



# Standard Specification for Welded Nickel-Chromium-Iron-Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Pipe<sup>1</sup>

This standard is issued under the fixed designation B517; 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 welded, cold-worked, and annealed nickel-chromium-iron alloy (UNS N06600,<sup>3</sup> N06603, N06025, and N06045) pipe for general corrosive service and heat-resisting applications.

1.2 This specification covers outside diameter and nominal wall pipe shown in ANSI B36.19. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification.

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>4</sup>

**B775 Specification for General Requirements for Nickel and Nickel Alloy Welded Pipe**

**B899 Terminology Relating to Non-ferrous Metals and Alloys**

<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 ASME Boiler and Pressure Code applications see related Specification SB-517 in Section II of that Code.

<sup>3</sup> New designation established in accordance with ASTM E527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

<sup>4</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.

### 2.2 ANSI Standard:

**B36.19 Stainless Steel Pipe<sup>5</sup>**

## 3. Terminology

3.1 Terms defined in Terminology B899 shall apply unless defined otherwise in this standard.

## 4. General Requirement

4.1 Material furnished in accordance with this specification shall conform to the applicable requirements of the current edition of Specification B775 unless otherwise provided herein.

## 5. Ordering Information

5.1 It is the responsibility of the purchaser to specify all requirements that are necessary for the safe and satisfactory performance of material ordered under this specification. Examples of such requirements include, but are not limited to, the following:

5.1.1 Alloy name or UNS number.

5.1.2 ASTM designation and year of issue.

5.1.3 Condition (temper).

5.1.4 *Dimensions:*

5.1.4.1 Nominal pipe size or outside diameter and schedule number or nominal wall thickness.

5.1.4.2 Length (specific or random).

5.1.5 Quantity (feet or metres, or number of pieces).

5.1.6 *Certification*—State if certification or a report of test results is required.

5.1.7 *Samples for Product (Check) Analysis*—State whether samples for product (check) analysis should be furnished.

5.1.8 *Purchaser Inspection*—If the purchaser wishes to witness tests or inspection of material at the place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed.

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

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

**TABLE 1 Chemical Requirements**

| Element             | Composition Limits, % |           |           |           | Product (Check) Analysis Variations, under min or over max, of the Specified Limit of Element |
|---------------------|-----------------------|-----------|-----------|-----------|---|
|                     | N06600                | N06603    | N06025    | N06045    |   |
| Nickel <sup>A</sup> | 72.0 min              | Bal       | Bal       | 45.0 min  | 0.45  |
| Chromium            | 14.0 min<br>17.0 max  | 24.0–26.0 | 24.0–26.0 | 26.0–29.0 | 0.15<br>0.25  |
| Iron                | 6.0 min<br>10.0 max   | 8.0–11.0  | 8.0–11.0  | 21.0–25.0 | 0.10<br>0.10  |
| Manganese           | 1.0                   | 0.15 max  | 0.15 max  | 1.0 max   | 0.03  |
| Carbon              | 0.15 max              | 20.0–40.0 | 0.15–0.25 | 0.05–0.12 | 0.01  |
| Copper              | 0.5 max               | 0.50 max  | 0.10 max  | 0.3 max   | 0.03  |
| Silicon             | 0.5 max               | 0.50 max  | 0.5 max   | 2.5–3.0   | 0.03  |
| Sulfur              | 0.015 max             | 0.010 max | 0.010 max | 0.010 max | 0.003   |
| Aluminum            | ...                   | 2.4–3.0   | 1.8–2.4   | ...       |   |
| Titanium            | ...                   | 0.01–0.25 | 0.1–0.2   | ...       |   |
| Phosphorus          | ...                   | 0.020 max | 0.02 max  | 0.02 max  |   |
| Zirconium           | ...                   | 0.01–0.40 | 0.01–0.10 | ...       |   |
| Yttrium             | ...                   | 0.01–0.15 | 0.05–0.12 | ...       |   |
| Cerium              | ...                   | ...       | ...       | 0.03–0.09 |   |

<sup>A</sup> Nickel shall be determined arithmetically by difference.

## 6. Materials and Manufacture

6.1 Pipe shall be made from flat-rolled alloy by an automatic welding process with no addition of filler metal. Subsequent to welding and prior to final heat treatment, the material shall be cold worked either in both weld and base metal or in weld metal only.

6.2 Pipe shall be furnished with a scale-free finish. When bright annealing is used, descaling is not necessary.

## 7. Chemical Composition

7.1 The material shall conform to the requirements as to chemical composition prescribed in [Table 1](#).

7.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in Specification [B775](#).

## 8. Mechanical and Other Requirements

8.1 *Mechanical Properties*—The material shall conform to the requirements for mechanical properties prescribed in [Table 2](#).

8.2 *Flattening Test*—Pipe shall be capable of withstanding, without cracking, flattening under a load applied gradually at room temperature until the distance between the platens is five

times the wall thickness. The weld shall be positioned 90° from the direction of the applied flattening force.

### 8.3 Nondestructive Test Requirements:

8.3.1 *Category 1*—Each piece of each lot shall be subject to one of the following four tests: hydrostatic, pneumatic (air underwater), eddy current, or ultrasonic.

8.3.2 *Category 2*—Each piece in each lot shall be subjected to a leak test and an electric test as follows:

8.3.2.1 *Leak Test*—Hydrostatic or pneumatic (air underwater).

8.3.2.2 *Electric Test*—Eddy current or ultrasonic.

8.4 The manufacturer shall have the option to test Category 1 or Category 2 and select the nondestructive test methods, if not specified by the purchaser.

8.5 *Transverse Guided Bend Test*—At the option of the pipe manufacturer, the transverse guided bend test may be substituted in lieu of the flattening test. Two bend specimens shall be taken transversely from pipe or the test specimens may be taken from a test plate of the same material and heat as pipe, which is attached to the end of the cylinder and welded as a prolongation of the pipe longitudinal seam. One test is required for each lot as defined in Specification [B775](#).

## 9. Number of Tests

9.1 *Chemical Analysis*—One per lot.

9.2 *Mechanical Properties*—One test per lot.

9.3 *Flattening or Transverse Guided Bend Test*—One test per lot.

9.4 *Nondestructive*—Each piece in each lot.

## 10. Keywords

10.1 welded pipe; N06600; N06603; N06025; N06045

**TABLE 2 Mechanical Property Requirements**

| Alloy  | Tensile Strength, min, psi (MPa) | Yield Strength, 0.2 % Offset, min, psi (MPa) | Elongation in 2 in. or 50 mm, min, % |
|--------|----------------------------------|--|--------------------------------------|
| N06600 | 80 000 (550)                     | 35 000 (240)                                 | 30                                   |
| N06603 | 94 000 (650)                     | 43 000 (300)                                 | 25                                   |
| N06025 | 98 000 (680)                     | 39 000 (270)                                 | 30                                   |
| N06045 | 90 000 (620)                     | 35 000 (240)                                 | 30                                   |

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