

INCH-POUND

MIL-DTL-13931J

16 August 1999

SUPERSEDING

MIL-C-13931H

11 February 1991

## DETAIL SPECIFICATION

### CANNON: GENERAL SPECIFICATION FOR

This specification is approved 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 Verifications to determine that these requirements have been met.

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army TACOM ARDEC CCAC, ATTN: AMSTA-AR-CCB-EC, 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

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

### 2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following 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 (see 6.2).

### SPECIFICATIONS

#### FEDERAL

A-A-50767 - Analyzer, Surface Finish

#### DEPARTMENT OF DEFENSE

MIL-PRF-3150 - Lubricating Oil, Preservative, Medium

MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys

MIL-L-14107 - Lubricating Oil, Weapons, Low Temperature

MIL-F-18264 - Finishes: Organic, Weapons System, Application and Control of

MIL-PRF-81322 - Grease, Aircraft, General Purpose, Wide Temperature Range

### STANDARDS

#### FEDERAL

FED-STD-H28 - Screw Thread Standards For Federal Services

#### DEPARTMENT OF DEFENSE

MIL-STD-129 - Marking for Shipment and Storage

MIL-STD-130 - Identification Marking of US Military Property

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MIL-STD-2073-1 - Standard Practice For Military Packaging

HANDBOOKS

FEDERAL

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

(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.)

2.2.2 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 6.11)

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

- |          |   |
|----------|---|
| 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.)

2.3 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 National Standards Institute (ANSI)/National Conference of Standards Laboratories

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(NCSL)

ANSI /NCSL Z540-1 - General Requirements for Calibration Laboratories and Measuring and Equipment

(Application for copies should be addressed to the American National Standards Institute (ANSI), 11 West 42<sup>nd</sup> Street, New York, NY 10036. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. )

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. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.).

American Society of Mechanical Engineers (ASME)

ASME B46.1 - Surface Texture

ASME B94.6 - Knurling

ASME Y14.6 - Screw Thread Representation

ASME Y14.6AM - Screw Thread Representation Metric Supplement

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 E. 47<sup>th</sup> Street, New York, NY 10018. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.).

American Society for Quality (ASQ)

ASQ A8402 - Quality Management and Quality Assurance - Vocabulary

ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Application for copies should be addressed to the American Society for Quality, 611 East Wisconsin Avenue, Milwaukee, WI 53202-3005. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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### International Organization (ISO) for Standardization

ISO 9002 - Quality Systems – Models For Quality Assurance in production, installation and service

ISO 10012-1 - Quality Assurance Requirements For Measuring Equipment– Part 1: Metrological Confirmation System for Measuring Equipment

(Application for copies should be addressed to the American National Standards Institute (ANSI), 11 West 42<sup>nd</sup> Street, New York, NY 10036. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. )

### Society of Automotive Engineers (SAE)

SAE J1122 - Helical Springs: Specification Check Lists

(Application for copies should be addressed to the Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096. DoD activities may obtain copies from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. )

(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).

2.4 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 2.4). 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 a standard Society of Automotive Engineers (SAE) or American Iron and Steel Institute (AISI) steel of the plain carbon or low –alloy classification. Merchant quality, leaded and free-cutting (re-sulfurized or re-phosphorized or both)

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steels not acceptable (See 6.3). Unless otherwise specified, castings are not acceptable. A list of standard SAE/AISI steels based on drawing call-outs 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).

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. Dimensions and tolerances shall be interpreted in accordance with the standard that was current at the time the drawing was originally prepared. For drawings revised prior to 30 September 1991, the revised dimensions and tolerances only shall be interpreted in accordance with the standard that was current at the time of revision, unless otherwise specified on the drawing. For drawings revised after 30 September 1991, the revised dimensions and tolerances shall be interpreted in accordance with the standard that was current at the time of original drawing preparation, unless otherwise specified on the drawing. Where a unilateral tolerance is specified without showing that the variation in the other direction is zero (e.g. 0.123 + 0.004) the unstated tolerance is zero and the general tolerance shall not apply. Where features are not controlled in accordance with the applicable standard(s) the requirements of drawing B8769390 shall apply. All features depicted as symmetrical to a centerline, without locational dimensions, are considered to have a common axis or center plane.

