

INCH-POUND

MIL-B-12253E(MR)

3 November 1988

SUPERSEDING

MIL-B-12253D(MR)

8 March 1985

## MILITARY SPECIFICATION

## BRAKES, MUZZLE, CANNON, STEEL CASTINGS 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 alloy steel castings for cannon muzzle brakes. 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 document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATIONS

## MILITARY

MIL-R-11470 - Radiographic Inspection: Qualification of Equipment, Operators and Procedures

MIL-C-13931 - Cannon, General Specification For

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, U.S. Army Laboratory Command, Materials Technology Laboratory, ATTN: SLCMT-MEE, Watertown, MA 02172-0001 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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## STANDARDS

## MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-130 - Identification Marking of U. S. Military Property
- MIL-STD-453 - Inspection, Radiographic
- MIL-STD-1261 - Welding Procedures for Constructional Steels

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

## ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

- ASTM A751 - Chemical Analysis of Steel Products, Standard Methods, Practices, and Definitions for
- ASTM D3951 - Commercial Packaging, Practice for
- ASTM E8 - Tension Testing of Metallic Materials
- ASTM E10 - Brinell Hardness of Metallic Materials, Test for
- ASTM E23 - Notched Bar Impact Testing of Metallic Materials
- ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron and Wrought Iron, Methods for

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 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. Each muzzle brake casting shall be in accordance with the applicable drawings, the requirements of this specification, the applicable paragraphs of the General Cannon Specification - MIL-C-13931 as incorporated in this document, and all referenced documents. Any conflicts are to be resolved by means of the order of precedence (see 2.3).

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3.2 First article. The contractor shall submit a first article unless it is specifically waived in the contract (see 4.3 and 6.2). No first article requirements shall be waived without review and approval by the procuring contracting officer (see 6.2, 6.6 and 6.7).

3.3 Test coupons. Integrally cast coupon or coupons shall be provided for mechanical property acceptance tests of production castings. Coupons shall be used for acceptance tests only after a correlation of mechanical properties of test specimens from coupons and fully heat treated first article castings has been satisfactorily demonstrated (see 4.3.1). The contractor shall remove the test coupons on production castings prior to shipment.

3.4 Chemical composition.

3.4.1 Material selection. Unless otherwise specified, the contractor shall select a steel composition which when heat treated will meet the mechanical properties specified on the applicable drawing or in the contract. The contractor shall submit his proposed chemistry with his bid for castings. The chemical composition of the castings shall conform to that established by the contractor in the recorded production procedure unless otherwise agreed upon between the contractor and the procuring contracting officer.

3.4.2 Certified analysis. The contractor shall furnish a certified chemical analysis of each melt of steel used in production castings.

3.5 Processing controls. The contractor shall prepare casting procedure data after successful initial production of castings. The procedure shall be the property of the contractor and it shall be subject to review at the contractor's plant by the Government representative. The contractor shall notify the Government representative and procuring contracting officer of any proposed changes to the casting procedure. The changes that affect the correlation of mechanical properties of the castings and test coupons shall constitute the need for resubmission of a first article for the determination of value difference (see 4.3.1). The casting procedure shall include the following:

- (a) Chemical composition of steel including ranges or limits for each element.
- (b) Heat treating procedure including type of furnace and recording controls used, time and temperature of heat treatment involved, quenching medium and method of circulation of same.
- (c) Number of castings per melt.

3.6 Material soundness. All castings shall equal or exceed the soundness requirements of the applicable drawings and specifications.

3.6.1 Radiographic acceptance criteria. Radiography shall proceed in accordance with the latest radiographic positioning charts. All sections indicated on the drawings shall equal or exceed the requirements specified on the drawings. Radiography may be accomplished prior to final heat treatment.

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3.6.2 Magnetic particle acceptance criteria. Requirements and acceptance standards shall be as specified on the applicable drawing. Magnetic particle inspection shall be performed after final heat treatment.

3.7 Surface contour and dimensions. Removal of heads, gates, risers, padding, fins or other protuberances shall be completed in such a manner that the resulting contour shall blend with the contour of the surrounding surfaces. Dimensions shall conform to the dimensions on the applicable drawing.

