Designation: B 423 – 03

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

This standard is issued under the fixed designation B 423; 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 and N08221)* 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 B 829.

1.2 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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 829 Specification for General Requirements for Nickel and Nickel Alloy Seamless Pipe and Tube[3]

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,

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

4.1.8 *Certification*— State if certification is required,

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

4.1.10 *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

4.1.11 *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 B 829.

TABLE 1 Chemical Requirements

Element	UNS N08825	UNS N08221
Nickel	38.0–46.0	39.0–46.0
Chromium	19.5–23.5	20.0–22.0
Iron	22.0 min	22.0 min
Manganese	1.0 max	1.0 max
Carbon	0.05 max	0.025 max
Copper	1.5–3.0	1.5–3.0
Silicon	0.5 max	0.5 max
Sulfur	0.03 max	0.03 max
Aluminum	0.2 max	0.2 max
Titanium	0.6–1.2	0.6–1.0
Molybdenum	2.5–3.5	5.0–6.5

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

[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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* New designation established in accordance with Practice E 527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).

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

[3] *Annual Book of ASTM Standards*, Vol 02.04.

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

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

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

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 B 829.

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*—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 B 829. 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.

10. Keywords

10.1 N08221; N08825; 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 X1.2.
[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.

TABLE X1.3 Tolerances on Cut Lengths of Light-Wall Tube

Length, ft (m)	Tube Size, in. (mm)	Permissible Variations, in. (mm)	
		Over	Under
Under 1 (0.30)	up to 1.250 (31.8), incl	1/32 (0.8)	0 (0)
1 to 4 (0.30 to 1.22), incl	up to 1.250 (31.8), incl	1/16 (1.6)	0 (0)
Over 4 to 10 (1.22 to 3.0), incl	up to 1.250 (31.8), incl	3/32 (2.4)	0 (0)
Over 10 (3.0)	up to 1.250 (31.8), incl	3/16 (4.8)	0 (0)

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 Cold-Worked Tube and Pipe

X2.2.1 *Cold-Worked, Annealed, with Ground Outside Diameter*—The inside diameter may have a bright finish when material is annealed in a protective atmosphere; otherwise, the inside diameter is supplied descaled as necessary. It is available in sizes ½ to 4 in. (12.7 to 102 mm), inclusive, in outside diameter in both normal and heavy-wall tube, and pipe sizes, all schedules, of corresponding outside-diameter dimensions.

X2.2.2 *Cold-Worked, Annealed, and Pickled (Not Ground)*—Outside and inside diameter will have dull, matte (pickled) surfaces. It is available in sizes ½ to 6⅝ in. (12.7 to 168 mm), inclusive, in outside diameter in both normal and heavy-wall tube, and pipe sizes, all schedules, of corresponding outside-diameter dimensions.

X2.3 Hot-Worked Tube

X2.3.1 *Hot-Worked-Annealed (Not Pickled) Tube*—Has an oxide surface resulting from the hot-working operation. Intended generally for machined parts where the oxide surface will be removed.

X2.3.2 *Hot-Worked-Annealed (Pickled) Tube*—Has the oxide surface removed on both outside and inside diameters by pickling. Surface may be spot ground for removal of minor surface imperfections at the manufacturer's option.

X2.3.3 *Hot-Worked-Annealed (Machined Outside and Inside Diameters) Tubes*—The outside and inside diameter surfaces are machined to specified dimensions. Minor surface imperfections may be spot ground for removal, at the manufacturer's option.