end of the tube shall be used to determine the required minimum bore enlargement in accordance with the table on the applicable drawing.

4.5.7.1 Before autofrettage. After machining is completed in preparation for autofrettage, the bore diameters of each tube shall be measured with approved inspection equipment. The measurements shall be recorded and identified with each tube.

4.5.7.2 After autofrettage. After autofrettage, bore diameters of each tube shall be measured with approved inspection equipment. The measurements shall be recorded and identified with the individual tube.

4.5.7.3 Tube bore enlargement. The actual bore enlargement of each tube shall be calculated from the measurements of the bore diameters before and after autofrettage. The calculations shall be recorded and identified with the individual tube. Any tube not having the minimum bore enlargement or having an enlarged bore diameter exceeding the maximum bore diameter permissible shall be rejected.

4.5.7.4 Material soundness of autofrettaged tubes. The interior surfaces of each autofrettaged tube shall be borescoped and the exterior surfaces shall be magnetic-particle inspected in accordance with the applicable drawings and specifications. When specified, the tube interior surfaces shall be magnetic-particle inspected with a black-light borescope in accordance with applicable drawings and specifications.

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4.5.8 Rifling operation. The rifling of the first weapon furnished under a contract shall be witnessed by the Government representative (see 6.4.1), who shall observe the operation and verify any measurement or detail necessary. Subsequent rifling operations shall be subject to periodic check by the Government representative for verifying that the contractor's control of the process provides adequate assurance of conformance to the drawing requirements.

4.5.9 Inspection of bore surfaces. Areas sufficiently near the muzzle or breech shall be checked by direct comparison with the applicable surface roughness specimens. The remaining surfaces shall be checked with a borescope by comparison with the surface previously compared to the specimens.

4.5.10 Bore and chamber diameter gaging.

4.5.10.1 Preparation for gaging. Preparation for gaging shall be meticulous to assure accuracy. The chamber and the bore shall be dry and free of all foreign material. During inclement weather gaging shall be performed under cover.

4.5.10.2 Method of inspection. Bore and chamber measurements shall be taken with a star gage, an air gage, an electronic gage, or approved equivalent inspection equipment.

4.5.10.3 Measuring tube bores. For rifled cannon, all bore measurements made in a tube shall be located relative to the muzzle "vertical land" which is defined as the land closest to the top vertical centerline position at the muzzle end. The adjacent groove, in a clockwise rotation as one faces the muzzle is the "vertical groove". For all cannon, bore measurements shall be taken at location(s), longitudinal and radial, as specified in the applicable tube QAP. All measurements shall be recorded and identified as to location in accordance with the applicable tube QAP.

4.5.10.4 Gaging tapered areas in chambers. Tapered areas less than 0.125 inch per inch and with an axial length greater than 0.5 inch shall be measured in two series of 0.5 inch intervals, 90 degrees apart, to verify conformance to the taper requirements. Readings shall be recorded and evaluated as variations from a basic cone with a 0.002 inch variation as the maximum permissible. Negative tapers are not acceptable. Maximum diameters are not to exceed drawing requirements. Chamber gages may be used in other than the above areas to verify conformance to specified requirements (see 4.5.10.2).

4.5.10.5 Record of measurement. The contractor's record of final measurements of bore and chamber shall accompany each tube.

4.5.11 Wall thickness. The following shall be the minimum acceptable procedures for determining tube wall thickness variations.

- a. In the tapered areas of the chamber, measure wall thickness continuously around the circumference at intervals prescribed in the applicable QAP.
- b. For the balance of the tube, measure wall thickness continuously around the circumference forward of the chamber to the muzzle and at intervals prescribed in the applicable QAP.

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- c. Maximum variation shall be reported for each point measured.
- d. If a recorded variation exceeds the tolerance specified on the applicable drawing, measurements in the chamber area shall be taken and reported one-inch intervals, and for the balance of the tube at twelve-inch intervals.
- e. If final readings exceed the tolerances specified on the applicable drawing, the tube shall be rejected and submitted to the Procuring Contracting Officer for disposition.

4.5.12 Resubmission of rejected tubes. Noncompliance with plating or dimensional requirements shall be cause for rejection of the tube. Such rejected tubes may be resubmitted for Government inspection after stripping and replating. For acceptance, resubmitted tubes shall be subject to the same inspections and requirements as the first submission.

