



Standard Specification for Welded Nickel and Nickel-Cobalt Alloy Tube¹

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1. Scope

1.1 This specification covers welded tubes made from the nickel and nickel-cobalt alloys (UNS N10001, UNS N10242, UNS N10665, UNS N12160, UNS N10629, UNS N10624, UNS N10675, UNS N10276, UNS N06455, UNS N06007, UNS N06975, UNS N08320, UNS N06985, UNS N06002, UNS N06022, UNS N06030, UNS N06058, UNS N06059, UNS N06200, UNS N06210, UNS N08031, UNS R30556, UNS N06230, UNS N06686, and UNS R20033)* listed in Table 1 intended for heat exchanger and condenser tubes and tubes for general corrosive service for heat-resisting applications.

1.2 This specification covers tube $\frac{1}{8}$ to $3\frac{1}{2}$ in. (3.2 to 88.9 mm) in outside diameter and 0.015 to 0.148 in. (0.41 to 3.7 mm) inclusive, in wall thickness.

1.3 Five classes of tube are covered as follows:

1.3.1 *Class IA*—Welded, sized, solution annealed, and non-destructively tested in accordance with 10.5.1.

1.3.2 *Class IB*—Welded, sized, and solution annealed.

1.3.3 *Class IIA*—Welded, cold worked, solution annealed, and nondestructively tested in accordance with 10.5.1.

1.3.4 *Class IIB*—Welded, cold worked, and solution annealed.

1.3.5 *Class III*—Welded, cold worked, solution annealed, and nondestructively tested in accordance with 10.5.2.

1.4 All tubes shall be furnished in the solution annealed and descaled condition. When atmosphere control is used, descaling is not necessary.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

B 880 Specification for General Requirements for Chemical

Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys²

E 8 Test Methods for Tension Testing of Metallic Materials³

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition⁵

E 426 Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys⁶

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys⁷

3. Ordering Information

3.1 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:

3.1.1 *Alloy* (Table 1),

3.1.2 *Class* (see 1.3),

3.1.3 *Quantity* (feet or number of lengths),

3.1.4 *Size* (outside diameter and average wall thickness),

3.1.5 *Length* (cut or random),

3.1.6 *Certification*—State if certification or a report of test results is required (Section 15),

3.1.7 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 13),

3.1.8 *Ends*—Plain ends cut and deburred will be furnished, unless otherwise specified, and

3.1.9 *Samples for Product (Check) Analysis*—State whether samples shall be furnished (see 9.2.2).

4. Materials and Manufacture

4.1 The tubes shall be made from flat-rolled alloy by an automatic welding process with no addition of filler metal.

4.2 Subsequent to welding and prior to final heat treatment, Class II and Class III tubes shall be cold worked either in both

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* New designations established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

² *Annual Book of ASTM Standards*, Vol 02.04.

³ *Annual Book of ASTM Standards*, Vol 03.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vol 03.05.

⁶ *Annual Book of ASTM Standards*, Vol 03.03.

⁷ *Annual Book of ASTM Standards*, Vol 03.06.

TABLE 1 Chemical Requirements

	Composition Limits, %														
	Ni	Cr	Mo	Fe	W	C	Si	Co	Mn	V	P	S	Ti	Cu	Cb (Nb) +Ta
Ni-Mo Alloys															
N10001	remainder ^A	1.0 max	26.0-30.0	4.0-6.0	...	0.05 max	1.0	2.5 max	1.0 max	0.2-0.4	0.04	0.03	...	...	...
N10665	remainder ^A	1.0 max	26.0-30.0	2.0 max	...	0.02 max	0.10	1.0 max	1.0 max	...	0.04	0.03	...	...	...
N10675	65.0 min	1.0-3.0	27.0-32.0	1.0-3.0	3.0 max	0.01 max	0.10	3.0 max	3.0 max	0.20 max	0.030	0.010	0.20 max	0.20 max	0.20 max
N10629	remainder ^A	0.5-1.5	26.0-30.0	1.0-6.0	...	0.01 max	0.05	2.5 max	1.5 max	...	0.04	0.01	...	0.5 max	...
N10624	remainder ^A	6.0-10.0	21.0-25.0	5.0-8.0	...	0.01 max	0.10	1.0 max	1.0 max	...	0.025	0.01	...	0.5 max	...
Ni-Mo-Cr-Fe Alloy															
N10242	remainder ^A	7.0-9.0	24.0-26.0	2.0 max	...	0.03 max	0.80	1.00 max	0.80 max	...	0.030	0.015	...	0.50 max	0.006 max
Low C Ni-Mo-Cr Alloys															
N10276	remainder ^A	14.5-16.5	15.0-17.0	4.0-7.0	3.0-4.5	0.010 max	0.08	2.5 max	1.0 max	0.35 max	0.04	0.03	...	...	...
N06022	remainder ^A	20.0-22.5	12.5-14.5	2.0-6.0	2.5-3.5	0.015 max	0.08	2.5 max	0.5 max	0.35 max	0.02	0.02	...	...	...
N06455	remainder ^A	14.0-18.0	14.0-17.0	3.0 max	...	0.015 max	0.08	2.0 max	1.0 max	...	0.04	0.03	0.70 max	...	...
Ni-Cr-Fe-Mo-Cu Alloys															
N06007	remainder ^A	21.0-23.5	5.5-7.5	18.0-21.0	1.0 max	0.05 max	1.0	2.5 max	1.0-2.0	...	0.04	0.03	...	1.5-2.5	1.75-2.5
N06975	47.0-52.0	23.0-26.0	5.0-7.0	remainder ^A	...	0.03 max	1.0	...	1.0 max	...	0.03	0.03	0.70-1.50	0.70-1.20	...
N06985	remainder ^A	21.0-23.5	6.0-8.0	18.0-21.0	1.5 max	0.015 max	1.0	5.0 max	1.0 max	...	0.04	0.03	...	1.5-2.5	0.50 max
N06030	remainder ^A	28.0-31.5	4.0-6.0	13.0-17.0	1.5-4.0	0.03 max	0.8	5.0 max	1.5 max	...	0.04	0.02	...	1.0-2.4	0.30-1.50
Ni-Fe-Cr-Mo Alloys															
N08320	25.0-27.0	21.0-23.0	4.0-6.0	remainder ^A	...	0.05 max	1.0	...	2.5 max	...	0.04	0.03	4xC min	...	...