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.

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- b. Black Oxide, Metallic Plated Surfaces (Chromium, Cadmium, Zinc) and Anodic Coatings – Dimensions and tolerances shall apply with coating.

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.

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 ASME 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 shall be within the 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 ASME B46.1.

3.3.2.1 Knurls. Knurling shall comply with the drawings and ASME B94.6.

3.3.3 Springs. Unless otherwise specified on the applicable drawing, helical compression and extension springs shall conform to the agency purchase description content in SAE J1122. 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.

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3.4.2.1.1 Straightening of tubes. Unless otherwise specified, cannon 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. (see 4.5.21 and Bend definition in 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.

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:

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- 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.

It should be noted that approval of the plating process implies no guarantee of acceptance of the results obtained in use.

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 cannon tubes only.

- a. Nodules are acceptable on the rifling surfaces (lands and grooves) providing the size and density do not exceed that shown in photographs designated by the design agency (see 6.2).
- b. Pits that result from nodule removal are acceptable.

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- 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 criteria and thresholds designated by the design agency (see 6.2).

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 spalling 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.

3.4.5.2.7.1 Dimensional limits of spalling depressions. The overall length of a spalling depression in a tube, measured parallel to the bore axis, shall not exceed two inches. The overall width of a spalling depression, measured at right angles to the length, shall not exceed the criteria and thresholds designated by the design agency (see 6.2).

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 criteria and thresholds designated by the design agency (see 6.2). 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 that are more than one year old from the date of manufacture, primer paint that is more than two years old from the date of manufacture, and top coat paint that is past the shelf life expiration date 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-

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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 re-tested 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.

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), re-lubricated 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 plus 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-PRF-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-PRF-81322. This requirement shall apply to the mating threads of the following:

- a. Breech ring and breech bushing.

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- 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-PRF-81322.

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 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.

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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.

3.4.7.6.2 Source control drawing. The identification marking for items depicted on source control drawings shall include letters "SOCN" (SOURCE CONTROL NUMBER) 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

Assembly  
Example: 19206 ASSY 1234567

MFR 54321

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

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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.

#### 4. VERIFICATION

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 (examination 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 as specified herein, unless disproved 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.

4.2 Terms and definitions. The quality assurance terms and definitions used in this specification and in the individual cannon specifications are in accordance with ASQ A8402.

4.3 Lot inspection.

4.3.1 Lot formation. The formation, size and presentation of lots for inspection shall be in accordance with ASQ Z1.4 (see 6.2), 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 ASQ Z1.4 (see 6.2) 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 re-inspected for all other characteristics in accordance with the normal inspection procedure.

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4.3.4 Classification of characteristics. The classification of characteristics is contained in the referenced specification or in the applicable QAP for a part, subassembly or assembly. The following provisions shall apply:

- a. ASQ Z1.4 (see 6.2), or other system approved by the Procuring Contracting Officer shall be used for all characteristics.
- b. 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 fielding 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

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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.

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 "vertical land", which is defined as the land at the six o'clock position at the commencement of rifling location when the cannon is in a normal (as mounted) position. The adjacent groove in a clockwise rotation, as one faces the muzzle, is designated the "vertical groove". Due to various rifling lengths/bore diameters/rifling twists, the correct land and groove "clocking" position for application of the stargage at muzzle end must be computed for each model cannon; such that upon full insertion, a measuring device probe tip will align with the vertical land/groove at the commencement of rifling location.

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 0.005 inch variation as the maximum permissible. 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.

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- a. Measure wall thickness continuously around the circumference of the tube at intervals prescribed in the applicable QAP.
- b. Maximum variation shall be reported for each point measured.
- c. 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.
- d. 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 cannon tubes may be resubmitted for Government inspection after stripping and re-plating. For acceptance, resubmitted cannon 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. Cannon 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.

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g. Base caps of mortar cannon.

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 agency inspection content in SAE J1122, 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 ASME B46.1. In case of dispute, surface texture measuring equipment conforming to A-A-50767 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
- h. Seams or laps
- i. Laminations

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- j. Cracks or visible steps which may affect serviceability, functioning, appearance or safety.
- k. Corners and edges inspected for nonconformance with the requirements of the applicable drawing.