4.5.13 Materials. Materials for parts shall be tested for compliance with the applicable specifications. The test results shall be available to the Government representative. Certified test reports identifiable with the material may, at the option of the Government, be accepted in lieu of tests. When the identity or quality of the material is in doubt and valid and acceptable data is absent, tests shall be conducted within the material specifications as required by the Government representative to determine the identity and quality. If proven to be sub-standard, the material shall be rejected.

4.5.13.1 Identification of materials. The following parts shall carry positive identification through all processes so that it is possible to determine the original source of the finished part. This record shall include the name of the producer (or Cage code number), detail specification number, and pertinent procedure data on the heat, ingot, lot, and other processing numbers.

- a. Tubes and tube members, including liners, jackets, hoops and separate chamber sections.
- b. Evacuator chambers.
- c. Muzzle brakes and blast deflectors.
- d. Breech rings, breech bushings and breech couplings.
- e. Breechblocks.
- f. Nozzle assemblies of recoilless rifles and guns.
- g. Base caps of mortar cannon.

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4.5.13.2 Heat, forging, or casting numbers of major items. Heat, forging, or casting numbers of major items shall be preserved throughout the manufacturing processes. If it is necessary to transfer the numbers to another area during machining, such transfer shall be documented. For source inspected material, documentation shall be reviewed by the Government representative, and confirmed by the inspector's stamp next to the transferred number on the material. For destination inspected material the documentation shall be subject to Government review. The contractor shall maintain a cross-reference record of heat or forging numbers, shop numbers if applied, and final serial numbers.

4.5.14 Helical springs. Helical springs shall be inspected as prescribed by MIL-S-13572, and applicable QAP, if any.

4.5.15 Threads. Threads shall be checked with thread gages appropriate to the type, form, size and class of thread specified.

4.5.16 Lubrication. Parts and assembled items shall be inspected for proper lubrication.

4.5.17 Surface texture. Surface texture shall be visually examined by direct comparison with applicable surface texture specimens conforming to ANSI/ASME B46.1. In case of dispute, surface texture measuring equipment conforming to MIL-I-45177 shall be used.

4.5.18 Workmanship. Parts shall be examined visually to determine compliance with the highest grade practice used in the manufacture of military weapons. Evidence of poor workmanship shall be:

- a. Scratches in excess of drawing and specification requirements
- b. Burrs
- c. Tool scores or gouges
- d. Deformations
- e. Knife edges and fins
- f. Excess metal
- g. Missing or damaged protective finish

Also, finished parts of defective material or processing resulting in:

- a. Seams or laps
- b. Laminations
- c. Cracks or visible steps which may affect serviceability, functioning, appearance or safety. Corners and edges shall be inspected for conformance with the requirements of the applicable drawing.

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4.5.19 Bearing of obturator parts. After assembly, the tube seating surface of each split ring shall be very lightly coated with red lead and the breech shall be closed and opened. Surface contact of the rings with the seating surface in the tube shall be examined to determine compliance with the bearing requirements. After examination the red lead shall be removed from the obturator parts and the tube seat with a clean, non-abrasive cloth.

4.5.20 Riveted joints. Rivets shall be examined visually for full formed heads concentric with the body. Rivets shall also be inspected to establish evidence of completely filled holes and firm contact between the joined surfaces. This inspection, which will certify the production process, will be accomplished by destructively sectioning a prototype riveted joint assembly to determine that the rivets completely fill the holes and effect firm contact between the joined surfaces. The sectioned joint shall be subject to verification by the Government representative. Failure to comply with the requirements of 3.4.4.2 shall be cause for rejection.

4.5.21 Straightening of tubes. When cannon tubes are straightened, the contractor shall certify to the Government representative that the straightening has been conducted in conformance with the requirements of 3.4.2.1.1.

4.5.22 Material soundness of parts. Material soundness of parts shall be inspected as specified in the applicable QAP.

4.5.23 Marking. Parts and assemblies shall be visually examined to determine compliance with marking requirements of item drawings or the contract, and this specification.

#### 4.6 Inspection equipment.

4.6.1 Government inspection equipment. Drawings or stock numbers of Government designed inspection equipment shall be obtained from the pertinent Inspection Equipment Lists of the QAP. When specified in the contract, inspection equipment available from the Government will be furnished for usage by the contractor and the Government representative.

4.6.2 Care and maintenance. Inspection equipment shall be kept clean and shall be properly preserved when not in use. Special inspection equipment such as air, optical or electronic equipment shall be repaired or cleaned by qualified personnel only. Technical assistance, if required, should be requested from the Government representative or the Procuring Contracting Officer.

