

SPECIFICATION FOR NICKEL SEAMLESS PIPE AND TUBE



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ASTM B161

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1. Scope

1.1 This specification 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 DELETED

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 (MSDS) 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

3. General Requirement

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

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 DELETED

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.

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, ⁴ 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

⁴ Element shall be determined arithmetically by difference.

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.

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 $\frac{1}{8}$ 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 $1\frac{1}{2}$ 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 as prescribed in Specification B 829.

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 $1\frac{1}{4}$ 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.

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.

TABLE X1.1
MECHANICAL PROPERTIES^A 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 ^B	75 000 (515) max	15 000 (105)	33
Half-hard ^C	80 000 (550) min	40 000 (275)	12
Full hard ^D	95 000 (655) min	75 000 (515)	4
Low-Carbon Nickel UNS N02201			
Annealed ^B	70 000 (480) max	12 000 (85)	35
Half-hard ^C	70 000 (480) min	30 000 (205)	12
Full hard ^D	85 000 (585) min	65 000 (450)	4

^A Not applicable to outside diameters under $\frac{1}{8}$ in. (3.2 mm) and wall thicknesses under 0.015 in. (0.38 mm).

^B This condition is sometimes designated as "No. 1 Temper."

^C This condition is sometimes designated as "No. 2 Temper."

^D This condition is sometimes designated as "No. 3 Temper."

TABLE X1.2
PERMISSIBLE VARIATIONS FOR SMALL-DIAMETER AND LIGHT-WALL TUBE (CONVERTER SIZES)^{A,B,C,D,E,F}

Specified Outside Diameter, in. (mm)	Outside Diameter		Inside Diameter		Wall Thickness, %	
	Plus	Minus	Plus	Minus	Plus	Minus
Under $\frac{3}{32}$ (2.4)	0.002 (0.05)	0	0	0.002 (0.05)	10	10
$\frac{3}{32}$ to $\frac{3}{16}$ (2.4 to 4.8), excl	0.003 (0.08)	0	0	0.003 (0.08)	10	10
$\frac{3}{16}$ to $\frac{1}{2}$ (4.8 to 12.7), excl	0.004 (0.10)	0	0	0.004 (0.10)	10	10
$\frac{1}{2}$ to $1\frac{1}{4}$ (12.7 to 31.8), incl	0.005 (0.13)	0	0	0.005 (0.13)	10	10

^A *Ovality, Normal Wall Tubes — 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.

^B *Ovality, Light-Wall Tube — As-Drawn (No. 2 and 3) Tempers* — Up to but not including $1\frac{1}{4}$ 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.

^C *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).

^D *Random Lengths:*

Where nominal random lengths on tubing $\frac{1}{8}$ in. (3.2 mm) and larger in outside diameter are specified, a length tolerance of $\pm 3\frac{1}{2}$ ft (1.06 m) applies to the nominal length. This is a total spread of 7 ft (2.10 m).

Random lengths in sizes $\frac{1}{8}$ 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 $\frac{1}{8}$ 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).

^E *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].

^F 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.