



# Standard Specification for Nickel Seamless Pipe and Tube<sup>1</sup>

This standard is issued under the fixed designation B 161; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification<sup>2</sup> covers nickel (UNS N02200)\* and low-carbon nickel (UNS N02201)\* in the form of cold-worked seamless pipe and tube in the conditions shown in Table 1 and Table X1.1.

1.1.1 Hot-worked material is available. Properties are to be agreed upon between the manufacturer and purchaser.

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

1.3 *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 for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

B 829 Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube<sup>3</sup>

E 426 Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys<sup>4</sup>

E 571 Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products<sup>4</sup>

## 3. General Requirement

3.1 Material furnished under this specification shall conform to the applicable requirements of Specification B 829 unless otherwise provided herein.

<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.

Current edition approved June 10, 2003. Published July 2003. Originally approved in 1941. Last previous edition approved in 2000 as B 161 - 00.

<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SB-161 in Section II of that Code.

\* New designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.03.

## 4. Ordering Information

4.1 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:

4.1.1 Alloy name or UNS number.

4.1.2 ASTM designation and year of issue.

4.1.3 *Condition* (see Appendix X2).

4.1.4 *Finish* (see Appendix X2).

4.1.5 *Dimensions*:

4.1.5.1 *Tube*—Specify outside diameter and nominal or minimum wall.

4.1.5.2 *Pipe*—Specify standard pipe size and schedule.

4.1.5.3 *Length*—Cut to length or random.

4.1.6 *Quantity*—Feet or number of pieces.

4.1.7 *Hydrostatic Test or Nondestructive Electric Test*—Specify test (see 6.2).

4.1.8 *Hydrostatic Pressure Requirements*—Specify test pressure if other than required by Specification B 829.

4.1.9 *Certification*—State if certification is required.

4.1.10 *Samples for Product (Check) Analysis*—State whether samples for product (check) analysis should be furnished (see 5.2).

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

4.1.12 *Small-Diameter and Light-Wall Tube (Converter Sizes)*—See Appendix X1.

## 5. Chemical Composition

5.1 The material shall conform to the composition limits specified in Table 2.

5.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in Specification B 829.

## 6. Mechanical and Other Properties

6.1 *Tension Test*—The material shall conform to the tensile properties specified in Table 1. The sampling and specimen preparation are as covered in Specification B 829.

**TABLE 1 Mechanical Properties**

Condition and Size	Tensile Strength, min, psi (MPa)		Yield Strength (0.2 % offset), min, psi (MPa)		Elongation in 2 in. or 50 mm (or 4D), min, %	
	Nickel (UNS N02200)	Low-Carbon Nickel (UNS N02201)	Nickel (UNS N02200)	Low-Carbon Nickel (UNS N02201)	Nickel (UNS N02200)	Low-Carbon Nickel (UNS N02201)
Annealed:						
5 in. (127 mm) and under outside diameter	55 000 (380)	50 000 (345)	15 000 (105)	12 000 (80)	35	35
Over 5 in. (127 mm) in outside diameter	55 000 (380)	50 000 (345)	12 000 (80)	10 000 (70)	40	40
Stress-Relieved:						
All sizes	65 000 (450)	60 000 (415)	40 000 (275)	30 000 (205)	15	15

**TABLE 2 Chemical Requirements**

Element	Composition, %	
	Nickel (UNS N02200)	Low-Carbon Nickel (UNS N02201)
Ni, <sup>A</sup> min	99.0	99.0
Cu, max	0.25	0.25
Fe, max	0.40	0.40
Mn, max	0.35	0.35
C, max	0.15	—
C, max	—	0.02
Si, max	0.35	0.35
S, max	0.01	0.01

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

6.1.1 Tensile properties for material specified as small-diameter and light-wall tube (converter sizes) shall be as prescribed in Table X1.1.

6.2 *Hydrostatic Test or Nondestructive Electric Test*—Each pipe or tube shall be subjected to the Nondestructive Electric Test or the Hydrostatic Test. Unless specified by the purchaser, either test may be used at the option of the producer.

## 7. Dimensions and Permissible Variations

7.1 Permissible variations for material specified as small-diameter and light-wall tube (converter size) shall conform to the permissible variations prescribed in Table X1.2.

## 8. Number of Tests

8.1 *Chemical Analysis*—One test per lot.

8.2 *Tension*—One test per lot.

8.3 *Hydrostatic or Nondestructive Electric Test*—Each piece in each lot.

## 9. Test Methods

9.1 *Hydrostatic Test*—Each pipe or tube with an outside diameter 1/8 in. (3 mm) and larger and with wall thickness of 0.015 in. (0.38 mm) and over shall be tested in accordance with Specification B 829. The allowable fiber stress, for material in the condition furnished, is as follows:

	UNS N02200	UNS N02201
Annealed:		
5 in. (127 mm) outside diameter and under	10 000 psi (70 MPa)	8000 psi (55 MPa)
Over 5 in. outside diameter	8000 psi (55 MPa)	6700 psi (45 MPa)
Stress-Relieved:		
All sizes	16 200 psi (110 MPa)	15 000 psi (105 MPa)

9.1.1 When so agreed upon by the manufacturer and purchaser, pipe or tube may be tested to 1½ times the allowable fiber stress given above.

9.1.2 If any pipe or tube shows leaks during hydrostatic testing, it shall be rejected.

9.2 *Nondestructive Electric Test*—Each pipe or tube shall be examined with a nondestructive electric test in accordance with Practice E 426 or Practice E 571. Unless specifically spelled out by the purchaser, the selection of the nondestructive test will be at the option of the producer. The range of pipe or tube sizes that may be examined by each method shall be subjected to the limitation in the scope of the respective practices.