4.6.3 Contractor inspection equipment. The contractor shall provide and maintain gages and other measuring and testing devices necessary for the contractor's inspection. Such equipment shall be subject to inspection by the Government and shall be available to the Government representative, when requested, for the purpose of product inspection.

4.6.4 Calibration. Through inspection of the contractor-furnished and the Government-furnished inspection equipment, the Government representative shall determine that the contractor correctly uses gaging, measuring and testing equipment of required accuracy, precision, type and range to make measurements of the required accuracy. The contractor shall have a set of master gages,

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standards and appropriate instruments for regularly scheduled calibration of the inspection equipment. Records of regularly scheduled calibration shall be maintained by the contractor and made available for review by the Government representative. The calibration of gages, standards and instruments shall be subject to periodic check by authorized Government personnel. Calibration may be provided by a Government-certified facility capable of providing the required service.

4.6.4.1 Calibration system. When inspection system requirements conform to MIL-I-45208, the calibration of inspection equipment shall be in accordance with MIL-STD-45662.

4.6.5 Periodic inspection of Government-furnished inspection equipment.

4.6.5.1 Periodic inspection time reached. Each time the frequency of calibration specified on the Gage Record Card is reached during a contract, the inspection equipment shall be calibrated in accordance with MIL-I-45607. The equipment shall be checked against a standard of higher accuracy. Adjustable type equipment such as gages with adjusting screws, shall be adjusted. Fixed-type equipment shall not be adjusted but shall be brought to the attention of the contracting officer. The results of calibration shall be recorded on the reverse side of the Gage Record Card.

4.6.5.2 Periodic inspection time not reached. If the frequency of calibration specified on the Gage Record Card is not reached during a contract, entries shall be made on the reverse side of the Gage Record Card in the following columns:

- a. DATE ISSUED (date equipment is provided to using element)
- b. NUMBER OF PIECES INSPECTED (total number of applications of equipment to item being produced)
- c. REMARKS (Contract number)

4.7 Inspection at the proving ground.

4.7.1 Examination before proof firing. The following inspection shall be performed before proof firing:

- a. Assembled weapon. Visual examination of assembled weapon for proper assembly.
- b. Automatic cannon. Before engineering tests and firings, manual operation of automatic cannon, using dummy rounds, to insure proper functioning and non-existence of broken or damaged parts.
- c. Breech mechanism. Functioning check of breech and firing mechanisms.

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- d. Interior surfaces. Borescope examination of the interior surfaces of tubes for defects. If the proving ground inspection of the first 10 consecutive tubes agrees with the examination taken at the manufacturing facility of the particular contractor, sampling inspection of tubes subjected to borescope examination may be conducted at a frequency of one tube out of 25 tubes thereafter. Sampling shall insure that continuing quality is being maintained (see 4.3.3).
- e. Bore and chamber measurements. Bore and chamber diameter measurements shall be in accordance with the applicable tube QAP and this specification (see 4.5.10). Measurements shall be recorded. If the measurements obtained during proving ground inspection of the first 10 consecutive tubes agree with the measurements taken at the manufacturing facility of the particular contractor, sampling inspection of bore measurements before firing may be made at a frequency of one tube out of 25 tubes thereafter. Sampling shall insure that continuing quality is being maintained (see 4.3.3).

4.7.2 Proof-firing tests. Proof-firing, simulation tests, or both shall be conducted as specified in the detail specification or as directed on all critical components defined by an approved Quality Assurance Activity. Unless otherwise specified, proof-firing tests shall be performed by the Government. When proof-firing tests are specified for components that are furnished separately, the tests shall be made by firing the specified rounds in an appropriate weapon with the component assembled. When practical, such tests shall be combined with proof-firing tests for cannon or repair tubes. A proof facility cannon may be used at the option of the Government.

4.7.2.1 Proof-firing schedule. A proof-firing test shall consist of firing the number of standard and specific-pressure rounds in the order and manner specified in the applicable detail specification. It shall include any additional rounds needed to clarify any indecisive results.

4.7.2.2 Proof ammunition. The standard weight of projectile, the muzzle velocity and the upper pressure limit at 70 degrees F + 3 degrees F shall be as specified on the applicable ballistic drawing or in the pertinent detail specification. Standard and specific pressure ammunition used in the proof-firing shall conform to the following:

- a. Standard-pressure round. A standard-pressure round shall use a standard weight projectile, shall be loaded with the weight of propellant established at the time of assessment of the propellant lot, and shall produce the specified muzzle velocity. The resultant pressure shall be within the limits of the upper pressure limit at 70 degrees F + 3 degrees F and the lower acceptable mean pressure. If the specified muzzle velocity is not reached with the maximum pressure and the weight of above propellant, the appropriate commodity command or arsenal shall be informed.
- b. Specific-pressure round. A specific-pressure round shall use a standard weight projectile and shall be loaded with a suitable propellant to give the specified percentage of the upper pressure limit at 70 degrees F + 3 degrees F.

