



Designation: A 265 – 94a (Reapproved 1999)

## Standard Specification for Nickel and Nickel-Base Alloy-Clad Steel Plate<sup>1</sup>

This standard is issued under the fixed designation A 265; 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<sup>2</sup> covers plate of a carbon steel or low-alloy steel base to which is integrally and continuously bonded on one or both sides a layer of nickel or nickel-base alloy. The material is generally intended for pressure vessel use.

1.2 The values stated in inch-pound units are to be regarded as the standard. SI units are provided for information only.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>3</sup>
- A 480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip<sup>3</sup>
- A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>3</sup>
- B 127 Specification for Nickel-Copper Alloy (UNS NO4400) Plate, Sheet, and Strip<sup>4</sup>
- B 162 Specification for Nickel Plate, Sheet, and Strip<sup>4</sup>
- B 168 Specification for Nickel-Chromium-Iron Alloy (UNS NO6600, NO6601, and NO6690) and Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS NO6617) Plate, Sheet, and Strip<sup>4</sup>
- B 333 Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip<sup>4</sup>
- B 409 Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip<sup>4</sup>
- B 424 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS NO8825 and NO8221) Plate, Sheet, and Strip<sup>4</sup>
- B 443 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS NO6625) Plate, Sheet, and Strip<sup>4</sup>
- B 463 Specification for UNS NO8020, UNS NO8026, and UNS NO8024 Alloy Plate, Sheet, and Strip<sup>4</sup>
- B 575 Specification for Low-Carbon Nickel-Molybdenum-Chromium and Low-Carbon Nickel-Chromium Molybde-

num Alloy Plate, Sheet, and Strip<sup>4</sup>

B 582 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip<sup>4</sup>

B 625 Specification for UNS N08904, UNS N08925, UNS N08931, UNS N08932, and UNS N08926 Plate, Sheet, and Strip<sup>4</sup>

#### 2.2 ASME Code:

Boiler and Pressure Vessel Code, Section IX, Welding Qualifications<sup>5</sup>

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:* Descriptions of Terms:

3.1.1 This material is considered as single-clad or double-clad nickel or nickel-base alloy clad steel plate, depending on whether one or both sides are covered.

3.1.2 The term plate as used in this specification applies to material  $\frac{3}{16}$  in. (2.73 mm) and over in thickness, and over 10 in. (254 mm) in width.

### 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 (mass or number of pieces),
- 4.1.2 Name of material (Nickel or Nickel-Base Alloy-Clad Steel Plate),
- 4.1.3 Heat treatment, if required,
- 4.1.4 Dimensions including the thickness of the cladding alloy,
- 4.1.5 Cladding metal (see Section 6),
- 4.1.6 Base metal (see Section 6),
- 4.1.7 Product analysis, if required (see Section 8),
- 4.1.8 Mechanical Properties (see Sections 7, 13, and 14),
- 4.1.9 Restrictions, if required, on repair by welding (see Section 12), and
- 4.1.10 Additions to the specification or special requirements.

### 5. Materials and Manufacture

#### 5.1 Process:

<sup>5</sup> Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys, and is the direct responsibility of Subcommittee A01.17 on Flat Stainless Steel Products.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SA-265 in Section II of that Code.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 02.04.

**A 265**

5.1.1 The steel shall be made by the open-hearth, electric-furnace (with separate degassing and refining optional), or basic-oxygen processes, or by secondary processes whereby steel made from these primary processes is remelted using electroslag remelting or vacuum arc remelting processes.

5.1.2 The cladding metal may be metallurgically bonded to the base metal by any method that will produce a clad steel that will conform to the requirements of this specification.

5.2 *Heat Treatment*—Unless heat treatment is required by the cladding material or base steel specification, the clad plate shall be furnished in the as-rolled condition. The purchaser and the manufacturer may agree on any other heat treatment within the base steel specification that is mutually agreeable.

**6. Chemical Composition**

6.1 The composite plate may conform to any desired combination cladding metal and base metal as described in 6.2 and 6.3, and as agreed upon between the purchaser and the manufacturer.

6.2 *Cladding Metal*—The nickel or nickel-base alloy cladding metal specified shall conform to the requirements as to chemical composition prescribed for the respective metal in Specifications B 127, B 162, B 168, B 333, B 409, B 424, B 443, B 463, B 575, B 582, and B 625.

