



Standard Specification for Forged Rings and Hollows Produced from Steels with Atmospheric Corrosion Resistance¹

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1. Scope

1.1 This specification covers high-strength, low-alloy steel ring and hollow forgings intended primarily for use as base plates in welded tubular structures. However use of this specification is not restricted to such applications and it may be used in other applications for which the attributes of the materials, as defined by this specification, are appropriate.

1.2 The atmospheric corrosion resistance of these steels in most environments is substantially better than that of carbon structural steel with or without copper addition (see [Note 1](#)). When exposed to the atmosphere, this steel is suitable for many applications in the bare (unpainted) condition.

NOTE 1—See Guide [G101](#) for methods of estimating the atmospheric corrosion resistance of low-alloy steels.

1.3 The thickness of forgings is limited only by the capacity of the composition to meet the specified mechanical property requirements; however, current practice normally limits the thickness of forgings furnished under this specification to a range of 2 to 6 in. [51 to 152 mm].

NOTE 2—When the steel is to be welded, a welding procedure suitable for the grade of steel and intended use or service should be used. See Appendix X3 of Specification [A6/A6M](#) for information on weldability.

1.4 The text of this specification contains notes, footnotes, or both that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.5 Supplementary requirements are available but shall apply only when specified by the purchaser at the time of ordering.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

¹ This specification is under the jurisdiction of ASTM Committee [A01](#) on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee [A01.06](#) on Steel Forgings and Billets.

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1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- [A6/A6M](#) Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- [A370](#) Test Methods and Definitions for Mechanical Testing of Steel Products
- [A788/A788M](#) Specification for Steel Forgings, General Requirements
- [A1058](#) Test Methods for Mechanical Testing of Steel Products—Metric
- [E112](#) Test Methods for Determining Average Grain Size
- [G101](#) Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

3. Ordering Information

3.1 In addition to the ordering information required by Specification [A788/A788M](#), the purchaser shall specify:

3.1.1 Grade designation.

3.1.2 Surface condition (for example, as-forged, rough machined etc.).

3.1.3 Include a sketch or written description of the forging with the inquiry and order.

3.2 The purchaser may specify:

3.2.1 Limits on repair welding, if permissible.

3.2.2 Non-destructive evaluation, in which case reporting and acceptance criteria must be provided.

4. Materials and Manufacture

4.1 The steel shall be deoxidized and shall be capable of achieving an ASTM grain size of 6 or finer when evaluated using any of the methods in Test Methods [E112](#).

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5. Chemical Composition

5.1 The heat analysis shall conform to the requirements prescribed in **Table 1**.

5.2 Product analysis shall be conducted once per heat and shall conform to the requirements prescribed in **Table 1** subject to the product tolerances in Specification **A788/A788M**.

5.3 The atmospheric corrosion-resistance index, calculated on the basis of the heat analysis of the steel, as described in Guide **G101** shall be 6.0 or higher.

NOTE 3—The user is cautioned that the Guide **G101** predictive equation (predictive method based on the data of Larabee and Coburn) for calculation of an atmospheric corrosion-resistance index has only been verified for the composition limits stated in the guide.

5.4 When required, the manufacturer shall supply evidence of corrosion resistance satisfactory to the purchaser in accordance with a recognized test method.

6. General Requirements for Delivery

6.1 Forgings produced to this specification shall conform to the current edition of Specification **A788/A788M** unless a conflict exists, in which case this specification shall prevail.

7. Heat Treatment

7.1 Materials supplied to this specification shall be quenched and tempered and shall meet the requirements of **Table 2**.

TABLE 1 Chemical Requirements

NOTE 1—Values are maximums unless a minimum or a range is specified. Where “...” appears in this table, there is no requirement.

Element	Grade A	Grade B	Grade C
Carbon ^A	0.19	0.20	0.17
Manganese ^A	0.80 to 1.35	0.75 to 1.35	0.50 to 1.20
Phosphorous	0.025	0.025	0.025
Sulfur	0.025	0.025	0.025
Silicon	0.30 to 0.65	0.15 to 0.50	0.25 to 0.50
Nickel	0.40	0.50	0.40
Chromium	0.40 to 0.70	0.40 to 0.70	0.40 to 0.70
Molybdenum	0.10
Copper	0.25 to 0.40	0.20 to 0.40	0.30 to 0.50
Vanadium	0.02 to 0.10	0.01 to 0.10	...
Columbium	0.005 to 0.05 ^B

^A For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage point above the specified maximum for manganese is permitted up to a maximum of 1.50 %.

^B For sections under ½ in. [13 mm], the columbium is waived.

TABLE 2 Tensile Requirements

Yield Point, min, ksi [MPa]	Tensile Strength, min, ksi [MPa]	Elongation in 2 in. [50 mm] min, %
60 [415]	75 [520]	18

8. Mechanical Requirements

8.1 *Tension Tests*—The steel shall conform to the requirements for longitudinal tensile properties prescribed in **Table 2** when tested in accordance with Test Methods **A370** or Test Methods **A1058**.

8.2 *Charpy V-Notch Impact Tests:*

8.2.1 The steel, as represented by the Charpy V-notch test, shall conform to the impact test requirements of **Table 3** when tested in accordance with Test Methods **A370** or Test Methods **A1058**.

8.3 *Test Frequency*—Testing shall be conducted a minimum of once per heat. When tests are taken from forgings that were not heat treated with the product to be qualified, the forging tested shall have a thickness equal to or greater than the parts to be qualified. The forging tested shall be processed using thermal cycles that are within 25°F [10°C] of the thermal cycles used on the forgings to be qualified.

8.4 *Test Location:*

8.4.1 The test specimen shall be extracted from an integral prolongation or a sacrificial forging and the center of the gauge length of tension test specimens shall be located midway between the inner and outer diameter surfaces and a minimum of one quarter the thickness from all other surfaces.

8.4.2 As an alternate to removing test specimens from integral prolongations or sacrificial forgings, test specimens may be extracted from separately forged test blocks. The test block shall not receive more reduction than the part it qualifies. Test specimens cut from test blocks shall be extracted in such a manner that the center of the gauge length is located at the mid-thickness and a minimum of one quarter the thickness from all other heat-treated surfaces.

9. Keywords

9.1 atmospheric corrosion resistance; bars; bolted construction; bridges; buildings; durability; forgings; high strength; low alloy; riveted constructions; shapes; steel; structural steel; weight; welded construction

TABLE 3 Charpy V-Notch Requirements

Average Absorbed Energy, ft-lb [J]	Temperature, °F [°C]
15 [20]	-20 [-29]



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