



Designation: B906 – 02 (Reapproved 2006)

# Standard Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip<sup>1</sup>

This standard is issued under the fixed designation B906; 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 a group of general requirements that, unless otherwise specified in the purchase order or in an individual specification, shall apply to rolled nickel and nickel alloy plate, sheet, and strip, under each of the following specifications issued by ASTM: Specifications B127, B162, B168, B333, B409, B424, B434, B435, B443, B463, B536, B575, B582, B599, B620, B625, B670, B688, B709, B718, B755, B814, B818, B872.

1.2 In case of any conflicting requirements, the requirements of the purchase order, the individual material specification, and this general specification shall prevail in the sequence named.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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 become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer; to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

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

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- A693 Specification for Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- B127 Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip
- B162 Specification for Nickel Plate, Sheet, and Strip
- B168 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Plate, Sheet, and Strip
- B333 Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip
- B409 Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip
- B424 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Plate, Sheet, and Strip
- B434 Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, UNS N10242) Plate, Sheet, and Strip
- B435 Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Plate, Sheet, and Strip
- B443 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip
- B463 Specification for UNS N08020 Alloy Plate, Sheet, and Strip
- B536 Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip
- B575 Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Plate, Sheet, and Strip
- B582 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip

- B599** Specification for Nickel-Iron-Chromium-Molybdenum-Columbium Stabilized Alloy (UNS N08700) Plate, Sheet, and Strip
- B620** Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Plate, Sheet, and Strip
- B625** Specification for UNS N08925, UNS N08031, UNS N08932, UNS N08926, UNS N08354, and UNS R20033 Plate, Sheet, and Strip
- B670** Specification for Precipitation-Hardening Nickel Alloy (UNS N07718) Plate, Sheet, and Strip for High-Temperature Service
- B688** Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip
- B709** Specification for Iron-Nickel-Chromium-Molybdenum Alloy (UNS N08028) Plate, Sheet, and Strip
- B718** Specification for Nickel-Chromium-Molybdenum-Cobalt-Tungsten-Iron-Silicon Alloy (UNS N06333) Plate, Sheet, and Strip
- B755** Specification for Nickel-Chromium-Molybdenum-Tungsten Alloys (UNS N06110) Plate, Sheet, and Strip
- B814** Specification for Nickel-Chromium-Iron-Molybdenum-Tungsten Alloy (UNS N06920) Plate, Sheet, and Strip
- B818** Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Plate, Sheet, and Strip
- B872** Specification for Precipitation-Hardening Nickel Alloys Plate, Sheet, and Strip
- B880** Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
- E8** Test Methods for Tension Testing of Metallic Materials
- E10** Test Method for Brinell Hardness of Metallic Materials
- E18** Test Methods for Rockwell Hardness of Metallic Materials
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E39** Methods for Chemical Analysis of Nickel<sup>3</sup>
- E55** Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition
- E76** Test Methods for Chemical Analysis of Nickel-Copper Alloys<sup>3</sup>
- E112** Test Methods for Determining Average Grain Size
- E140** Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness
- E1473** Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys
- 2.2 *AIAG Standard:*
- B-5** Primary Metals Identification Tag Application Standard<sup>4</sup>

- 2.3 *ANSI Standard:*  
Accredited Standards Committee X 12 (ANSI ASC X 12)<sup>5</sup>
- 2.4 *ASME Standard:*  
ASME Boiler and Pressure Vessel Code, Section IX<sup>6</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 Plate, Sheet, Strip, and Cold work as used in this specification apply to the following:

3.1.1.1 *plate*—material  $\frac{3}{16}$  in. [4.76 mm] and over in thickness and over 10 in. [250 mm] in width. Finishes for plate are actually shown in Section 13.

3.1.1.2 *sheet*—material under  $\frac{3}{16}$  in. [4.76 mm] in thickness and 24 in. [600 mm] and over in width. Finishes for sheet are actually shown in Section 11.