3.8 Mechanical properties. The mechanical properties of each specimen taken from the casting and coupon or coupons thereof shall comply with the following requirements:

- a. First article. The casting and coupon specimen properties shall comply with all requirements except that the yield strength of the coupon specimen may exceed the maximum amount specified.
- b. Production castings. The adjusted property values (see 4.3.1) of coupon specimens taken from production castings shall comply with the following:

3.8.1 Yield strength. The yield strength shall be as specified on the applicable drawing or in the contract.

3.8.2 Reduction of area. The minimum percent reduction of area shall be as specified in table I for the corresponding yield strength.

3.8.3 Impact resistance. The minimum Charpy impact resistance shall be as specified in table I for the corresponding yield strength.

3.8.4 Hardness. Hardness readings of each casting, taken at two places (approximately 90° apart) on the outside of the hub after heat treatment and shall vary no more than 50 Brinell hardness numbers. The hardness of all castings not tension tested shall be within + 25 Brinell hardness numbers of the average hardness of the castings from the same lot that have been tension tested.

3.8.5 Results. The contractor shall maintain records of the chemical and mechanical property tests (see 6.5).

### 3.9 Repair-welding of castings.

3.9.1 General. Surface defects can be removed by grinding or any other suitable removal method. Any remaining cavity can be left without filler metal providing its depth does not exceed 1/8 inch. If the depth of the defect exceeds 1/8 inch, welding shall be required to fill the defective area. Blend surrounding surfaces leaving no sharp edges.

3.9.2 Preparation of castings for welding. The casting shall be annealed or normalized before welding.

TABLE I. Mechanical properties.

Yield strength ranges (0.10% Offset) p.s.i.	Reduction of area Percent Minimum	Charpy V-notch impact resistance at -40° +2°F (foot-pounds minimum)
90,001 - 100,000	35	30
100,001 - 110,000	35	30
110,001 - 120,000	35	30
120,001 - 130,000	35	30
130,001 - 140,000	30	25
140,001 - 150,000	25	20
150,001 - 160,000	23	18
160,001 - 180,000	20	15

The average yield strength values of the two tensile specimens determines which yield strength range in table I is applicable for determining the minimum Charpy impact resistance.

Note: See paragraph 6.8 for metric conversion table.

3.9.3 Welding procedures and controls. Procedures and controls for repair welding shall be in accordance with all provisions of MIL-STD-1261, Class 3.

3.9.4 Repair-weld soundness. A repair-weld casting shall be as sound as a non-welded casting. Welded areas shall be radiographed prior to final heat treatment to assure soundness of the repair.

3.9.5 Final heat treatment. After completion of the repair welding, the repaired casting, including its representative coupon, shall be heat treated by the same procedures used on non-welded castings of the same lot.

3.10 Identification marking. Castings shall be marked as specified on the drawing in accordance with MIL-STD-130 and shall include melt, lot, and casting numbers or any other numbers that will positively identify each casting with the report of tests, shipments, manifest, invoice or any other correspondence covering the casting. Other markings specified on applicable drawings shall be applied in accordance with MIL-C-13931.

3.11 Workmanship. All castings shall be of uniform quality and condition, free from blowholes, porosity, shrinkage defects, cracks and other injurious defects, unless specifically allowed in the applicable drawings or unless otherwise agreed upon between the contractor and the procuring contracting officer.

#### 4. QUALITY ASSURANCE PROVISIONS

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

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

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3)
- b. Quality conformance inspection (see 4.4)

4.3 First article inspection. A first article shall be submitted for inspection in accordance with contract requirements. The first article shall be representative of the production processes to be used during quantity production and shall consist of two castings selected at random from one melt. If only one casting can be poured from one melt, the first article shall consist of two castings, one from each of two melts. Each casting shall be inspected nondestructively and destructively for compliance with all requirements. The first article shall be subjected to the inspections, examinations, and tests as is necessary to determine compliance with the requirements of the contract.

4.3.1 Correlation of first article test-coupon results to first article casting results. Each acceptably sound first article casting shall be destructively tested for correlation of casting and coupon test results and acceptance of casting procedure. Two tension and three Charpy impact tests shall be performed on integrally cast coupons from each casting and also on

casting specimens taken from the casting at the locations shown on the applicable drawing. In order to qualify for correlation and acceptance of casting procedure, the individual mechanical property values of each specimen taken from the first article castings (coupon and casting) shall meet requirements of 3.8 except the specimens taken from the coupons may exceed the maximum yield strength specified. The average mechanical property values of all first article test coupons shall be correlated with the average mechanical property values from the castings. The correlation is named "value difference". The value difference shall be established for each of the required mechanical property values except hardness and shall be used for the acceptance of production castings. The value difference is equal to the average of all values obtained from the two first article castings minus the average of all values obtained from the related coupons. The value difference may be plus or minus and shall be added algebraically to the test value of each coupon from the production castings to obtain the adjusted value. These adjusted values shall meet the requirements of table I.