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- c. Storage. Proof rounds shall be maintained at 70 degrees F  $\pm$  3 degrees F for not less than 12 hours immediately before being fired.

4.7.3 Inspection after proof-firing. The following examinations and tests shall be performed after proof-firing.

- a. Visual examination. A visual examination shall be made of the cannon for looseness or interference of parts and any defects in material, workmanship or function.
- b. Material soundness. Examine all surfaces of the breechblock, breech ring, and bushing and the outer surfaces of the tube by magnetic particle inspection conducted in accordance with applicable drawings and specifications, to determine compliance with requirements (see 3.2.2). A borescope examination shall be made of the tube interior surfaces to determine compliance with requirements. When specified, the tube interior surfaces shall also be magnetic-particle inspected with a black-light borescope in accordance with applicable drawings and specifications to determine compliance with requirements. Examine all surfaces of muzzle brakes, bore evacuators, mortar base plates, etc., by non-destructive inspection (magnetic-particle, liquid penetrant, radiographic, etc.) in accordance with applicable drawings and specifications to determine compliance with requirements.
- c. Bore and chamber diameters. Bore and chamber diameter measurements shall be in accordance with the applicable tube QAP and this specification (see 4.5.10). Measurements shall be recorded. Bore enlargements shall be in accordance with the bore enlargement table of the pertinent detail specification.

4.7.4 Proof-marking. Proof-tested cannon, mortars, recoilless rifles, muzzle devices and repair tubes shall be marked near the serial number as proof accepted or adequately tagged as proof rejected by the proving ground.

4.8 Inspection provisions for packaging. The provisions for inspection of packaging requirements shall be as prescribed in the applicable individual cannon specification and this specification.

4.8.1 Lot formation. The formation, size and presentation of lots for examination and testing of cleaning, drying, preservation, packaging, packing and marking shall be in accordance with MIL-STD-105, and subject to approval by the Government representative.

4.8.2 Sampling inspection. Sampling procedures shall be in accordance with MIL-STD-105, or other system approved by the Procuring Contracting Officer.

4.8.3 Examination. Packaging, packing and marking shall be visually examined in accordance with the classification of defects and acceptable quality levels prescribed in the applicable detail specification. The following provisions shall apply:

- a. An individual AQL is specified for each listed defect, not for a group of defects.

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b. Each item in the sample shall be examined for the listed defects.

#### 4.8.4 Testing.

4.8.4.1 Control of packaging process. Before packaging of each lot of items and when requested by the Government representative during the packaging process, cleaning solvents and preservative compounds shall be tested for freedom of contaminants.

4.8.4.1.1 Cleaning solvents. Cleaning solvents shall be tested by agitating the solution vigorously. Presence of particles or cloudiness of the solution is cause for rejection.

4.8.4.1.2 Preservative compounds. Condition of the preservative containers and appearance of the compounds shall be examined. Rips or holes in the containers, uncovered containers, and dirt or gum in or on the containers are each sufficient cause for rejection of the compound.

4.8.4.2 Determination of cleanliness testing. The contractor shall test items selected by the Government representative from each inspection lot for determination of cleanliness. Test methods and sampling shall be in accordance with MIL-P-116.

4.8.4.3 Heat seal and vacuum retention testing. When applicable, the contractor shall test the bags or containers the Government representative selects from each lot for heat seal and vacuum retention in accordance with MIL-P-116.

4.8.4.4 Repair parts. Packaging of repair parts shall be inspected in accordance with MIL-STD-2073-1.

### 5. PACKAGING

5.1 Special Packaging Instructions (SPIs). SPIs specify the detailed cleaning, drying, preservation, packaging, and packing requirements for Level A (B and C when applicable) protection. Unit and package quantities shall be as specified on the SPIs, except when the quantity quoted in the contract is less than the unit quantity specified on the SPI.

5.2 Complete items and repair parts. Unless otherwise specified, cleaning, preserving, packing, and marking (package) of complete items and repair parts shall be in accordance with the applicable SPIs.

