

QQ-I-666D  
January 28, 1969  
SUPERSEDING  
Fed. Spec. QQ-I-666C  
May 21, 1954

## FEDERAL SPECIFICATION

### IRON, MALLEABLE, FERRITIC, FOR CASTINGS

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for use of all Federal agencies.

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers high grade ferritic malleable iron for general purpose castings.

1.2 Classification. The malleable iron covered by this specification shall be of the following grades according to their tensile properties at the point of yield:

Grade I (35018) - Black, ungalvanized.  
Grade IG (35018G) - Zinc-coated (galvanized).  
Grade II (32510) - Black, ungalvanized.  
Grade IIG (32510G) - Zinc-coated (galvanized).

1.2.1 The first three digits of the grade designations indicate the minimum yield strength ( x 100 p.s.i.). The last two digits indicate the minimum elongation (percent in 2 inches).

#### 2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards of the issue in effect on date of invitation for bids, or request for proposal, form a part of this specification to the extent specified herein.

##### Federal Specifications:

QQ-S-781 - Steel Strapping, Flat.  
PPP-B-585 - Boxes, Wood, Wirebound.

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- PPP-B-601 - Boxes, Wood, Cleated-Plywood.
- PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
- PPP-C-650 - Crates, Wood, Open and Covered.

Federal Standards:

- Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
- Fed. Test Method Std. No. 151 - Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications, and Standards, at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.)

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Washington.)

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks, and the Index of Federal Specifications and Standards, from established distribution points in their agencies.)

Military Specifications:

- MIL-P-116 - Preservation, Methods of.
- MIL-L-10547 - Liners, Case, and Sheet, Overwrap, Water-Vaporproof or Waterproof, Flexible.

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-147 - Palletized Unit Loads (40" x 48" 4 Way Partial and 4 Way Pallets).
- MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; With Appropriate Test Methods.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- A47 - Malleable Iron Castings.
- A153 - Zinc Coating (Hot Dip) on Iron and Steel-Hardware.
- E3 - Preparation of Metallographic Specimens.
- E10 - Test for Brinell Hardness of Metals.

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

American Trucking Associations, Inc.

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., 1616 P St., N.W., Washington, D. C. 20036.)

Uniform Classification Committee:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, Chicago, Ill. 60606.)

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3. REQUIREMENTS

3.1 Material and mechanical properties. Malleable iron shall conform to the material and mechanical properties specified in ASTM A47 and shall be as specified herein.

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3.2 Grade IG and grade IIG castings. Grade IG and grade IIG castings shall be zinc-coated by the hot-dip process in accordance with ASTM A153. Castings shall be of a composition that will preclude the possibility of galvanized embrittlement, or shall be either cooled from the anneal or subsequently heat-treated so as to be immunized against such embrittlement.

3.3 Dimensions and tolerances. Castings shall conform to the dimensions indicated on drawings or patterns furnished by the contracting officer. Tolerances specified in ASTM A47 shall be acceptable.

3.3.1 Threading. Unless otherwise specified (see 6.2), when threading of a grade IG and grade IIG casting is required, the threading shall be performed after the galvanizing operation.

3.4 Brinell hardness. When specified (see 6.2), castings shall have a Brinell hardness from 100 to 150 when tested as specified in 4.4.2.

3.5 Identification marking. Unless otherwise specified (see 6.2), the identification mark of the manufacturer, and the pattern, or part numbers assigned by the procuring activity shall be located on all castings of sufficient size as shown on applicable drawings. When locations are not indicated on drawings, marking shall be cast in positions that will not interfere with the function of the casting.

3.6 Repair of castings. Unless otherwise specified (see 6.2), castings shall not be repaired, plugged, or welded.

3.6.1 When repairs are authorized, each item repaired shall be encircled with a ring of white paint, prior to submission for final inspection. If grade IG and grade IIG castings are repaired, they shall not be galvanized until weld repairs are approved by the procuring activity.

3.7 Workmanship. Castings shall have a uniform finish and shall be free of harmful primary graphite, shrinks, cold shuts, cracks, blowholes, porosity, shrinkage, or other defects that could render the castings unsuitable for the purpose intended.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

#### 4.2 Sampling.

4.2.1 Lot for sampling. A lot shall consist of all castings of the same pattern, same grade, same melt (or cast during a 4-hour pour period), simultaneously subjected to the same heat-treatment (or subjected to the same heat-treating cycle if the castings are to be heat-treated by a continuous process).

4.2.2 Sampling for examination. A random sample of castings shall be selected from each lot in accordance with MIL-STD-105, at inspection level II. In terms of defects per 100 units, the acceptable quality levels shall be 1.5 for major defects and 4.0 for minor defects.

4.2.3 Sampling for tension and elongation test. Tension test specimens shall be cast to the form and dimensions shown either in figure 1 or figure 2 of ASTM A47 in the same kind of molding material used for the production castings. At least three such specimens shall be cast from a representative ladle of iron either from each batch-melted heat or, in continuous melting, from each 4-hour pour period during which the castings were poured, or as specified herein (see 6.2). Test specimens shall be suitably identified either by the batch-melted heat or the pour period of a continuous heat. Test specimens shall be heat-treated in regular production furnaces. The heat-treatment shall conform as closely as possible to the heat-treatment of the castings which were prepared during the same heat or pour period.

