Designation: B423 – 11 (Reapproved 2021)

Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825, N08221, and N06845) Seamless Pipe and Tube[1]

This standard is issued under the fixed designation B423; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification[2] covers nickel-iron-chromium-molybdenum-copper alloys (UNS N08825, N08221, and N06845)[3] in the form of cold-worked and hot-finished seamless pipe and tube intended for general corrosive service. The general requirements for pipe and tube are covered in Specification B829.

1.2 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.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 9, of this specification: *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 Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

B829 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 B829 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,

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 metres) or number of pieces,

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

4.1.8 *Hydrostatic Pressure Requirements*—Specify test pressure if other than required by 9.1.1,

4.1.9 *Certification*—State if certification is required,

[1] 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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[2] For ASME Boiler and Pressure Vessel Code applications see related specification SB-423 in Section II of that code.

[3] New designation established in accordance with Practice E527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Chemical Requirements[A]

Element	UNS N08825	UNS N08221	UNS N06845
Nickel	38.0–46.0	39.0–46.0	44.0–50.0
Chromium	19.5–23.5	20.0–22.0	20.0–25.0
Iron	22.0 min[B]	22.0 min[B]	remainder[B]
Manganese	1.0	1.0	0.5
Carbon	0.05	0.025	0.05
Copper	1.5–3.0	1.5–3.0	2.0–4.0
Silicon	0.5	0.5	0.5
Sulfur	0.03	0.03	0.010
Aluminum	0.2	0.2	...
Titanium	0.6–1.2	0.6–1.0	...
Molybdenum	2.5–3.5	5.0–6.5	5.0–7.0
Tungsten	...	...	2.0–5.0

[A] Maximum unless range or minimum is given. Where ellipses (...) appear in this table, there is no requirement and analysis for the element need not be determined or reported.
[B] Element shall be determined arithmetically by difference.

TABLE 2 Mechanical Properties of Pipe and Tube

Alloy	Condition and Size	Tensile Strength, min, ksi (MPa)	Yield Strength 0.2 % Offset, min, ksi (MPa)	Elongation in 2 in. or 50 mm (4D), min,%
UNS N08825	hot-finished annealed	75 (517)	25 (172)	30
UNS N08825	cold-worked annealed	85 (586)	35 (241)	30
UNS N08825	hot-forming quality (hot-finished or cold-drawn annealed)	[A]	[A]	[A]
UNS N08221	cold-finished, annealed	79 (545)	34 (234)	30
UNS N06845	cold-finished, annealed	100 (690)	40 (276)	30

[A] Hot-forming quality is furnished to chemical requirements and surface inspection only. No mechanical properties are 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, and

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 1. One test is required for each lot as defined in Specification B829.

5.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations of Specification B829.

6. Mechanical Properties and Other Requirements

6.1 *Tension Test*—The material shall conform to the tensile properties specified in Table 2. The sampling and specimen preparation are as covered in Specification B829.

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 or Nondestructive Electric Test*—Each pipe or tube shall be subjected to either the hydrostatic test or the nondestructive electric test. The type of test to be used shall be at the option of the manufacturer, unless otherwise specified in the purchase order.

7. Dimensions and Permissible Variations

7.1 *Diameter and Wall Thickness*—The permissible variations in the outside diameter and wall thickness shall conform to the permissible variations prescribed in Tables 3, 4, and 5 of Specification B829.

7.2 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 ⅛ 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 B829. The allowable fiber stress, for material in the condition furnished, is as follows:

UNS N08825 hot finished, annealed:	16 600 psi (114 MPa)
UNS N08825 cold-worked, annealed:	21 200 psi (146 MPa)
UNS N08221 cold finished, annealed:	19 700 psi (138 MPa)

9.1.1 When so agreed upon between the manufacturer and purchaser, pipe or tube may be tested to 1½ times the allowable fiber stress given in 9.1.

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 Specification B829.

10. Keywords

10.1 N08221; N08825; N06845; seamless pipe; seamless tube

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 right finish. Such material shall conform to the applicable requirements in Table X1.1 and Table X1.2.

TABLE X1.1 Mechanical Properties[A] of Small-Diameter and Light-Wall Tubing (Converter Sizes)

Condition	Tensile Strength, ksi (MPa)	Yield Strength (0.2 % offset) min, ksi (MPa)	Elongation in 2 in. or 50 mm, min, %
Annealed[BC]	85–115 (586–793)	35 (241)	30
Half-hard[D]	105 (724) min	75 (517)	15
Full-hard[E]	125 (862) min	100 (689)	5

[A] Not applicable to outside diameters under ⅛ in. (3.2 mm) and wall thickness under 0.015 in. (0.381 mm).
[B] This condition is sometimes designated as "No. 1 Temper."
[C] The minimum tensile strength value applies only to tubing in straight lengths.
[D] This condition is sometimes designated as "No. 2 Temper."
[E] This condition is sometimes designated as "No. 3 Temper."

TABLE X1.2 Permissible Variations for Small-Diameter and Light-Wall Tube (Converter Sizes)[ABCDEFG]

Specified Outside Diameter, in. (mm)	Outside Diameter, in. (mm)		Inside Diameter, in. (mm)		Wall Thickness, %	
	+	–	+	–	+	–
Under 3⁄32 (2.4)	0.002 (0.05)	0	0	0.002 (0.05)	10	10
3⁄32 to 3⁄16 (2.4 to 4.8), excl	0.003 (0.08)	0	0	0.003 (0.08)	10	10
3⁄16 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

[A] *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.
[B] *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.
[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 ⅛ 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 ⅛ 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, ⅛ 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] *Cut Lengths*—Tolerances on cut lengths shall be in accordance with Table X1.3.
[F] *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) on length].
[G] 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.