5.3 Packing of inspection equipment. Inspection equipment shall be shipped in suitable containers having adequate cushioning and blocking to prevent damage in transit. Small or fragile equipment shall be afforded the maximum protection of intermediate packaging. Extreme care shall be taken when packaging and packing inspection equipment. Where applicable, the exterior of the container shall be clearly and legibly labeled "Fragile", "Delicate Instrument" or "Glass".

5.4 Long term storage. Cannon, cannon components, and repair parts which are to be stored for a minimum of one year from the date of packaging shall receive Level A protection for the period of storage time. Periodic inspections shall

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be performed in accordance with AR 700-15. Repackaging shall be accomplished in accordance with applicable SPI.

5.5 Level C packaging. When specified, Level C packaging shall be in accordance with MIL-STD-1190.

5.6 Industrial packaging. When specified, industrial packaging shall be in accordance with ASTM D 3951.

5.7 Controls.

5.7.1 Cleaning and preserving. Cleaning solvents and preservative oils and compounds shall be free from contamination.

5.7.2 Volatile Corrosion Inhibitor (VCI) Paper. Unless otherwise specified, opaque VCI treated packaging materials, when required, shall be of the coated treated carrier only. The carrier shall have a pH of no less than 6.5 and no greater than 7.5. VCI treated paper shall be applied and stored in accordance with MIL-I-8574.

5.7.3 Sealing. Heat seals, seams of wraps, overwraps and bags shall be neat and uniform in appearance. Sealing tape shall be applied uniformly and shall adhere completely. Horizontal seams and folds in barrier wraps/bags on cannon/tubes shall be located below the center axis of the tube and folded downward to prevent trapping of water.

5.7.4 Strapping. Girth strapping shall be applied just prior to shipment. It shall be tight and perpendicular to the edges of the container.

5.8 Marking of packages. Unit and intermediate packages and shipping containers shall be marked in accordance with MIL-STD-129, MIL-STD-1190, or ASTM D3951, as applicable. Unless otherwise specified, any special marking requirements shall be in accordance with the applicable item SPI.

6. NOTES

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

6.1 Interpretation of drawings.

6.1.1 Abbreviations. Abbreviations are in accordance with MIL-STD-12.

6.2 Nodule photographs. Photographs, Figure 1 and Figure 2, referenced in 3.4.5.2.6(a) will be available upon request through the Procuring Contracting Officer at Watervliet Arsenal.

6.3 Definitions.

6.3.1 Blend. (see 3.3.1.5).

6.3.2 Spalled depression. A spalled depression is a peeling or flaking of all or any thickness of the plate that leaves in the depression a surface which

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<u>English</u>	<u>Multiply by</u>	<u>Equals</u>	<u>Metric SI Unit</u>
degree Fahrenheit	$(F-32) \times 5/9$	=	degree Celsius (C)
pounds per square inch	6.894	=	Pascal (Pa)
square inch	6.452	=	(Cm) <sup>2</sup>
inch	2.54	=	Centimeter (cm)

Note: Conversion factors can be associated with ASTM E 380 entitled "Metric Practice Guide". Soft conversion is the process of converting dimensions from the English system of units to the metric system of units without changing the physical configuration of the item.

6.8 Waivers and deviations. The Procuring Contracting Officer shall coordinate all requests for waiver or deviation to this specification with Benet Laboratories and the Product Assurance Directorate at Watervliet Arsenal.

6.9 Subject term (key word) listing.

Cannon, general  
Mortar, general  
Guns, general  
Howitzer, cannon, general

6.10 Drawings. Drawings listed in Section 2 of this specification under the heading "U.S. Army Armament Research, Development and Engineering Center" (ARDEC) may also include drawings prepared by, and identified as Watervliet Arsenal, Ordnance Corps, Weapons Command, or U.S. Army Armament Research and Development Command, U.S. Army Armament, Munitions and Chemical Command, etc. Technical data originally prepared by these activities are now under the cognizance of ARDEC.

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

Custodian:

Army - AR

User activity:

Navy - MC, OS

Preparing activity:

Army - AR

(Project 10GP-0009)

## 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.

<b>RECOMMEND A CHANGE</b>		1. DOCUMENT NUMBER MIL-C-13931H	2. DOCUMENT DATE (YYMMDD) .11 February 1991
3. DOCUMENT TITLE CANNON: GENERAL SPECIFICATION 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 INFORMATION			
6a. NAME (Last, First, Middle Initial)		6b. ORGANIZATION	
6c. ADDRESS (Include Zip Code)		6d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	6e. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME US Army ARDEC ATTN: SMCAR-CCB-SS		b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON	
c. ADDRESS (Include Zip Code) Watervliet, NY 12189-4050		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	