

# ASTM B546 / SB546

## Standard Specification for Electric Fusion-Welded Ni-Cr-Co-Mo Alloy (UNS N06617), Ni-Fe-Cr-Si Alloys (UNS N08330 and UNS N08332), Ni-Cr-Fe-Al Alloy (UNS N06603), Ni-Cr-Fe Alloy (UNS N06025), and Ni-Cr-Fe-Si Alloy (UNS N06045) Pipe

This specification covers electric fusion-welded nickel-chromium-cobalt-molybdenum alloy UNS N06617, nickel-iron-chromium-silicon alloys UNS N08330 and UNS N08332, Ni-Cr-Fe-Al Alloy (UNS N06603), Ni-Cr-Fe Alloy UNS N06025, and Ni-Cr-Fe-Si Alloy UNS N06045 pipe intended for heat resisting applications and general corrosive service.

This specification covers pipe in sizes 3 in. (76.2 mm) nominal diameter and larger and possessing a minimum wall thickness of 0.083 in. (2.11 mm).

Two classes of pipe are covered as follows:

Class 1—All welded joints to be 100 % inspected by radiography.

Class 2—No radiographic examination is required.

### A. General Requirement :-

1. Material furnished in accordance with this specification shall conform to the applicable requirements of the current edition of Specification B 775 unless otherwise provided herein.

### B. Materials :-

1. The UNS N08330 and UNS N08332 alloy plate material shall conform to the requirements of Specification B 536.
2. The UNS N06617, UNS N06603, UNS N06025, and UNS N06045 alloy plate material shall conform to the requirements of Specification B 168.

### C. Heat Treatment :-

1. All pipe shall be furnished in the annealed condition.

### D. Chemical Composition :-

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

Table 1

Element	N08330	N08332	N06603	N06617	N06025	N06045
Carbon	0.08 max	0.05–0.10	0.20-0.40	0.05–0.15	0.15–0.25	0.05–0.12
Manganese	2.00 max	2.00 max	0.15 max	1.0 max	0.15 max	1.0 max
Phosphorus	0.03 max	0.03 max	0.20 max	...	0.02 max	0.02 max
Sulfur	0.03 max	0.03 max	0.10 max	0.015 max	0.010 max	0.010 max
Silicon	0.75-1.50	0.75-1.50	0.50 max	1.0 max	0.5 max	2.5–3.0
Chromium	17.0-20.0	17.0-20.0	0.24-0.26	20.0–24.0	24.0–26.0	26.0–29.0
Nickel	34.0-37.0	34.0-37.0	Bal	remainder	Bal	45.0min
Copper	1.00 max	1.00 max	0.50 max	0.5 max	0.1 max	0.3 max
Lead	0.005 max	0.005 max	...	...	...	...
Tin	0.025 max	0.025 max	...	...	...	...
Iron	remainder <sup>A</sup>	remainder	8.0–11.0	3.0 max	8.0–11.0	21.0–25.0
Aluminum	...	...	2.4-3.0	0.8–1.5	1.8–2.4	...

Cobalt	...	...	...	10.0–15.0	...	...
Molybdenum	...	...	...	8.0–10.0	...	...
Zirconium	...	...	0.01–0.10	...	0.01–0.10	...
Yttrium	...	...	0.01–0.15	...	0.05–0.12	...
Cerium	...	...	...	...	...	0.3–0.09
Titanium	...	...	0.010-0.025	...	...	...

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

#### **E. Mechanical and Other Requirements :-**

##### 1. Tensile Properties:

- i. Transverse tension tests taken across the weld joints shall meet the requirements shown in Table 2.

**Table 2**

Alloy	Condition	Tensile Strength, min, psi (MPa)	Yield Strength, 0.2 % offset, min, psi (MPa)	Elongation in 2 in. or 50 mm, or 4D, min, %	Hardness <sup>A</sup>
UNS N08330	Annealed	70 000 (483)	30 000 (207)	30	70 to 90 HRB
UNS N08332	Annealed	67 000 (462)	27 000 (186)	30	65 to 88 HRB
UNS N06603	Annealed	94 000 (650)	43 000 (300)	25	...
UNS N06617	Annealed	95 000 (655)	35 000 (240)	30	...
UNS N06025	Annealed	98 000 (680)	39 000 (270)	30	...
UNS N06045	Annealed	90 000 (620)	35 000 (240)	30	...

<sup>A</sup> Hardness values are informative only and not to be construed as the basis for acceptance.

##### 2. Transverse Guided-Bend Weld Tests:

- i. Two bend test specimens shall be taken transversely from the pipe. One shall be subject to a face guided-bend test and the second to a root guided-bend test.

##### 3. Pressure (Leak) Test—

- i. Any pipe that shows leaks during hydrostatic testing shall be rejected.

##### 4. Grain Size—

- i. Annealed alloy UNS N08332 shall conform to an average grain size of ASTM No. 5 or coarser.

##### 5. Annealing Temperature—

- i. Alloy UNS N08330 shall be annealed at 1900°F (1040°C) minimum.
- ii. Alloy UNS N08332 shall be annealed at 2100°F (1150°C) minimum.
- iii. Alloy UNS N06617 shall be annealed at 2050°F (1121°C) minimum.
- iv. Alloy UNS N06025 shall be annealed at 2100°F (1150°C) minimum.
- v. Alloy UNS N06603 and UNS N06045 shall be annealed at 2120°F (1160°C) minimum.

#### **F. Lengths :-**

1. Circumferentially welded joints of the same quality as the longitudinal joints shall be permitted by agreement between the manufacturer and the purchaser.

#### **G. Test Methods :-**

1. Chemical Composition— In case of disagreement, the chemical composition shall be determined in accordance with Test Methods E 1473.
2. Brinell Hardness —Test Method E 10.
3. Pressure (Leak) Test— Each length of pipe shall be tested based on allowable fiber stress, for material as follows:

UNS N06617—23 300 psi (or 161 MPa)  
UNS N08330—17 500 psi (or 121 MPa)  
UNS N08332—16 600 psi (or 114 MPa)  
UNS N06025—24 500 psi (or 169 MPa)  
UNS N06045—22 500 psi (or 155 MPa)  
UNS N06603—24 000 psi (or 165 MPa)

4. Hardness Conversion— Hardness Conversion Tables E140.

5. Radiographic Examination:

- i. For Class 1 welded-joint quality, all welded joints shall be 100 % inspected by radiography.
- ii. Radiographic examination shall be in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, latest edition, Paragraph UW-51.

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