4.3.2 Casting acceptance. No production casting shall be submitted for acceptance until the contractor has qualified his procedure and has demonstrated mechanical property correlation between the first article test coupons and the first article castings. Compliance of the first article with all inspection requirements shall be considered the basis for approval for the start of production. Failure of the first article to meet any specified individual requirement shall be cause for rejection of the casting procedure. Reevaluation and resubmission of the first article casting procedure shall then become necessary.

4.4 Quality conformance inspection. Quality conformance inspection is listed in table II.

4.4.1 Inspection lot. An inspection lot shall consist of all castings that are produced from the same individual melt of steel, to the same drawing and that, if heat treated, are heat treated together by batch procedures or by being passed consecutively and continuously through a continuous-type of heat treatment process. The formation, size and presentation of lots for inspection shall be determined in accordance with MIL-STD-105.

4.4.2 Examinations.

4.4.2.1 Surface contour and dimensions. Casting samples taken in accordance with MIL-STD-105, using an AQL of 6.5, shall be examined for compliance with surface contour and dimensional requirements. Integrally cast coupon or coupons which are not used in quality conformance testing shall be removed before shipment of castings. Non-conforming castings shall be subject to rejection.

4.4.2.2 Identification marking. Casting samples taken in accordance with MIL-STD-105, using an AQL of 6.5, shall be examined for complete, correct and legible marking.

4.4.2.3 Packaging. Casting samples shall be examined for compliance with requirements for packaging.

4.4.2.4 Workmanship. Castings shall be examined to determine compliance with the requirements of 3.11. Failure to comply shall be cause for rejection.

4.4.3 Tests and test methods.

4.4.3.1 Chemical analysis. Samples of each melt of steel shall be taken from the ladle for analysis at the time of pouring. Chemical analysis of each melt shall be conducted in accordance with the applicable wet or the dry methods of ASTM A751. In case of dispute, referee tests shall be made by the wet method of ASTM E350. A melt shall be rejected if the chemical analysis fails to comply with the composition ranges specified in the recorded casting procedure.

TABLE II. Quality conformance inspection.

<u>Categories/ Characteristic</u>	<u>Requirement Paragraph</u>	<u>Examination Paragraph or Test Method Paragraph</u>
<u>Examinations</u>		
Surface contour and dimensions	3.7	4.4.2.1
Identification marking	3.10	4.4.2.2
Workmanship	3.11	4.4.2.4
Packaging	5.	4.4.2.3
<u>Tests</u>		
Chemical analysis	3.4.2	4.4.3.1
Material soundness	3.6	
Radiographic	3.6.1	4.4.3.2
Magnetic particle	3.6.2	4.4.3.3
Mechanical properties	3.8.b.	4.4.3.4
Yield strength	3.8.1	4.4.3.4.1
Reduction of area	3.8.2	4.4.3.4.2
Charpy impact	3.8.3	4.4.3.4.3
Hardness	3.8.4	4.4.3.4.4

TABLE III. Minimum sample sizes  
for radiographic tests.

<u>Lot size</u>	<u>Sample size</u>
Up to 5	All
6 - 8	5
9 - 11	6
12 - 15	7
16 - 20	8
21 - 26	9
27 - 36	10
37 - 51	11
52 - 82	12
83 and over	15

4.4.3.2 Radiography. The number of castings to be radiographed from each production lot shall be in accordance with table III. Radiographic testing shall be performed in accordance with MIL-STD-453 to assure conformance with the requirements of 3.6.1. Qualification of equipment, operator and procedures shall be in accordance with MIL-R-11470. The positioning of the radiographs shall be as shown in the applicable drawing. If any casting in a sample fails to meet the soundness requirements, the remaining castings in the lot shall be radiographed in those positions which failed to meet the requirements. Castings which fail to meet the radiographic soundness requirements shall be subject to rejection.