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.

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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, 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. The calibration of inspection equipment shall be in accordance with ANSI/NCSL Z540-1 and ISO 10012 PT. 1.

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 ANSI/NCSL Z540-1 and ISO 10012 – PT. 1. 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.

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- 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.
- d. Interior surfaces. Borescope examination of the interior surfaces of cannon tubes for defects. If the proving ground inspection of the first 10 consecutive cannon tubes agrees with the examination taken at the manufacturing facility of the particular contractor, sampling inspection of cannon tubes subjected to borescope examination may be conducted at a frequency of one tube out of 25 cannon 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 cannon 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 cannon 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 the design agency. 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  $\pm$  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  $\pm$  3 degrees F and the lower acceptable mean pressure. If the specified muzzle velocity is not reached with the maximum

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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  $\pm$  3 degrees F.
- c. Storage. Proof rounds shall be maintained at 70 degrees F  $\pm$  3 degrees F for not less than 24 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 cannon 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 ASQ Z1.4, and subject to approval by the Government representative.

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4.8.2 Sampling inspection. Sampling procedures shall be in accordance with ASQ Z1.4, 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 prescribed in the applicable detail specification. 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-STD-2073-1.

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-STD-2073-1.

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

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points packaging activity within the Military Department or Defense Agency, or within the Military Departments System Command. Packaging data retrieval is available from the managing Military Departments or Defense Agencies automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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## 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 gun and howitzer cannon; mortar cannon, mounts, and baseplates; recoilless rifles and mounts; and related equipment covered by this specification are military unique because they are used for close combat only and have no commercial application.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- c. Nodule photographs (see 3.4.5.2.6a).
- d. Pits size and density (see 3.4.5.2.6c).
- e. Spalling depression width (see 3.4.5.2.7.1).
- f. Chipped area width (3.4.5.2.7.2).
- g. AQL's in order to implement the procedures of ASQ Z1.4 (see 4.3.1, 4.3.3 and 4.3.4a).
- h. Packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Blend. (see 3.3.1.5).

6.3.2 Spalling. Peeling or flaking of all or any thickness of the plate that leaves in the depression a surface which appears smooth and parallel to the corresponding surface of the base metal before plating.

6.3.3 Chipping. Chipping, which leaves a rough appearing surface, is the removal-of plating, or of plating and base metal, other than by spalling.

6.3.3.1 Chipped areas. A chipped area shall be either of the following:

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- a. Any portion of the plated surface with two or more visible cavities spaced not more than 0.5 inch apart (between nearest edges of nearest cavities) in a direction parallel to the bore axis and not more than 0.1 inch apart in the transverse direction.
- b. The area of any single cavity that is separated from all other cavities by greater distances than the limits stated in a. and whose maximum dimension exceeds 0.1 inch. (A similarly isolated cavity 0.1 inch or less in maximum dimension shall not constitute a chipped area).

6.3.4 Bend. Bend in a machined tube is the deflection, excluding droop, from a theoretical straight line extending between the bore centers at the origin of rifling or forcing cone and at the muzzle end.

6.3.5 Staking. Staking consists of deforming the metal of assembled parts in such a way as to prevent loosening under operating conditions. It is usually applied to cylindrical parts at one or more points around the periphery by a sharp tool (prick punch) that forces the metal at those points tightly against the mating part. It is frequently applied to the end of a screw or to the face of a nut at the edge of the screw thread. In the case of a flush screw head, the surrounding metal is sometimes staked so as to project into the screw head slot, thus locking the screw in position after tightening.

6.3.6 Merchant Quality Steel. Merchant quality steels are those steels that are not suitable for applications that involve forging, heat treating or other operations in which internal soundness or relative freedom from surface imperfections is of prime importance.

6.3.7 Autofrettage. The application of such interior pressure to the bore of a cannon tube as will deform the inner portion of the wall of the cannon tube beyond the elastic limit that would be reached by the explosion of any charge to be used subsequently in the gun.

