



Designation: A 1014 – 00

Standard Specification for Precipitation-Hardening Bolting Material (UNS N07718) for High Temperature Service¹

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1. Scope

1.1 This specification covers a precipitation hardening bolting material (UNS N07718) for high temperature service.

2. Referenced Documents

2.1 ASTM Standards:

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²

A 962/A 962M Specification for Common Requirements for Steel Fasteners or Fastener Materials, or Both, Intended for Use at Any Temperature from Cryogenic to the Creep Range³

B 637 Specification for Precipitation-Hardening Nickel Alloy Bars, Forgings, and Forging Stock for High-Temperature Service⁴

E 112 Test Methods for Determining the Average Grain Size⁵

E 292 Test Methods for Conducting Time-For-Rupture Notch Tension Tests of Materials⁵

2.2 ANSI Standards:

B1.1 Screw Threads⁶

3. Ordering Information

3.1 *Ordering*—It shall be the responsibility of the purchaser to specify all requirements that are necessary for product under this specification including any supplementary ones and those included in the ordering information required by Specification A 962/A 962M.

4. Common Requirements

4.1 *Common Requirements*—Product furnished to this specification shall conform to Specification A 962/A 962M, including any supplementary requirements indicated on the purchase order. Failure to comply with Specification A 962/

A 962M constitutes non-conformance with this specification. If the requirements of this specification conflict with those of Specification A 962/A 962M then the requirements of this specification shall prevail.

5. Manufacture

5.1 *Melting Process*—Alloy shall be multiple melted using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum. If consumable electrode remelting is not performed in vacuum, electrodes produced by vacuum induction melting shall be used.

5.2 Heat Treatment:

5.2.1 *Solution Treatment*—Material shall be solution heat treated at a temperature within the range of 1725 to 1850°F (941 to 1010°C), held at the selected temperature for a time commensurate with cross-sectional thickness, and cooled at a rate equivalent to an air cool or faster.

5.2.1.1 *Temperature Variation*—Solution treating temperatures shall be controlled in the range of $\pm 25^\circ\text{F}$ ($\pm 14^\circ\text{C}$).

5.2.2 *Precipitation Heat Treatment*—Material shall be heated to a temperature of 1325°F (718°C), held at temperature for eight hours minimum, furnace cooled to 1150°F (621°C) at 100°F (56°C) per hour, held at temperature for eight hours, and cooled to room temperature. Alternatively, material may be furnace cooled to 1150°F (621°C) at any rate provided the time at 1150°F (621°C) is adjusted so the total precipitation heat treatment time is 18 hours minimum.

5.2.2.1 *Temperature Variation*—Precipitation treatment temperatures and cooling rates shall be controlled in the range of $\pm 15^\circ\text{F}$ ($\pm 8^\circ\text{C}$).

5.3 *Straightening*—When straightening is necessary it shall be done after solution treating and prior to aging. Straightening after aging is prohibited.

5.4 *Threads*—Threads shall be formed by rolling in one pass after oxides have been removed from the area to be threaded.

5.5 *Dimensions and Tolerances, Bolting Material*—Fully heat treated bolting material shall meet the dimensional requirements of Specification B 637 for UNS N07718.

6. Chemical Composition

6.1 *Remelt Ingots*—The chemical analyses of each remelted ingot shall conform to the requirements for chemical composition prescribed in Table 1.

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 A01.22 on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 01.01.

⁴ *Annual Book of ASTM Standards*, Vol 02.04.

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

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.