3.1.1.3 *strip*—cold-rolled material under  $\frac{3}{16}$  in. [4.76 mm] in thickness and under 24 in. [600 mm] in width. Finishes are detailed in Section 12 for strip, and strip edges in Section 14 for Cold-Rolled Strip.

3.1.1.4 *cold work*—the changing of mechanical properties by work hardening.

### 4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to, the following:

4.1.1 Quantity (weight and number of pieces),

4.1.2 Name of material,

4.1.3 Condition (hot-rolled, cold-rolled, annealed, heat-treated),

4.1.4 Finish (see Section 11 for Sheet, Section 12 for Strip, and Section 13 for Plates). In the case of polished finishes, specify whether one or both sides are to be polished,

4.1.5 Form (plate, sheet, or strip),

4.1.6 Dimensions (thickness, width, length),

4.1.6.1 Thickness shall be ordered to decimal or fractional thickness. The use of the gage number is discouraged as being an archaic term of limited usefulness not having general agreement on meaning. The gage number shall not be a basis for rejection.

4.1.6.2 Thickness, width, and length, when applicable, should be ordered in the same units, for example, 0.060 in. By 48 in. By 120 in. (1.52 mm by 1219 mm by 3048 mm),

4.1.7 Edge, strip only (see Section 14 for Cold-Rolled Strip),

4.1.8 Type, refer to the applicable material specification,

4.1.9 Specification designation and date of issue,

4.1.10 Additions to specification or special requirements,

4.1.11 Restrictions (if desired) on methods for determining yield strength (see appropriate footnote to mechanical properties table of the basic material specification),

4.1.12 Restrictions on weld repair (see Section 17),

<sup>5</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>6</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>3</sup> Withdrawn. The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48034, <http://www.aiag.org>.

- 4.1.13 Marking requirements (see Section 22),  
 4.1.14 Preparation for delivery (see Section 22), and over.

## 5. Process

5.1 The material shall be manufactured/produced by the following or as specified in the applicable material specification.

5.1.1 The material shall be made by one of the following processes: electric-arc, electric-induction, or other suitable processes.

5.1.2 If a specific type of melting is required by the purchaser, it shall be so specified on the purchase order.

5.1.3 If a specific type of remelt is required by the purchaser, it shall be so specified on the purchase order.

## 6. Chemical Composition

6.1 In case of disagreement, the chemical composition shall be determined in accordance with the following methods:

UNS No. Prefixes	ASTM Method
N02	E39
N04	E76
N06, N08	E1473

6.2 The ladle analysis of the material shall conform to the chemical requirements prescribed by the individual product specification.

6.3 The product (check) analysis of the material shall meet the requirements of Specification B880.

## 7. Sampling

7.1 *Lots for Chemical Analysis and Mechanical Testing:*

7.1.1 A lot for chemical analysis shall consist of one heat.

7.1.2 A lot of plate, sheet, or strip for mechanical testing shall be defined as the material from one heat in the same condition and specified thickness.

7.2 *Sampling for Chemical Analysis:*

7.2.1 A representative sample shall be obtained from each heat during pouring or subsequent processing.

7.2.2 Product (check) analysis shall be wholly the responsibility of the purchaser.

7.3 *Sampling for Mechanical Testing*—Representative samples shall be taken from each lot of finished material.

## 8. Number of Tests and Retests

8.1 *Chemical Analysis*—One test per heat.

8.2 *Tension Tests*—One test per lot.

8.3 *Grain Size*—One test per lot.

8.4 *Retests*—If one of the specimens used in the above tests of any lot fails to meet the specified requirements, two additional specimens shall be taken from different sample pieces and tested. The results of the tests on both of these specimens shall meet the specified requirements.

## 9. Specimen Preparation

9.1 Tension test specimens shall be taken from material in the final condition and tested transverse to the direction of rolling when width will permit.

