



# Standard Specification for General Requirements for Nickel and Nickel Alloy Welded Pipe<sup>1</sup>

This standard is issued under the fixed designation B 775; 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 contains various requirements that, with the exception of Section 5 and Section 10, are mandatory requirements to the following ASTM nickel and nickel alloy, longitudinally welded piping specifications:<sup>2</sup>

| Title of Specification                                                          | ASTM Designation <sup>2</sup> |
|---------------------------------------------------------------------------------|-------------------------------|
| Welded UNS N08020, UNS N08024, and UNS N08026 Alloy Pipe                        | B 464                         |
| Welded Nickel-Iron-Chromium Alloy Pipe                                          | B 514                         |
| Welded Nickel-Chromium-Iron-Alloy (UNS N06600) Pipe                             | B 517                         |
| Welded Nickel and Nickel-Cobalt Alloy Pipe                                      | B 619                         |
| UNS N08904, UNS N08925, and UNS N08926 Welded Pipe                              | B 673                         |
| UNS N08366 and UNS N08367 Welded Pipe                                           | B 675                         |
| Nickel-Alloy (UNS N06625 and N08825) Welded Pipe                                | B 705                         |
| Ni-Cr-Mo-Co-W-Fe-Si Alloy (UNS N06333) Welded Pipe                              | B 723                         |
| Welded Nickel (UNS N02200/UNS N02201) and Nickel Copper Alloy (UNS N04400) Pipe | B 725                         |

1.2 One or more of the test requirements of Section 5 apply only if specifically stated in the product specification or in the purchase order.

1.3 In case of conflict between a requirement of the product specification and a requirement of this general specification, only the requirement of the product specification needs to be satisfied.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

## 2. Referenced Documents

### 2.1 ASTM Standards:

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys<sup>2</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>3</sup>

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

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>4</sup>

E 39 Test Methods for Chemical Analysis of Nickel<sup>5</sup>

E 76 Test Methods for Chemical Analysis of Nickel Copper Alloys<sup>5</sup>

E 112 Test Methods for Determining the Average Grain Size<sup>3</sup>

E 213 Practice for Ultrasonic Examination of Metal Pipe and Tubing<sup>6</sup>

E 426 Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys<sup>6</sup>

E 571 Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products<sup>6</sup>

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys<sup>7</sup>

### 2.2 ANSI Standards:<sup>8</sup>

B 1.20.1 Pipe Threads

B 36.10 Welded and Seamless Wrought Steel Pipe

B 36.19 Stainless Steel Pipe

## 3. Terminology

### 3.1 Definitions:

3.1.1 *average diameter*—the average of the maximum and minimum outside diameters, as determined at any one cross section of the pipe.

3.1.2 *nominal wall*—a specified wall thickness with a plus or minus tolerance from the specified thickness.

3.1.3 *welded pipe*—a round hollow produced by forming flat stock and joining the single longitudinal seam by welding, and produced to the particular dimensions commercially known as pipe sizes (NPS).

## 4. Chemical Composition

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

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 03.05.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 03.03.

<sup>7</sup> *Annual Book of ASTM Standards*, Vol 03.06.

<sup>8</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

| UNS No. Prefixes | ASTM Method |
|------------------|-------------|
| N02              | E 39        |
| N04              | E 76        |
| N06, N08         | E 1473      |

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

4.3 The product (check) analysis of the material shall meet the requirements for the ladle analysis within the tolerance limits prescribed in B 880.

## 5. Test Requirements

### 5.1 Flattening Test:

5.1.1 A length of pipe not less than three times the specified diameter or 4 in. (102 mm), whichever is longer, shall be flattened 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.