4.4.3.3 Magnetic particle inspection. Each casting shall be magnetic particle inspected over its entire surface in accordance with the applicable drawing to determine conformance with the requirements of 3.6.2. Non-conforming castings shall be rejected.

4.4.3.4 Mechanical property tests. The number of castings randomly selected for mechanical property tests other than hardness shall be at least 20% of each lot up to and including a lot size of 50 castings; but in no case less than two castings from a lot. Two tension and three Charpy impact tests shall be performed for each sample casting. Coupons from sample castings shall be tested for yield strength, reduction of area and Charpy impact resistance. If any casting representing the production lot fails to comply with the mechanical property requirements, the lot shall be rejected and coupons from every casting in the lot shall be tested for mechanical properties. Non-conforming castings shall be rejected. In lieu of testing the mechanical properties of every casting in the lot, the lot may be reheat treated and resubmitted (see 4.5.3).

4.4.3.4.1 Yield strength. Yield strength shall be determined by the offset method in accordance with ASTM E8. The limiting off-set shall be 0.10 % (0.001 inch per inch of gage length). All adjusted values of yield strength shall be as specified on the applicable drawing or in the contract. Non-conforming castings shall be rejected.

4.4.3.4.2 Reduction of area. Reduction of area shall be determined in accordance with ASTM E8. All values shall be as specified in table I for the corresponding yield strength. Non-conforming castings shall be rejected.

4.4.3.4.3 Charpy V-notch impact. Charpy V-notch impact tests shall be conducted in accordance with ASTM E23. The temperature of the test specimen at the time of testing shall be -40 degrees F  $\pm$  2 degrees F. All impact resistance values shall be as specified in table I for the corresponding yield strength. Non-conforming castings shall be rejected.

4.4.3.4.4 Hardness. Hardness tests shall be conducted in accordance with ASTM E10. Brinell hardness readings shall be taken after heat treating on the outside hub area of each casting approximately 90 degrees apart. The hardness readings on any one casting shall vary no more than 50 Brinell hardness numbers. The hardness of any casting not tension tested shall fall within  $\pm$  25 Brinell hardness numbers of the average hardness of the castings from the same lot that have been tension tested. Non-conforming castings shall be rejected.

same lot that have been tension tested. Non-conforming castings shall be rejected.

4.5 Rejection. Castings which fail to meet the requirements of this specification when tested in accordance with 4.4 shall be rejected.

4.5.1 Local defects. If rejection of a casting can be traced to the presence of allowable defects (e.g. shrinkage) in the failed test specimen, the test values obtained from that specimen may be disregarded subject to the approval of the procuring contracting officer and another specimen may be substituted for each such specimen. The location of the substitute specimen shall be as close to the original location as possible, however, it should be from a location that is free of deleterious defects.

4.5.2 Defective machined specimens and faulty test equipment or methods. If a defectively machined test specimen, faulty test equipment, or faulty operation of the testing equipment results in the rejection of a casting, the test values obtained from such specimens may be disregarded subject to the approval of the procuring contracting officer and another specimen from as close to the original location as possible may be substituted for each such specimen.

4.5.3 Resubmission after reheat treatment. A lot which fails to meet mechanical property requirements may be reheat treated as a lot. A reheat treated lot shall be retested by taking at least the minimum number of tests required for original testing; in which case, only those tests taken after retempering, or requeenching and retempering shall be used to determine acceptability.

4.6 Check tests. From any lot of castings found acceptable under prescribed inspection, the Government may designate any casting as a check casting. Such a casting shall be subjected to any or all tests specified herein. If the casting fails to comply with any of the requirements, two additional castings selected by the Government from the same lot shall be tested. Failure of either of these castings shall be cause for rejection of the lot and all lots produced under the recorded casting procedure. However, if both castings comply with all requirements, the lot shall be accepted and the recorded casting procedure shall be validated. If the check casting fails to pass any or all tests specified herein, the cost of the tests on the check casting and the two additional castings shall be borne by the contractor.

4.6.1 Establishment of new recorded procedure. Where a check test has nullified the existing recorded procedure, a new recorded casting procedure shall be effected in accordance with 3.3, 3.5, 3.6 and 4.3.1.

4.6.2 Disposition of lots. Where a check test has caused rejection of one or more lots resulting from a nullified recorded casting procedure, disposition of lots may be determined by additional testing or screening or both if so requested by the contractor and approved by the procuring contracting officer.

