Designation: A 47M – 90
METRIC

Standard Specification for Ferritic Malleable Iron Castings [Metric][1]

This standard is issued under the fixed designation A 47M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification[2] covers ferritic malleable castings for general engineering usage at temperatures from normal ambient to approximately 400°C.

1.2 No precise quantitative relationship can be stated between the properties of the iron in various locations of the same casting and those of a test specimen cast from the same iron (see Appendix X1).

NOTE—This specification is the metric counterpart of Specification A 47.

2. Referenced Documents

2.1 *ASTM Standards:*

A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware[3]

A 247 Test Method for Evaluating the Microstructure of Graphite in Iron Castings[4]

A 644 Terminology Relating to Iron Castings[4]

E 8 Test Methods for Tension Testing of Metallic Materials[5]

E 10 Test Method for Brinell Hardness of Metallic Materials[5]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[5]

E 140 Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, and Knoop Hardness)[5]

2.2 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[6]

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Domestic Shipment (Civilian Agencies)[6]

3. Terminology

3.1 *Definitions*—Definitions for many terms common to iron are found in Terminology A 644.

4. Classification

4.1 Castings ordered and produced under this specification are classified under the following grades based on tests on separately cast test bars. Separately cast test bars shall be poured from the same lot of iron as the castings they represent and shall be heat treated with those castings except as provided in 7.2.1.3.

4.1.1 *Grade 22010.*

4.1.1.1 The first three digits of the grade designation indicate the minimum yield strength (MPa) and the last two digits indicate the minimum elongation (% in 50 mm).

5. Ordering Information

5.1 The purchase order for castings ordered under this specification shall state the specification designation, the year in which the specification was issued, and the grade of malleable iron to be supplied. Any option or special additions to the basic requirements of this specification shall be clearly and fully stipulated.

6. Chemical Composition

6.1 The chemical composition of the iron shall be such as to produce the structural and mechanical properties required by this specification.

7. Mechanical Properties

7.1 Factors influencing the properties of castings and their relationship to those of test specimens and separate test castings are discussed in Appendix X1.

7.2 *Tension Test Specimens:*

7.2.1 The tension test specimens shall be cast to the form and dimensions shown in Fig. 1 or Fig. 2, 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-h pour period during which the purchaser's castings were poured, or as otherwise agreed upon between manufacturer and purchaser.

7.2.2 All test specimens shall be suitably identified with the designation of either the batch-melted heat or the pour period of a continuous heat.

7.2.3 All test specimens shall be heat treated in the same production furnaces and in the same cycles as the castings they represent. However, in those instances wherein the critical sections of the production castings differ appreciably from that of the central portion of the test specimens, the time cycle for tempering the test specimens may be altered from that of the production lot in order to obtain similar microstructures or hardness, or both, in both specimen and

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[1] This specification is under the jurisdiction of ASTM Committee A-4 on Iron Castings and is the direct responsibility of Subcommittee A04.02 on Malleable Iron Castings.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Specification SA-47 in Section II of that Code.

[3] *Annual Book of ASTM Standards,* Vol 01.06.

[4] *Annual Book of ASTM Standards,* Vol 01.02.

[5] *Annual Book of ASTM Standards,* Vol 03.01.

[6] Available from Standardization Documents, Order Desk, Building 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

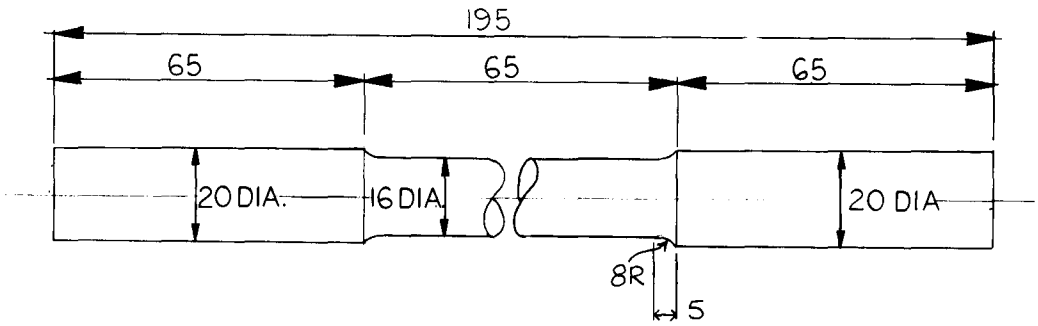


FIG. 1 Tension Test Specimen

castings. In such cases the hardness of the specimens shall be tested and reported along with the tensile test results.