## 10. Keywords

10.1 seamless pipe; seamless tube; N02200; N02201

**APPENDIXES**
**(Nonmandatory Information)**
**X1. CONVERTER SIZES**

X1.1 Small-diameter and light-wall tube in outside diameters 1¼ in. (31.8 mm) and under may be furnished in the conditions listed in Table X1.1 when so specified. The material is furnished in a limited range of sizes and the manufacturer

should be consulted as to the various outside diameters and wall thicknesses that may be furnished. Material will have a bright finish. Such material shall conform to the applicable requirements in Table X1.1 and Table X1.2.

**TABLE X1.1 Mechanical Properties<sup>A</sup> of Small-Diameter and Light-Wall Tubing (Converter Sizes)**

Condition	Tensile Strength, psi (MPa)	Yield Strength (0.2 % offset), min, psi (MPa)	Elongation in 2 in. or 50 mm, min, %
Nickel UNS N02200			
Annealed <sup>B</sup>	75 000 (515) max	15 000 (105)	33
Half-hard <sup>C</sup>	80 000 (550) min	40 000 (275)	12
Full hard <sup>D</sup>	95 000 (655) min	75 000 (515)	4
Low-Carbon Nickel UNS N02201			
Annealed <sup>B</sup>	70 000 (480) max	12 000 (85)	35
Half-hard <sup>C</sup>	70 000 (480) min	30 000 (205)	12
Full hard <sup>D</sup>	85 000 (585) min	65 000 (450)	4

<sup>A</sup> Not applicable to outside diameters under ½ in. (3.2 mm) and wall thicknesses under 0.015 in. (0.38 mm).

<sup>B</sup> This condition is sometimes designated as "No. 1 Temper."

<sup>C</sup> This condition is sometimes designated as "No. 2 Temper."

<sup>D</sup> This condition is sometimes designated as "No. 3 Temper."

**TABLE X1.2 Permissible Variations for Small-Diameter and Light-Wall Tube (Converter Sizes)<sup>A,B,C,D,E ,F,G</sup>**

Specified Outside Diameter, in. (mm)	Outside Diameter		Inside Diameter		Wall Thickness, %	
	Plus	Minus	Plus	Minus	Plus	Minus
Under ⅜ (2.4)	0.002 (0.05)	0	0	0.002 (0.05)	10	10
⅜ to ⅜ (2.4 to 4.8), excl	0.003 (0.08)	0	0	0.003 (0.08)	10	10
⅜ to ½ (4.8 to 12.7), excl	0.004 (0.10)	0	0	0.004 (0.10)	10	10
½ to 1 ¼ (12.7 to 31.8), incl	0.005 (0.13)	0	0	0.005 (0.13)	10	10

<sup>A</sup> *Ovality, Normal Wall Tube—As-Drawn (No. 2 and 3) Tempers*—Ovality will be held within the outside diameter tolerances shown in the table.

*Annealed (No. 1) Temper*—Ovality will be held within 2 % of the theoretical average outside diameter.

<sup>B</sup> *Ovality, Light-Wall Tube—As-Drawn (No. 2 and 3) Tempers*—Up to but not including 1¼ in. (31.8 mm) in outside diameter, ovality will be held within 2 % of the theoretical average outside diameter.

*Annealed (No. 1) Temper*—Ovality will be held within 3 % of the theoretical average outside diameter.

<sup>C</sup> *Wall Tolerances, Light-Wall Tube*—The plus and minus wall tolerance shown in the table shall apply down to and including 0.005 in. (0.13 mm) in wall thickness. For wall thicknesses less than 0.005 in. (0.13 mm), the tolerance shall be ± 0.0005 in. (0.013 mm).

<sup>D</sup> *Random Lengths:*

Where nominal random lengths on tubing ⅝ in. (3.2 mm) and larger in outside diameter are specified, a length tolerance of ± 3½ ft (1.06 m) applies to the nominal length. This is a total spread of 7 ft (2.10 m).

Random lengths in sizes ⅝ in. (3.2 mm) and larger in outside diameter shall be subject to a length range of 5 to 24 ft (1.50 to 7.30 m). Long random lengths are subject to a range of 15 to 22 ft (4.57 to 6.70 m).

Random lengths in sizes up to, but not including ⅝ in. (3.2 mm) in outside diameter, and fragile light-wall tubes over this outside diameter are subject to the length range of 1 to 15 ft (0.30 to 4.57 m).

<sup>E</sup> *Cut Lengths*—Tolerances on cut lengths shall be in accordance with Table .

<sup>F</sup> *Straightness*—Round tubing is subject to a straightness tolerance of one part in 600 [equivalent to a depth of arc of 0.030 in. (0.76 mm) in any 3 ft (0.91 m) of length].

<sup>G</sup> When specified, the tolerance spreads of this table may be applied as desired. However, when not specified, the tolerances in this table will apply. It should be noted that inside diameter tolerances are based upon the outside diameter range.

## **X2. CONDITIONS AND FINISHES NORMALLY SUPPLIED**

### **X2.1 Scope**

X2.1.1 This appendix lists the conditions and finishes in which pipe and tube (other than converter sizes) are normally supplied. These are subject to change, and the manufacturer should be consulted for the latest information available.

### **X2.2 Nickel (UNS N02200)**

X2.2.1 *Annealed*—Soft, with a dull matte finish.

X2.2.2 *Stress-Relieved*—Thermally treated below the annealing temperature to relieve the major portion of the internal stresses, with a thin, light to medium-dark surface.

### **X2.3 Low-Carbon Nickel (UNS N02201)**

X2.3.1 *Annealed*—Similar to X2.2.1.

X2.3.2 *Stress-Relieved*—Similar to X2.2.2.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*