6.3 *Base Metal*—The base metal may be carbon steel or low-alloy steel conforming to the ASTM specifications for steels for pressure vessels. The base metal shall conform to the chemical requirements of the specification to which it is ordered.

**7. Mechanical Properties**

7.1 *Tensile Requirements:*

7.1.1 The tensile properties shall be determined by a tension test of the composite plate for clad plates that meet all of the following conditions. However, if the cladding is for corrosion allowance only, the cladding may be removed before tensile testing. The tensile properties thus determined shall be not less than the minimum and not more than 5000 psi (35 MPa) over the maximum prescribed in the specification for the base steel used. All other tensile test requirements of the specification for the base steel shall be met.

7.1.1.1 The composite gage is less than or equal to 1 1/2 in.

7.1.1.2 The specified minimum tensile strength of the base steel is less than or equal to 70 000 psi (485 MPa).

7.1.1.3 The specified minimum yield strength of the base steel is less than or equal to 40 000 psi (275 MPa).

7.1.2 The tensile properties shall be determined by a tension test of the base steel only for clad plates that meet one of the following conditions. The properties thus determined shall meet all of the tensile test requirements for the base steel.

7.1.2.1 The composite gage is greater than 1 1/2 in.

7.1.2.2 The specified minimum tensile strength of the base steel is greater than 70 000 psi (485 MPa).

7.1.2.3 The specified minimum yield strength of the base steel is greater than 40 000 psi (275 MPa).

7.2 *Ductility*—Two bend tests of the composite plate shall be made, one with the cladding metal in tension and the other with the cladding metal in compression, to determine the ductility of the materials. On double-clad plates, the bend tests

shall be made so that one specimen represents the cladding metal in tension on one side while the other specimen represents the cladding metal in tension on the opposite side. Bend tests shall be made in accordance with the requirements prescribed in the specifications for the base metal.

7.3 *Bond Strength*—When required by the purchaser, three bend tests shall be made with the cladding metal in compression to determine the quality of the bond. Bends shall be made in accordance with the specifications for the base metal. At least two out of the three tests shall show not more than 50 % separation on both edges of the bent portion. Greater separation shall be cause for rejection.

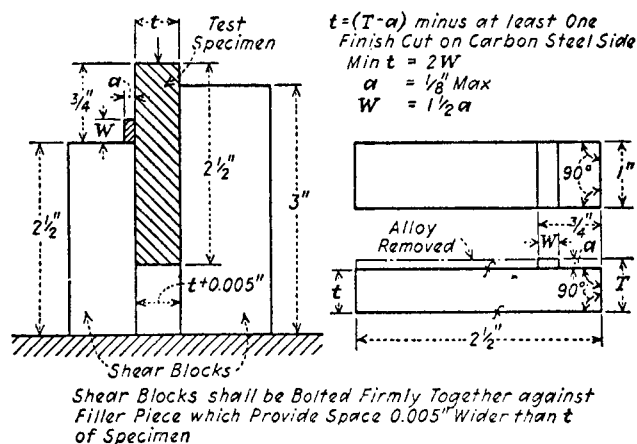
7.4 *Shear Strength*—As an alternative to the bend test provided in 7.3 and when required by the purchaser, the minimum shear strength of the cladding and base metals shall be 20 000 psi (140 MPa). The shear test when specified, shall be made in the manner indicated in Fig. 1.

7.5 Methods and practices relating to mechanical testing required by this specification shall be in accordance with Test Methods and Definitions A 370.

**8. Product Analysis**

8.1 Product analysis may be required on finished product. Chemical analysis may be accomplished by wet chemical or instrumental procedures. If wet chemical procedures are used, millings may be taken only when the composite plate thickness is sufficient to permit obtaining millings without danger of contamination from the adjacent layer. If spectrometric procedures are used, the sample shall be exposed on the center line of the cladding when there is sufficient cladding thickness available so that there is no contamination from the adjacent base metal.

8.2 If product analysis is specified by the purchaser, it shall be made on a sample taken from the finished product or a broken test specimen. For wet chemical analysis, in order to



**Metric Equivalents**

| in.   | mm    | in.   | mm   |
|-------|-------|-------|------|
| 0.005 | 0.127 | 1     | 25.4 |
| 1/8   | 3.17  | 2 1/2 | 64.5 |
| 3/4   | 19.1  | 3     | 76.2 |

**FIG. 1 Test Specimen and Method of Making Shear Test of Clad Plate**