4.2.4 Sampling for Brinell hardness test. When specified (see 6.2), at least 5 castings shall be randomly selected from each lot for the Brinell hardness test specified in 4.4.2. When the shape and size of the casting prevents performance of the Brinell hardness test, the three test bars, cast as specified in 4.2.3, shall be used for the test.

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4.3 Examination. Each sample shall be examined to verify compliance with this specification. Examination shall be conducted as specified in table I.

TABLE I. Classification of defects

Categories	Defects
Critical:	None defined.
Major:	
101	Casting dimensions not as specified.
102	Casting not galvanized, when applicable.
103	Galvanized coating not uniform.
104	Galvanized coating cracked.
105	Surface of casting not smooth and not reasonably free from scale or burned-on sand.
106	Repaired areas of castings not marked.
107	Workmanship requirements not met.
Minor:	
201	Identification marking not as specified.

#### 4.4 Tests.

4.4.1 Tension and yield strength. One of the tension test specimens cast as specified in 4.2.3 shall be subjected to the test specified in ASTM A47 or to method 211.1 of Fed. Test Method Std. No. 151, to determine the tensile strength, the yield strength, and the percent elongation in 2 inches. If the test specimen fails to meet the requirements, a second test bar shall be selected and tested as described above. If the second test specimen passes the test, the lot shall be considered satisfactory.

4.4.2 Hardness test. When specified (see 6.2), at least three Brinell hardness determinations shall be made on each of the sample castings in accordance with ASTM E-10 or method 242 of Fed. Test Method Std. No. 151. If any hardness determination fails to meet the requirements of this specification, the lot shall be rejected.

4.4.3 Microscopic test. When specified (see 6.2), one sample broken in the tension test shall be microscopically examined to determine conformance with the microstructure specified in ASTM A47.

The specimen surface shall be prepared, polished, and etched with a 5 percent nital solution in accordance with ASTM E3. The specimen shall be examined under 100x magnification for temper carbon, primary carbides, and perlites (see fig. 1).

4.5 Inspection of preparation for delivery. The preservation, packing, and marking of the castings shall be inspected to determine conformance with the applicable requirements of section 5 of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation. Preservation shall be level A or C as specified (see 6.2).

5.1.1 Level A. All finished or polished surfaces of the castings subject to corrosion shall be cleaned, dried, and coated with type P-1 preservative in accordance with MIL-P-116.

5.1.2 Level C. Castings shall be preserved in accordance with the supplier's standard practice.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Castings shall be packed in containers conforming to PPP-C-650, style A, type II, PPP-B-601 (overseas type), PPP-B-621 (class 2), or PPP-B-585 (class 3). Castings with finished or polished surfaces that are subject to damage shall be cushioned, anchored, and braced in accordance with MIL-STD-1186. When specified, containers shall be provided with a case liner conforming to MIL-L-10547 and shall be sealed in accordance to the appendix thereto. Container closure shall be as specified in the applicable specification and appendix thereto, except that flat steel strapping shall be in accordance with QQ-S-781, type I, class B. The gross weight shall not exceed the weight limitations of the applicable container specification.

5.2.1.1 Large rough castings shall be shipped loose or in bundles or as palletized loads. Palletized loads shall be in accordance with MIL-STD-147.

5.2.2 Level B. The castings shall be packed as specified for level A, except that the containers shall be domestic type or class 1 as applicable, and the class B strapping need not apply. Castings shall be anchored, blocked and braced to prevent movement.

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5.2.3 Level C. The castings shall be packed in a manner which will insure arrival at destination in satisfactory condition and be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

5.3 Marking (see 6.2).

5.3.1 Civil agencies. In addition to any special marking required by the contract or order, loose castings, bundles, pallets, or shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military agencies. In addition to any special marking required by the contract or order, loose castings, bundles, pallets, or shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Ferritic malleable iron castings covered by this specification are intended for use in the construction of gear cases, pole line hardware, brake and clutch pedals, tools, and other general items.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Grade of castings required (see 1.2).
- c. Applicable drawings, pattern numbers, and dimensions required (see 3.3).
- d. If Brinell hardness requirement is required (see 3.4, 4.2.4 and 4.4.2).
- e. If identification marking is different (see 3.5).
- f. If repair of castings is permitted (see 3.6).
- g. If method of casting tension samples is different (see 4.2.3).
- h. If microscopic test is required (see 4.4.3).

- i. If case liners are required (see 5.2.1).
- j. Level of preservation and level of packing required (see 5.1 and 5.2).
- k. Marking required (see 5.3).

**MILITARY INTEREST:**

Custodians:

- Army - MR
- Navy - YD
- Air Force - 84

Review activities:

- Navy - AS
- Air Force - 85

User activities:

- Navy - CG, MC

Preparing activity:

- Navy - YD

**CIVIL AGENCY INTEREST:**

- GSA - FSS

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Figure 1. Ferritic malleable iron. Temper carbon in ferrite.  
Etched in 5 percent nital. 100X.

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Order for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein. Price 15 cents each.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-H004	
<b>INSTRUCTIONS</b>			
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).			
SPECIFICATION			
ORGANIZATION (of submitter)		CITY AND STATE	
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT	
		\$	
MATERIAL PROCURED UNDER A			
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT			
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?			
A. GIVE PARAGRAPH NUMBER AND WORDING.			
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.			
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID			
3. IS THE SPECIFICATION RESTRICTIVE?			
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?			
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)			
SUBMITTED BY (Printed or typed name and activity)		DATE	

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