



Designation: **A747/A747M – 12** **A747/A747M – 16**

## Standard Specification for Steel Castings, Stainless, Precipitation Hardening<sup>1</sup>

This standard is issued under the fixed designation A747/A747M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification covers iron-chromium-nickel-copper corrosion-resistant steel castings, capable of being strengthened by precipitation hardening heat treatment.

1.2 These castings may be used in services requiring corrosion resistance and high strengths at temperatures up to 600°F [315°C]. They may be machined in the solution-annealed condition and subsequently precipitation hardened to the desired high-strength mechanical properties specified in **Table S14.1** with little danger of cracking or distortion.

1.3 The material is not intended for use in the solution-annealed condition.

NOTE 1—If the service environment in which the material is to be used is considered conducive to stress-corrosion cracking, precipitation hardening should be performed at a temperature that will minimize the susceptibility of the material to this type of attack.

1.4 Supplementary requirements of an optional nature are provided for use at the option of the purchaser. The Supplementary requirements shall apply only when specified individually by the purchaser in the purchase order or contract.

1.5 This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or contract specifies the applicable M specification designation (SI units), the inch-pound units shall apply.

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.

1.6.1 Within the text, the SI units are shown in brackets.

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A781/A781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use](#)

[A957/A957M Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use](#)

[A1080 Practice for Hot Isostatic Pressing of Steel, Stainless Steel, and Related Alloy Castings](#)

2.2 *ASME Standard*:<sup>3</sup>

[ASME Boiler and Pressure Vessel Code, Supplementary Requirements S6, S14, and S27 Section II, Part A](#)

### 3. General Conditions for Delivery

3.1 Except for investment castings, castings furnished to this specification shall be in accordance with the requirements of Specification **A781/A781M**, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification **A781/A781M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A781/A781M**, this specification shall prevail.

3.2 Steel investment castings furnished to this specification shall conform to the requirements of Specification **A957/A957M**, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

Current edition approved March 1, 2012; Feb. 1, 2016. Published April 2012; February 2016. Originally approved in 1977. Last previous edition approved in 2007; 2012 as **A747/A747M – 07**; **A747/A747M – 12**. DOI: [10.1520/A0747-A0747M-12](#); [10.1520/A0747-A0747M-16](#).

<sup>2</sup> 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.

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, [http://www.asme.org](#).

\*A Summary of Changes section appears at the end of this standard

of Specification **A957/A957M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A957/A957M**, **A957/A957M** shall prevail.

#### 4. Ordering Information

4.1 Orders for material to this specification should include the following:

4.1.1 Quantity,

4.1.2 Specification designation and date of issue,

4.1.3 Grade designation **Table 1**, and

4.1.4 Description of casting by part, pattern, or drawing number. (Dimensional tolerances and machined surfaces should be indicated on the casting drawing).

4.1.5 Heat treatment condition (SA, H900, and so forth), see **5.2** and **Table 1** ~~Table 2~~,

4.1.6 Options in the specification, if any, in accordance with **5.2** and Section **7**, and

4.1.7 Supplementary requirements, if any, including the standards of acceptance.

4.1.8 ~~Notice when the castings are to be used in equipment covered by the ASME Boiler and Pressure Vessel Code, Supplementary Requirements S6, S14, and S27~~ For ASME Boiler & Pressure Vessel Code applications and equipment, if applicable, supplementary requirements **S6**, **S8**, **S15**, and **S24** are mandatory and ~~must~~ shall be specified in the purchase order.

#### 5. Materials and Manufacture

5.1 The steel shall be made by the electric furnace process with or without separate refining such as argon-oxygen decarburization (AOD).

5.2 *Heat Treatment*—Castings may be given a homogenization heat treatment in accordance with **5.2.1** at the supplier's option or when specified by the purchaser (see **S26**) prior to solution heat treatment. All castings, whether homogenized or not, shall be given a solution treatment in accordance with **5.2.2** and unless ordered in the solution-annealed condition shall be precipitation hardened to the ordered condition (**Table 1**).

5.2.1 Homogenization heat treatment shall consist of heating the castings and test material to a minimum of 1900°F [1040°C], holding for a minimum of 1½ h, and cooling to below 90°F [30°C].

5.2.1.1 When agreed upon between purchaser and supplier, supplementary requirement **S18**, Hot Isostatic Pressing (HIPing), in accordance with Practice **A1080** may be used in place of the homogenization heat treatment.

5.2.2 Solution annealing heat treatment shall consist of heating the castings and test material to 1925°F ± 50°F [1050°C ± 30°C], holding the 30 min/in. [1.2 min/mm] of section but not less than 30 min, and cooling to below 90°F [30°C].

5.2.3 Temperature used for precipitation hardening shall be maintained within the range of ±25°F [±15°C] of that listed in **Table 1** for the heat-treatment condition ordered. (See **Note 1**)

5.2.4 When the order or contract specifies a minimum columbium content, the minimum precipitation hardening temperature shall be 925°F [495°C].

#### 6. Chemical Composition

6.1 The steel shall be in accordance with the requirements as to chemical composition prescribed in **Table 2**.

6.2 When the H900 condition is ordered, the minimum columbium content (**Table 2**) shall not apply. It is recommended that columbium other than that in revert material not be added.

**TABLE 1 Precipitation Hardening Heat Treatment<sup>A, B</sup>**

Condition	PH <sup>C</sup> Temperature, °F[°C]	Time in hours minimum	Cooling Treatment
SA	Not precipitation hardened (see <b>5.2.3</b> )		
H900	900 [480]	1.5	air cool
H925	925 [495]	1.5	air cool
H1025	1025 [550]	4.0	air cool
H1075	1075 [580]	4.0	air cool
H1100	1100 [595]	4.0	air cool
H1150	1150 [620]	4.0	air cool
H1150M	1400 [760]	2.0	air cool
	1150 [620]	4.0	air cool
H1150 DBL	1150 [620]	4.0	air cool
	1150 [620]	4.0	air cool

<sup>A</sup> The furnace and controls used shall be calibrated and capable of uniformity of heating in order to ensure consistent results.

<sup>B</sup> See **Note 1**.

<sup>C</sup> ±25°F [15°C].