9.2 Tension test specimens shall be any of the standard or subsize specimens shown in Test Methods E8.

9.3 In the event of disagreement, referee specimens shall be as follows:

9.3.1 Full thickness of the material, machined to the form and dimensions shown for the sheet-type specimen in Test Methods E8 for material under ½ in. (12.7 mm) in thickness.

9.3.2 The largest possible round specimen shown in Test Methods E8 for material ½ in. (12.7 mm) and over.

## 10. Test Methods

10.1 The chemical composition and mechanical properties of the material as enumerated in this specification shall be determined, in case of disagreement, in accordance with the following ASTM standards:

10.1.1 *Chemical Analysis*—Test Methods E1473. For elements not covered by Test Methods E1473, the referee test method shall be as agreed upon between the manufacturer and the purchaser. The nickel composition shall be determined arithmetically by difference.

10.1.2 *Tension Test*—Test Methods E8.

10.1.3 *Rockwell Hardness Test*—Test Methods E18.

10.1.4 *Hardness Conversion*—Hardness Conversion Tables E140.

10.1.5 *Grain Size*—Test Methods E112.

10.1.6 *Determining Significant Places*—Practice E29.

10.1.7 *Method of Sampling*—Practice E55.

10.2 For purposes of determining compliance with the limits in this specification, an observed or calculated value shall be rounded in accordance with the rounding method of Practice E29:

Test Requirement	Rounded Unit for Observed or Calculated Value
Chemical composition and tolerances	nearest unit in the last righthand place of figures of the specified limit
Tensile strength and yield strength	nearest 1000 psi (7 Mpa)
Elongation	nearest 1 %

## 11. Finish for Sheet

11.1 The type of finish available on sheet products are:

11.1.1 No. 1 Finish—Hot-rolled, annealed, and descaled.

11.1.2 No. 2D Finish—Cold-rolled, dull finish.

11.1.3 No. 2B Finish—Cold-rolled, bright finish.

11.1.3.1 *Bright Annealed Finish*—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

11.1.4 No. 3 Finish—Intermediate Polished finish, one or both sides.

11.1.5 No. 4 Finish—General purpose polished finish, one or both sides.

11.1.6 No. 6 Finish—Dull satin finish, Tampico brushed, one or both sides.

11.1.7 No. 7 Finish—High luster finish.

11.1.8 No. 8 Finish—Mirror finish.

11.1.9 Sheets can be produced with one or two sides polished. When polished on one side only, the other side may be rough ground in order to obtain necessary flatness.

NOTE 1—Explanation of Sheet Finishes:

No. 1—This finish is produced by hot rolling to specified thickness followed by annealing and descaling. It is generally used in industrial

applications, such as for heat and corrosion resistance, where smoothness of finish is not of particular importance.

No. 2D—Produced on either hand sheet mills or continuous mills by cold rolling to the specified thickness, annealing and descaling. The dull finish may result from the descaling or pickling operation or may be developed by a final light cold-rolled pass on dull rolls. The dull finish is favorable for retention of lubricants on the surface in deep drawing operations. This finish is generally used in forming deep-drawn articles which may be polished after fabrication.

No. 2B—Commonly produced the same as 2D, except that the annealed and descaled sheet receives a final light cold-rolled pass on polished rolls. This is a general purpose cold-rolled finish. It is commonly used for all but exceptionally difficult deep drawing applications. This finish is more readily polished than No. 1 or No. 2D Finish.

Bright Annealed Finish is a bright cold-rolled highly reflective finish retained by final annealing in a controlled atmosphere furnace. The purpose of the atmosphere is to prevent scaling or oxidation during annealing. The atmosphere is usually comprised of either dry hydrogen or a mixture of dry hydrogen and dry nitrogen (sometimes known as dissociated ammonia).

No. 3—For use as a finish-polished surface or as a semifinished-polished surface when it is required to receive subsequent finishing operations following fabrication. Where sheet or articles made from it will not be subjected to additional finishing or polishing operations, No. 4 finish is recommended.