5.1.2 The flattened specimen shall not exhibit cracks.

5.1.3 Superficial ruptures resulting from surface imperfections shall not be a cause for rejection.

### 5.2 Pressure (Leak Test):

5.2.1 *Hydrostatic*—Each pipe shall be tested by the manufacturer to an internal hydrostatic pressure of 1000 psi (6.9 MPa) provided that the fiber stress, calculated from the following equation, does not exceed the allowable fiber stress for the material:

$$P = 2St/D \quad (1)$$

where:

$P$  = hydrostatic test pressure, psi (MPa),

$S$  = allowable fiber stress, for material in the condition (temper) furnished as specified in the product specification ( $S$  is calculated as the lower of  $\frac{2}{3}$  of the specified minimum 0.2 % offset yield strength or  $\frac{1}{4}$  of the specified minimum ultimate strength for the material),

$t$  = minimum wall thickness permitted, in. (mm), including minus tolerance, if any, and

$D$  = nominal outside diameter of the pipe, in. (mm).

5.2.1.1 The test pressure must be held for a minimum of 5 s.

NOTE 1—Testing at a pressure greater than 1000 psi may be performed upon agreement between the purchaser and manufacturer provided that the allowable fiber stress is not exceeded.

5.2.2 *Pneumatic (Air Underwater Test)*—Each pipe shall be tested at a pressure of 150 psi (1.05 MPa). The test pressure shall be held for a minimum of 5 s. Visual examination is to be made when the material is submerged and under pressure. The full length of pipe must be examined for leaks.

5.2.3 If any pipe shows leaks during hydrostatic or pneumatic testing, it shall be rejected.

### 5.3 Nondestructive Electric Test:

5.3.1 *Eddy Current Testing*—Testing shall be conducted in accordance with Practices E 426 or E 571. The eddy current examination reference in this specification has the capability of

detecting significant discontinuities, especially of the short, abrupt type.

5.3.1.1 Unless otherwise specified by the purchaser, the calibration standard shall contain, at the option of the manufacturer, any one of the following discontinuities to establish a minimum sensitivity level for rejection. The discontinuity shall be placed in the weld if visible.

5.3.1.2 *Drill Hole*—A hole not larger than 0.031 in. (0.79 mm) diameter shall be drilled radially and completely through the wall, care being taken to avoid distortion of the material while drilling.

5.3.1.3 *Transverse Tangential Notch*—Using a round file or tool with a  $\frac{1}{4}$  in. (6 mm) diameter, a notch shall be filed or milled on the pipe outside diameter tangential to the surface and transverse to the longitudinal axis of the material. Said notch shall have a depth not exceeding 12.5 % of the specified wall thickness of the material, or 0.004 in. (0.10 mm), whichever is greater.

5.3.2 *Ultrasonic Testing*—Testing shall be conducted in accordance with Practice E 213. The ultrasonic examination referred to in this specification is intended to detect longitudinal discontinuities having a reflective area similar to or larger than the calibration reference notches specified in 5.3.2.1. The examination may not detect circumferentially oriented imperfections or short, deep defects.

5.3.2.1 For ultrasonic testing, longitudinal calibration notches shall be machined on the outside and inside diameter surfaces. The depth of the notches shall not exceed 12.5 % of the specified wall thickness or 0.004 in. (0.10 mm), whichever is greater. The notch shall be placed in the weld, if visible.

5.3.3 *Calibration Frequency*—The frequency of calibration checks shall be as follows:

5.3.3.1 At the beginning of each production run.

5.3.3.2 At least every four hours during testing.

5.3.3.3 At the end of each production run.

5.3.3.4 After any suspected equipment malfunction or work stoppage.

5.3.3.5 If, during any check, the equipment fails to detect the calibration defects, the instrument must be recalibrated and all material tested since the last satisfactory check shall be retested.

5.3.4 *Acceptance and Rejection*—Material producing a signal equal to or greater than the calibration defect shall be subject to rejection.

5.3.4.1 Test signals that are produced by imperfections that cannot be identified or that are produced by cracks or crack-like imperfections shall result in rejection of the pipe, subject to rework and retest.

5.3.4.2 If the imperfection is judged as not fit for use, the tube shall be rejected, but may be reconditioned and retested providing the wall thickness requirements are met. To be accepted, retested material shall meet the original electric test requirements.

5.3.4.3 If the imperfection is explored to the extent that it can be identified, and the pipe is determined to be fit for use, the material may be accepted without further testing providing the imperfection does not encroach on minimum wall thickness requirements.