7.2.4 The tension test is usually performed on unmachined specimens. However, for referee work the specimen may be machined from the standard cast bar to the dimensions shown in Fig. 3.

7.3 *Tension Test Method:*

7.3.1 The gage length of the standard tension specimen shall be 50.0 ± 0.3 mm.

7.3.2 The diameter used to compute the cross-sectional area shall be the average between the largest and smallest diameters in that section of the 50-mm gage length having the smallest diameter and shall be measured to the nearest 0.2 mm. No cast bar having a mean diameter less than 15.0 mm shall be accepted for test.

7.3.3 After reaching a stress equivalent to approximately half of the anticipated yield stress, the speed of the moving head of the testing machine shall not exceed 12.5 mm/min through the breaking load.

7.3.4 While the values for yield point and yield strength are not identical, they are sufficiently close for most applications of ferritic malleable irons to be used interchangeably. They may be determined by any of the approved techniques described in the paragraphs on Determination of Yield Strength and Yield Point of Test Methods E 8. If determined as yield strength, that stress producing an extension under load of 0.25 mm over the 50-mm gage length (for example, 0.5 % extension) or an offset of 0.2 % shall be taken as the yield stress, which shall be converted to yield strength by dividing by the original cross-sectional area of the gage length found in accordance with 7.3.2. It shall be reported to the nearest MPa. In referee work, yield strength shall be determined as the stress which produces an extension under load of 0.5 % of the gage length.

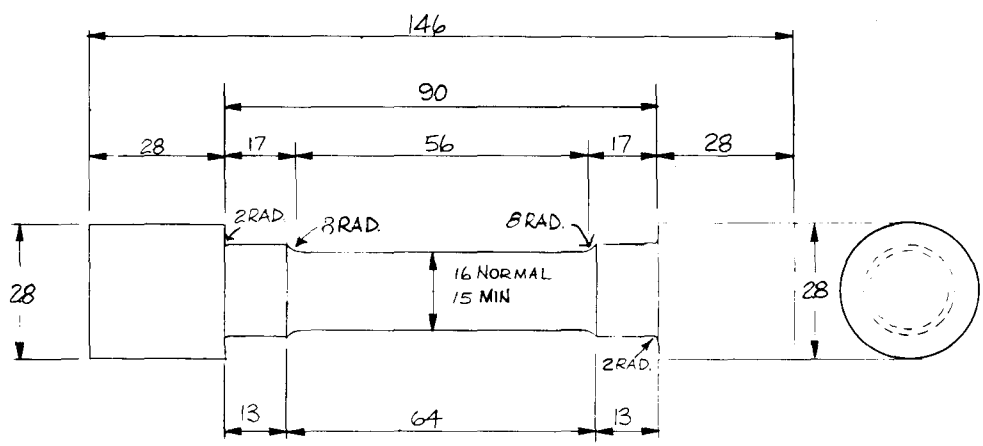
7.3.5 The tensile strength shall be the maximum load carried by the specimen during the test divided by the original cross-sectional area of the gage length, as found in accordance with 7.3.2. It shall be reported to the nearest MPa.

7.3.6 The elongation is the increase in gage length after fracture of a tensile specimen, measured to the nearest 0.25 mm, expressed as a percentage of the original gage length. It shall be reported to the nearest 0.5 %.

7.4 *Retesting:*

7.4.1 If, after testing, a specimen shows evidence of a defect, another tension test may be made on a companion specimen. Also, a retest shall be permitted whenever fracture occurs outside the central 50 % of the gage length.

7.4.2 If the results of a valid test fail to conform to the requirements of this specification, two retests shall be made. If either retest fails to meet the specification, the castings represented by these test specimens shall be rejected. A valid test is one wherein the test specimen has been properly prepared and appears to be sound and on which the



NOTE—Modifications may be made in the dimensions indicated above for those details of the specimen outside of the gage length as required by testing procedure and equipment.

FIG. 2 Alternative Unmachined Tension Test Specimen