No. 4—Widely used for restaurant equipment, kitchen equipment, store fronts, dairy equipment, etc. Following initial grinding with coarser abrasives, sheets are generally finished last with abrasives approximately 120 to 150 grit.

No. 6—Has a lower reflectivity than No. 4 finish. It is produced by Tampico brushing No. 4 finish sheets in a medium of abrasive and oil. It is used for architectural applications and ornamentation where high luster is undesirable; it is also used effectively to contrast with brighter finishes.

No. 7—Has a high degree of reflectivity. It is produced by buffing a finely ground surface, but the grit lines are not removed. It is chiefly used for architectural or ornamental purposes.

No. 8—The most reflective finish that is commonly produced. It is obtained by polishing with successively finer abrasives and buffing extensively with very fine buffing rouges. The surface is essentially free of grit lines from preliminary grinding operations. This finish is most widely used for press plate, as well as for small mirrors and reflectors.

## 12. Finish for Strip

12.1 The various types of finish procurable on cold-rolled strip products are:

12.1.1 No. 1 Finish—Cold rolled to specified thickness, annealed, and descaled.

12.1.2 No. 2 Finish—Same as No. 1 Finish, followed by a final light cold-roll pass, generally on highly polished rolls.

12.1.3 *Bright Annealed Finish*—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.

12.1.4 *Polished Finish*—Strip is also available in polished finishes such as No. 3 and No. 4, which are explained in **Note 1**.

## 13. Finish for Plates

13.1 The types of finish available on plates are:

13.1.1 *Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated, and Blast Cleaned or Pickled*—Condition and finish commonly preferred for corrosion-resisting and most heat-resisting applications, essentially a No. 1 Finish.

13.1.2 Hot Rolled or Cold rolled, annealed or heat treated, blast cleaned and/or ground.

13.1.3 Hot Rolled or Cold rolled, annealed or heat treated, blast cleaned and/or ground, and pickled.

## 14. Edges for Cold-Rolled Strip

14.1 The types of edges available on strip products are:

14.1.1 No. 1 Edge—A rolled edge, either round or square as specified.

14.1.2 No. 3 Edge—An edge produced by slitting.

14.1.3 No. 5 Edge—An approximately square edge produced by rolling or filing after slitting.

## 15. Permissible Variations in Dimensions and Weight

15.1 *Sheet*—Sheet shall conform to the permissible variations in dimensions specified in **Tables A1.1-A1.7** for materials produced to Specifications **B463, B536, B599, B625, B688, B709 or B718**; and **Table A2.2 and Table A2.4** for materials produced to Specifications **B333, B434, B435, B575, B582, B620, B814 or B818**; and **Table A3.3 and Table A3.6** for materials produced to Specifications **B127, B162, B168, B409, B424, B443, B670, B755 or B872**.

15.2 *Cold-Rolled Strip*—Cold-rolled strip shall conform to the permissible variations in dimensions specified in **Tables A1.1-A1.11** for materials produced to Specifications **B463, B536, B599, B625, B688, B709 or B718**; **Table A2.2 and Table A2.4** for materials produced to Specifications **B333, B434, B435, B575, B582, B620, B814 or B818**; and **Table A3.3 and Table A3.6** for materials produced to Specifications **B127, B162, B168, B409, B424, B443, B670, B755 or B872**.

15.3 *Plates*—Plates shall conform to the permissible variations in dimensions specified in **Tables A1.12-A1.18** for materials produced to Specifications **B463, B536, B599, B625, B688, B709 or B718**; **Table A2.1 and Table A2.3** for materials produced to Specifications **B333, B434, B435, B575, B582, B620, B814 or B818**; and **Table A3.1, Table A3.2, Table A3.4, Table A3.5, and Table A3.7** for materials produced to Specifications **B127, B162, B168, B409, B424, B443, B670, B755 or B872**.

