

ASTM B444 / ASME SB444

Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium- Molybdenum-Silicon Alloy (UNS N0621 9) Pipe and Tube

This specification covers nickel-chromium-molybdenum- columbium alloys (UNS N06625 and UNS N06852) and nickel-chromium-molybdenum-silicon alloy (UNS N06219) in the form of cold-worked seamless pipe and tube.

UNS N06625 products are furnished in two grades of different heat-treated conditions:

Grade 1 (annealed)—Material is normally employed in service temperatures up to 1100°F (593°C).

Grade 2 (solution annealed)—Material is normally employed in service temperatures above 1100°F (593°C) when resistance to creep and rupture is required.

Alloys UNS N06219 and UNS N06852 are supplied in the solution annealed condition only.

A. General Requirement :-

1. Material furnished under this specification shall conform to the applicable requirements of Specification B829 unless otherwise provided herein.

B. Chemical Composition :-

The material shall conform to the composition limits specified in Table 1.

Table 1

| Element | N06852 | N06625 | N06219 |
|------------------------|-----------|-----------|-----------|
| Carbon | 0.05 max | 0.10 max | 0.05 max |
| Manganese | 0.50 max | 0.50 max | 0.50 max |
| Silicon | 0.50 max | 0.50 max | 0.70-1.10 |
| Phosphorus | 0.015 max | 0.015 max | 0.020 max |
| Sulfur | 0.015 max | 0.015 max | 0.010 max |
| Chromium | 20.0-23.0 | 20.0 min | 18.0-22.0 |
| | ... | 23.0 max | ... |
| Columbium + tantalum | ... | 3.15 min | ... |
| | ... | 4.15 max | ... |
| Columbium | 0.51-1.00 | ... | ... |
| Cobalt (if determined) | ... | 1.0 max | 1.0 max |
| Molybdenum | 8.0-10.0 | 8.0 min | 7.0-9.0 |
| | | 10.0 max | ... |
| Iron | 15.0-20.0 | 5.0 max | 2.0-4.0 |
| Aluminum | 0.40 max | 0.40 max | 0.50 max |
| Titanium | 0.40 max | 0.40 max | 0.50 max |
| Copper | ... | ... | 0.50 max |
| Nickel ^A | Bal. | 58.0 min | Bal. |

^A Element shall be determined arithmetically by difference.

C. Mechanical Properties and Other Requirements :-

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.

2. Hydrostatic or Non-destructive Electric Test—
The type of test to be used shall be at the option of the manufacturer, unless otherwise specified in the purchase order.

Table 2: Room Temperature Tensile Properties and Heat Treatment Including Small Diameter and Light-Wall Tubing (Converter Sizes)^{AB}

| Condition | Tensile Strength, min, ksi (MPa) ^C | Yield Strength (0.2% Offset), min, ksi (MPa) ^C | Elongation in 2 in. or 50.8 mm (or 4D), min, % |
|--|---|---|--|
| Alloy N06625 | | | |
| Grade 1 (annealed) ^D | 1 20 (827) | 60 (41 4) | 30 |
| Grade 2 (solution annealed) ^E | 100 (690) | 40 (276) | 30 |
| Alloy N0621 9 | | | |
| All (solution annealed) | 96 (660) | 39 (270) | 30 |
| Alloy N06852 | | | |
| All (solution annealed) | 85 (586) | 35 (241) | 30 |

^A Not applicable to outside diameters under 1/8 in. (3.2 mm) and to wall thicknesses under 0.015 in. (0.38 mm).

^B Hot forming quality pipe and tubing is furnished to chemical requirements and surface inspection only. No tensile properties are required.

^C The minimum strength values apply only to tubing in straight lengths.

^D Annealed at 1600°F (871 °C) minimum.

^E Solution annealed at 2000°F (1093°C) minimum, with or without subsequent stabilization anneal at 1800°F (982°C) minimum to increase resistance to sensitization.

D. Test Methods :-

1. Hydrostatic Test—

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

UNS N06625:

Grade 1— 30000 psi (207 MPa)

Grade 2— 25000 psi (172 MPa)

UNS N06219:

All— 24000 psi (165 MPa)

UNS N06852:

All— 21000 psi (145 MPa)

- ii. When so agreed upon by the manufacturer and purchaser, pipe or tube may be tested to 1(1/2) times the allowable fiber stress given above.

2. Non-destructive Electric Test—

- i. Each pipe or tube shall be examined with a non-destructive electric test as per prescribed in Specification B829.

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