

INCH-POUND  
MIL-C-24707/4  
27 January 1989

## MILITARY SPECIFICATION

### CASTINGS, FERROUS, AUSTENITIC MANGANESE (HADFIELD MANGANESE), (LOW MAGNETIC PERMEABILITY AND/OR WEAR RESISTANT)

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

#### 1. SCOPE

1.1 Scope. This specification covers Hadfield manganese steel castings for use in ship nonmagnetic or wear resistant applications.

1.2 Classification. Austenitic manganese steel shall be furnished in accordance with grade A of ASTM A 128 and in the following types, as specified (see 6.2):

##### Types

- A - Rough ground or pickled
- B - Galvanized

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specification. The following specification forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that 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).

#### SPECIFICATION

##### MILITARY

MIL-C-24707 - Castings, Ferrous, General Specification for.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 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

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

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(Unless otherwise indicated, copies of federal and military specifications 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 document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A 128 - Standard Specification for Steel Castings, Austenitic Manganese.
- A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware. (DoD adopted)
- A 342 - Standard Test Methods for Permeability of Feebly Magnetic Materials.

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

(Nongovernment 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 for austenitic manganese steel shall be in accordance with MIL-C-24707, ASTM A 128, and as specified.

3.2 Material. Unless otherwise specified (see 6.2), the steel shall be made by the electric furnace process, with or without separate refining or degassing.

3.3 Composition. The maximum manganese content shall be 14 percent.

3.4 Mechanical properties. Unless otherwise specified (see 6.2), the mechanical properties shall meet the requirements of table I.

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TABLE I. Mechanical property requirements.

Tensile strength	Yield strength at 0.2 percent offset	Elongation
ksi (minimum)	ksi (minimum)	percent (minimum)
110	45	30

3.5 Finish. In addition to the requirements of MIL-C-24707, castings shall be free of magnetic skin which shall be removed either by surface grinding, machining or pickling. The pickling shall be such that the casting surfaces shall not be damaged by pitting. If skin removal is incomplete by pickling, the remainder shall be removed by grinding.

3.6 Galvanizing. Type B castings shall be hot dip galvanized in accordance with ASTM A 153, class A, except that the embrittlement test of 4.3.1 shall be conducted. The zinc coating shall be applied after removal of the magnetic skin. Zinc coating shall not embrittle the steel as shown by the bend test of 4.3.1.

3.7 Magnetic permeability. Unless otherwise specified (see 6.2), the relative magnetic permeability of the castings shall not exceed 1.20 ( $\mu$ ) (see 4.3.2) after heat treatment and cleaning. For first article, the relative magnetic permeability of the interior metal shall be determined from a casting or from a magnetic permeability test block cast for the purpose. Test specimens shall not exceed a relative magnetic permeability of 1.05. Unless otherwise specified (see 6.2), the first article field strength shall not exceed 0.5 oersteds (see 4.3.2).

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Quality assurance provisions shall be in accordance with MIL-C-24707 and as specified.

##### 4.2 Sampling.

4.2.1 Bend test (type B only). Two bend test specimens shall be cast as separate blocks and shall receive the same heat treatment, surface treatment and zinc coating as the castings they represent.

##### 4.2.2 Magnetic permeability.

4.2.2.1 Quality conformance inspection. Unless otherwise specified (see 6.2), tests shall be made on the actual castings. Each casting shall be tested.

4.2.2.2 First article inspection. The normal permeability of the interior metal shall be determined from a casting or from a permeability test block cast for the purpose.

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4.3 Test methods.

4.3.1 Bend test. One specimen shall be prepared and bent with the zinc-coated surface in compression, through an angle sufficient to develop cracks in the uncoated metal surface. The second specimen shall be prepared and bent with the zinc-coated metal surface in tension through an angle sufficient to develop cracks in the coated metal surface that penetrate into the basis metal. The bend test shall be considered satisfactory if the angle through which the specimen with the coated face in tension bends before the development of cracks into the basis metal is greater than the angle of bend that the specimen with the uncoated face withstands in tension before the development of surface cracks in the uncoated face. A tolerance of minus 15 degrees is permitted.

4.3.2 Magnetic permeability test. For quality conformance testing, the relative magnetic permeability ( $\mu$ ) shall be measured as less than that of a calibrated standard in accordance with ASTM A 342, method 6. For first article tests, the normal magnetic permeability ( $\mu$ ) shall be measured in accordance with ASTM A 342, method 1, 2, or 3. Methods 1, 2, and 3 may be used for measuring a ( $\mu$ ) 1 to 4 and method 6 may be used for measuring a ( $\mu$ ) of less than 2.5.

## 5. PACKAGING

5.1 Packaging shall be in accordance with MIL-C-24707.

## 6. NOTES

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

6.1 Intended use. Austenitic manganese steel castings are intended for applications requiring a low magnetic permeability, high toughness and ductility. It also possesses a high work hardening capacity which provides a good resistance to abrasion. Corrosion resistance of austenitic manganese steel may be improved by galvanizing.

6.2 Acquisition requirements. In addition to the acquisition requirements of MIL-C-24707, acquisition documents should specify the ordering information of ASTM A 128, ASTM A 153 or ASTM A 342, and the following:

- (a) Title, number, and date of this specification.
- (b) Grade and type required (see 1.2).
- (c) 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).
- (d) When the melting practice is other than electric furnace (see 3.2).
- (e) If alternate or no mechanical properties are required (see 3.4).
- (f) If the magnetic permeability requirements are to be deleted or modified (see 3.7).
- (g) If first article field strength is other than specified (see 3.7).
- (h) If the sampling for magnetic permeability test is other than specified (see 4.2.2.1).

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6.3 Supersession data. The supersession data for the applicable specification grades are as follows:

Previous specification

Replacement specification

MIL-S-17249, type A

MIL-C-24707/4, ASTM A 128, grade A, type A

MIL-S-17249, type B

MIL-C-24707/4, ASTM A 128, grade A, type B

6.4 Subject term (key word) listing.

Bend test  
Composition  
Galvanizing  
Nonmagnetic  
Steel

Custodians:

Army - MR  
Navy - SH  
Air Force - 20

Preparing activity:

Navy - SH  
(Project MECA-0332)

Review activities:

Army - AR, MI  
Navy - AS, YD, OS  
Air Force - 84

User activities:

Navy - MC  
Army - ME