## 5. PACKAGING

5.1 Packaging and packing. Unless otherwise specified, the castings shall be packed for shipment in accordance with ASTM D3951.

5.2 Marking for shipment. Marking for shipment shall be in accordance with ASTM D3951 in addition to any special marking required in the contract or purchase order.

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 castings specified herein are intended for use with military cannon.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- c. Instructions for the submission of a first article including the number of castings, unless the first article is waived (see 3.2, 4.3 and 6.7).
- d. Steel composition if required (see 3.4).
- e. All inspection and test data that is required including material selection (see 3.4.1), certificate of chemical analysis (see 3.4.2), yield strength (see 3.8.1), reduction of area (see 3.8.2), Charpy V-notch impact resistance (see 3.8.3), hardness (see 3.8.4), radiographic inspection (see 3.6.1), magnetic particle inspection (see 3.6.2), and any additional or extended examinations and tests beyond the scope of this specification.
- f. Applicable drawings or sketches showing locations and numbers of test specimens, and mechanical property requirements (see 3.6 and 4.4).
- g. The examinations and tests to be performed by the contractor and the examinations and tests to be performed by the Government.
- h. Heat treatment to be used if required.
- i. At whose expense a retest may be performed.
- j. Special identification marking not covered in 3.10.
- k. Inspection equipment, responsibility for acquisition, maintenance, and disposition thereof, if other than as specified.
- l. Availability of inspection equipment from the Government.
- m. Extent of contractor's responsibility for Government furnished and for contractor required final inspection equipment.
- n. Applicable acceptance test procedures.

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- o. Packing and marking for shipment (see 5.1 and 5.2).
- p. Residual metal.
- q. When warranted, the application of MIL-I-45208.

6.3 Waiver of first article lots. The procuring contracting officer may waive the requirement for first article in a succeeding procurement if the following conditions are met:

- (a) The contractor has produced castings for a previous procurement in accordance with recorded casting data.
- (b) The contractor's data and procedure are unchanged.
- (c) The subject casting design and strength level are duplicates to those castings previously procured.
- (d) The period of non-productivity of this item does not exceed one year and the contractor has not lost his know-how through a turnover in personnel, equipment and facilities.

6.4 Retention of casting procedure by the contractor. The proposed casting procedure (see 3.5) should be retained by the contractor for a minimum of two years after completion of the contract.

6.5 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.2	DI-T-4902	First Article Inspection Report	
3.4.2	UDI-T-23264	Certification Data Report	
3.8.5	DI-P-1638	Chemical and Physical Properties for Castings	

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMS DL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.6 First article. When first article inspection is required, the procuring contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample,

a first production item, a sample selected from the first lot of production items, a standard production item from the contractor's current inventory, and the number of items to be tested as specified in 4.3. The procuring contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.7 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.

6.8 Metric units. When metric units are required, units for degree Fahrenheit, pounds per square inch, square inch, inch, and foot-pound may be converted to the metric equivalent by multiplying them by the following conversion factors:

<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	6.895E3	=	Pascal (Pa)
square inch	6.452	=	square centimeter
inch	2.54	=	Centimeter (cm)
foot-pound	1.356	=	Joule (J)

Note: Conversion factors can be associated with ASTM E380 entitled "Metric Practice Guide".

6.9 Subject term (key word) listing.

Cannon	Castings
Muzzle Brakes	Steel

6.10 Additional testing for information. All impact testing for casting acceptance under this specification is performed at -40 degrees F. When additional impact testing at -40 degrees F, for information only, is to be presented, the requirements will be as specified in the contract.

6.11 International standardization agreements. Certain provisions (3.8.3 and 4.4.3.4.3) of this specification are the subject of international standardization agreements (NATO-STANAG NO. 4020: ABC-ARMY-STD-129). When amendment, revision, or cancellation of this specification is proposed which modifies the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental offices to change the agreement or make other appropriate accommodations.

6.12 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.13 Beneficial comments. Duplicate copies of beneficial comments addressed to Director, U.S. Army Materials Technology Laboratory, ATTN: SLCMT-MEE, Watertown, MA 02172-0001 should also be sent to Director, Benet Laboratories, ATTN: SMCAR-CCB-SAS, Watervliet, NY 12189-4050.

Custodian:  
Army - MR

Preparing activity:  
Army - MR

Review activity:  
Army - AR

Project MECA-A121

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