## 16. Workmanship

16.1 The material shall be of uniform quality consistent with good manufacturing and inspection practices. The material shall have no imperfections of a nature or degree, for the type and quality ordered, that will adversely affect the stamping, forming, machining, or fabrication of finished parts.

16.2 *Sheet, Strip, and Plate*—Sheet, and strip with No. 1 finish and plate with hot-roll anneal or hot-roll anneal and pickle finish may be ground to remove surface imperfections, provided such grinding does not reduce the thickness or width at any point beyond the permissible variations in dimensions. An iron free abrasive wheel shall be used for such grinding and shall be operated in a speed ample to ensure that defective areas are cleanly cut out.

## 17. Repair of Plate by Welding

17.1 Repair of surface defects of plate, by welding, is permitted unless prohibited by other specifications or purchase order requirements.

17.2 Defect depth shall not exceed  $\frac{1}{3}$  of the nominal thickness, and the total area shall not exceed 1 % of the plate surface area, unless prior approval from the purchaser is obtained.

17.3 Unacceptable imperfections shall be suitably prepared for welding by grinding or machining. Open clean defects, such as pits or impressions, may not require preparation.

17.4 The welding procedure and the welders or welding operators shall be qualified in accordance with Section IX of the ASME Code.

17.5 The welding consumables shall be compatible with both the chemistry and mechanical properties of the base material.

17.6 After repair welding, the welded area shall be ground smooth and blended uniformly to the surrounding surface.

17.7 Weld repair, if performed, shall be reported on the test report in accordance with Section 21.

## 18. Inspection

18.1 Inspection of the material by the purchaser's representative at the producing plant shall be made as agreed upon between the purchaser and the seller as part of the purchase order.

18.2 Unless otherwise specified in the contract or purchase order: (1) the seller is responsible for the performance of all the inspection and test requirements in this specification, (2) the seller may use his own or other suitable facilities for the performance of the inspection and testing, and (3) the purchaser shall have the right to perform any of the inspection and tests set forth in this specification. The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being furnished in accordance with the specification. Inspection by the purchaser shall not interfere unnecessarily with the manufacturer.

## 19. Rejection

19.1 Material that shows injurious imperfections per alloy specification subsequent to its acceptance at the purchaser's works will be rejected and the seller shall be notified.

## 20. Rehearing

20.1 Samples tested in accordance with the specification that represent rejected material shall be retained for a period agreed upon by purchaser and seller from the date of the notification to the seller of the rejection. In case of dissatisfaction with the results of the test, the seller may make claim for a rehearing within that time.

## 21. Material Test Report and Certification

21.1 A report of the result of all tests required by the product specification shall be supplied when required by the purchase order. This material test report shall reference the product specification designation and year date indicating that the material was manufactured, sampled, tested, and inspected in accordance with requirements of the product specification and has been found to meet those requirements. The material test report shall report the melting process when the purchase order requires either a specific type of melting or requires that the melting process used is to be reported.

21.1.1 The report shall indicate the type of material. If certifying that the material conforms to the requirements for more than one type of material, the manufacturer may indicate each type of material on the report, or may issue a separate report for each type of material.

21.1.2 When weld repair is performed, it shall be so stated on the test report, noting the alloy type of weld consumable used.

21.2 A signature is not required on the report. However, the document shall clearly identify the organization submitting the report.

21.3 A material test report, certificate of inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

21.4 When finished material is supplied to a purchase order specifying the product specification, the organization supplying that material shall provide the purchaser with a copy of the original manufacturer's test report.

NOTE 2—Notwithstanding the absence of a signature, the organization submitting the report is responsible for the content of the report.

NOTE 3—The industry definition as invoked here is: EDI is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X 12.