#### 6.4 Miscellaneous notes.

6.4.1 Notification. Not less than 14 calendar days prior to performing the initial rifling operation, the contractor will furnish written notice to the authorized Government representative of the time, date, and location so that the representative may witness the rifling operation.

6.4.2 Quality and inspection requirements. When warranted, the contract should specify the application of ISO 9002, as appropriate.

6.4.2.1 Sampling inspections. Sampling procedures are in accordance with ASQ Z1.4.

6.5 Suggested steels. The following is a list of suggested steels based on drawing callouts. This list is furnished for informational purposes only and its use does not excuse the bidder or contractor from the sole responsibility of meeting all contract, drawing, and specification requirements. The UNS (Unified Numbering System for Metals and Alloys) equivalents may be used in lieu of the suggested steels listed.

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DRAWING CALLOUT

.23C Max. AISI Plain Carbon (10XX) or Alloy (4XXX or 8XXX) Steel

.34C Max. AISI Carbon (10XX) or Alloy (4XXX or 8XXX) Steel

.13-.34C AISI Carbon (10XX) or Alloy (4XXX or 8XXX) Steel

.27-.46C AISI Alloy (4XXX or 8XXX) Steel

.38-.46C AISI Alloy (4XXX) Steel

SUGGESTED STEELS\*

SAE/AISI 1015 thru 1020 or 4118, 4620, 4320, 4422, 8617, 8620, E8620

SAE/AISI 1025 thru 1033 or 4130, 4330, 4626, 4427, 8627, E8630

SAE/AISI 1015 thru 1033 or 4023, 4118, 4130, 4320, 4330, E4330, 4626, 4427, 8627, E8630

SAE/AISI 4130, 4140, 4330, 4340, E4330 E4340, 4427, 8627, E630

SAE/AISI 4140, 4145, 4340, E4340

\* Suggested steels and their chemical composition limits can be found in ASM International Metals Handbook, Carbon and Low-Alloy Steels. Specifications for these steels, if desired, can also be found in this handbook. ASTM or AMS specifications can be used for any of the suggested SAE/AISI steels.

6.6 Contract data requirements. Monthly reports of the results of final examination and performance testing will be as specified for delivery on DD Form 1423 in the contract.

6.7 Metric units. When metric units are required, units for degree Fahrenheit, pounds per square inch, square inch and inch may be converted to the metric equivalent (soft conversion) by multiplying them by the following conversion factors:

<u>English</u>	<u>Conversion factor</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	=	$(\text{Cm})^2$
inch	2.54	=	Centimeter (cm)

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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 will coordinate all requests for waiver or deviation to this specification with Benet Laboratories and the Product Assurance and Purchasing Directorate at Watervliet Arsenal.

6.9 Subject term (key word) listing.

Mortar, general  
Guns, general  
Howitzer, cannon, general

6.10 Interpretation of drawings.

6.10.1 Abbreviations. Abbreviations are in accordance with ASME Y14.38M.

6.11 Drawings. Drawings listed in Section 2 of this specification under the heading "U.S. Army Armament Research, Development and Engineering Center" (ARDEC) may also include drawings prepared by, and identified as Watervliet Arsenal, Ordnance Corps, Weapons Command, or U.S. Army

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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.

6.12 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.

Custodians:

Army - AR  
Navy - AS

Preparing activity:

Army - AR

Review activities:

Navy - MC, OS

(Project 10GP-0016)

## 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 documents(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER MIL-DTL-13931J	2. DOCUMENT DATE (YYMMDD) 990816
3. DOCUMENT TITLE Canon: General Specification For		
4. NATURE OF CHANGE ( <i>Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.</i> )		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME ( <i>Last, First, Middle Initial</i> )	b. ORGANIZATION	
c. ADDRESS ( <i>Include Zip Code</i> )	d. TELEPHONE ( <i>Include Area Code</i> ) (1) Commercial (2) AUTOVON ( <i>if applicable</i> )	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME  U. S. Army TACOM-ARDEC	b. TELEPHONE ( <i>Include Area Code</i> ) (1) Commercial (518) 266-3540	(2) AUTOVON 974-3540
c. ADDRESS ( <i>Include Zip Code</i> )  ATTN: AMSTA-AR-CCB-EC Watervliet, N.Y. 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	