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TABLE 1 Chemical Requirements (continued)

Composition Limits, %																									
	Ni	Cr	Mo	Fe	W	C	Si max	Co	Mn	V	P max	S max	Ti	Cu	Cb (Nb) +Ta	Al	Zr	La	N	B	Cb (Nb)	Ta	Ni+ Mo	Mg	
Ni-Cr-Mo-Fe Alloy N06002	remainder ^A	20.5- 23.0	8.0- 10.0	17.0-20.0	0.20- 1.0	0.05- 0.15	1.0	0.5- 2.5	1.0 max	...	0.04	0.03	...	...	...										
Ni-Fe-Cr-Co Alloy R30556	19.0-22.5	21.0- 23.0	2.5- 4.0	remainder ^A	2.0- 3.5	0.05- 0.15	0.20- 0.80	16.0- 21.0	0.50- 2.00	...	0.04	0.015	...	...	...	0.10- 0.50	0.001- 0.10	0.005- 0.10	0.10- 0.30	0.02 max	0.30 max	0.3- 1.25			
Ni-Cr-W-Mo Alloy N06230	remainder ^A	20.0- 24.0	1.0- 3.0	3.0 max	13.0- 15.0	0.05- 0.15	0.25- 0.75	5.0 max	0.30- 1.00	...	0.03	0.015	...	...	...	0.20- 0.50	...	0.005- 0.050	...	0.015 max	...				
Low C-Ni- Cr-Mo Alloy N06058	balance	20.0- 23.0	19.0- 21.0	1.5 max	0.3 max	0.010 max	0.10 max	0.3 max	0.50 max	...	0.015	0.010	...	0.50 max	...	0.40 max	...		0.02- 0.15	...	...				
N06059	balance	22.0- 24.0	15.0- 16.5	1.5 max	...	0.010 max	0.010 max	0.3 max	0.5 max	...	0.015	0.010	...	0.50 max	...	0.1- 0.4	...	...	...	...	...			...	
Low C-Ni- Cr-Mo-Cu Alloy N06200	remainder ^A	22.0- 24.0	15.0- 17.0	3.0 max	...	0.010 max	0.08	2.0 max	0.50 max	...	0.025	0.010	...	1.3- 1.9	...	0.50 max									
Low C-Ni- Fe-Cr- Mo-Cu Alloy N08031	30.0-32.0	26.0- 28.0	6.0- 7.0	balance	...	0.015 max	0.3	...	2.0 max	...	0.020	0.010	...	1.0- 1.4	...	...	...	...	0.15- 0.25	...	...				
Low C-Ni- Cr-Mo-W Alloy N06686	remainder ^A	19.0- 23.0	15.0- 17.0	5.0 max	3.0- 4.4	0.010 max	0.08	...	0.75 max	...	0.04	0.02	0.02- 0.25	...	...	...	...	...	...	...	...				
Ni-Co-Cr-Si Alloy N12160	remainder ^A	26.0- 30.0	1.0 max	3.5 max	1.0 max	0.15 max	2.4- 3.0	27.0- 33.0	1.5 max	...	0.030	0.015	0.20- 0.80	...	...	...	...	...	...	...	1.0 max	...	...	...	
Cr-Ni-Fe-N Alloy R20033	30.0-33.0	31.0- 35.0	0.50- 2.0	balance	...	0.015 max	0.050	...	2.0 max	...	0.02	0.01	...	0.3- 1.20	...	...	...	...	0.35- 0.60	...	...	...	...	...	
Low C-Ni- Mo-Cr-Ta Alloy N06210	remainder ^A	18.0- 20.0	18.0- 20.0	1.0 max	...	0.015 max	0.08	1.0 max	0.5 max	0.35 max	0.02	0.02	...		...		...	...	...	...	...	1.5- 2.2			

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