## 22. Packaging, Marking, and Loading

22.1 *For Commercial Procurement:*

22.1.1 *Marking*—Unless otherwise specified in the applicable material specification or the purchase order, marking shall be conducted as follows:

22.1.1.1 Sheet, strip, and plate shall be marked on one face, in the location indicated below with the specification designation number, type of material, material identification number, and the name or mark of the manufacturer. The characters shall be of such size as to be clearly legible. The marking shall be sufficiently stable to withstand normal handling. Unless otherwise specified by the purchaser, the marking, at the producers option, may be done with (a) marking fluid (if a specific maximum impurity limit of designation elements in the marking fluid is required by the purchaser, it shall be so stated on the purchase order), (b) low-stress blunt-nosed continuous or low-stress blunt-nosed-interrupted-dot die stamp, (c) a vibratory tool with a minimum tip radius of 0.005 in [0.1 mm], or (d) electrochemical etching.

22.1.1.2 Flat sheet, strip in cut lengths, and plate shall be marked in two places near the ends or may be continuously line marked. Cut pieces from sheet, strip and plate, with both width and length, or diameter dimensions less than 48 in., may be marked in only one place.

22.1.1.3 Sheet, strip, and plate in coil form shall be marked near the outside end of the coil. The inside of the coil shall also be marked or shall have a tag or label attached and marked with the information of 22.1.1.1.

22.1.1.4 Material less than ¼ in. [6.4 mm] in thickness shall not be marked with die stamps.

22.1.1.5 Material that conforms completely with the requirements of two types of material within the ordering specification may be marked as both types of material provided that the manufacturer is certifying the material as meeting the requirements of each of the types of material. Such marking, if used may be part of the same marking as used for a single type of material, or may be a separate but similar marking immediately adjacent to the marking used for a single type of material.

22.1.1.6 The AIAG primary metals identification tag (AIAG B-5) may be used as a auxiliary method of identification in cases where a bar-coded identification tag is desired. Use of this method shall be by agreement between purchaser and supplier.

### 23. Keywords

23.1 nickel alloy; plate; sheet; strip

## ANNEXES

### (Mandatory Information)

#### A1. PERMISSIBLE VARIATIONS IN DIMENSIONS, ETC.—INCH-POUND (SI) UNITS

A1.1 Listed in Annex A1 are tables showing the permissible variations in dimensions expressed in inch-pound (SI) units of measurement applicable to material produced to Specifications B463, B536, B599, B625, B688, B709 and B718, unless modified in accordance with Section 1.2 of this specification (Tables A1.1-A1.18).

**TABLE A1.1 Permissible Variations in Thickness for Hot-Rolled Sheets in Cut Lengths, Cold-Rolled Sheet in Cut Lengths and Coils**

Specified Thickness, <sup>A</sup> in. [mm]	Permissible Variations, Over and Under <sup>B</sup>	
	in.	mm
Over 0.145 [3.68] to less than 3/16 [4.76]	0.014	0.36
Over 0.130 [3.30] to 0.145 [3.68], incl	0.012	0.30
Over 0.114 [2.90] to 0.130 [3.30], incl	0.010	0.25
Over 0.098 [2.49] to 0.114 [2.90], incl	0.009	0.23
Over 0.083 [2.11] to 0.098 [2.49], incl	0.008	0.20
Over 0.072 [1.83] to 0.083 [2.11], incl	0.007	0.18
Over 0.058 [1.47] to 0.072 [1.83], incl	0.006	0.15
Over 0.040 [1.02] to 0.058 [1.47], incl	0.005	0.13
Over 0.026 [0.66] to 0.040 [1.02], incl	0.004	0.10
Over 0.016 [0.41] to 0.026 [0.66], incl	0.003	0.08
Over 0.007 [0.18] to 0.016 [0.41], incl	0.002	0.05
Over 0.005 [0.13] to 0.007 [0.18], incl	0.0015	0.04
0.005 [0.13]	0.001	0.03

<sup>A</sup> Thickness measurements are taken at least 3/16 in. [9.52 mm] from the edge of the sheet.

<sup>B</sup> Cold-rolled sheets in cut lengths and coils are produced in some type numbers and some widths and thickness to tolerances less than those shown in the table.