Designation: B 619 ± 04

Standard Speci®cation for Welded Nickel and Nickel-Cobalt Alloy Pipe[1]

This standard is issued under the ®xed designation B 619; 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 (e) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This speci®cation[2] covers welded pipe of nickel and nickel-cobalt alloys (UNS N10001; UNS N10242; UNS N10665; UNS N12160; UNS N10624; UNS N10629; UNS N10675; UNS N10276; UNS N06455; UNS N06007; UNS N06975; UNS N08320; UNS N06002; UNS N06022; UNS N06035; UNS N06058; UNS N06059; UNS N06200; UNS N06985; UNS N06030; UNS R30556; UNS N08031; UNS N06230; UNS N06686; UNS N06210; and UNS R20033)* as shown in Table 1.

1.2 This speci®cation covers pipe in Schedules 5S, 10S, 40S, and 80S through 8-in. nominal pipe size as set forth in ANSI B36.19 (see Table 2).

1.3 Two classes of pipe are covered as follows:

1.3.1 *Class I*ÐAs welded and solution annealed or welded and sized and solution annealed.

1.3.2 *Class II*ÐWelded, cold worked, and solution annealed.

1.4 All pipe 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.

1.6 *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 identi®ed in the appropriate Material Safety Data Sheet for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [3]

B 775 Speci®cation for General Requirements for Nickel and Nickel Alloy Welded Pipe

2.2 *ANSI Standards:*

B36.19 Stainless Steel Pipe[4]

B2.1 Pipe Threads[4]

3. General Requirement

3.1 Material furnished under this speci®cation shall conform to the applicable requirements of Speci®cation B 775 unless otherwise provided herein.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this speci®cation. Examples of such requirements include, but are not limited to the following:

4.1.1 *Alloy* (Table 1),

4.1.2 *Class* (see 1.3),

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

4.1.4 *Size* (nominal size or outside diameter and schedule number or average wall thickness),

4.1.5 *Length*ÐSpecify cut length or random,

4.1.6 *Certi®cation*Ð State if certi®cation or a report of test results is required,

4.1.7 *Purchaser Inspection*ÐState which tests or inspections are to be witnessed,

4.1.8 *Ends*ÐPlain ends cut and deburred will be furnished, unless otherwise speci®ed, and

4.1.9 *Samples for Product (Check) Analysis*ÐState whether samples shall be furnished.

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[1] This speci®cation is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Re®ned Nickel and Cobalt and Their Alloys.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Speci®cation SB-619 in Section II of that Code.

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

[3] 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.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

***A Summary of Changes section appears at the end of this standard.**

TABLE 1 Chemical Requirements

	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-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	...	0.50 max	0.10 max	...	...	...	0.20 max	0.20 max	94.0-98.0	
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	...	0.1-0.5	...	...	...	...	...	...	...	
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		0.50 max				0.006 max				
Low C Ni-Cr-Mo 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	...	...	...									
N06035	remainder[A]	32.25-34.25	7.60-9.00	2.00 max	0.60 max	0.050 max	0.60	1.00 max	0.50 max	0.20 max	0.030	0.015	...	0.30 max	...	0.40 max								
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	...	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 max	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	...	0.05 max	1.0	...	2.5 max	...	0.04	0.03	4xC min	...	...									
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	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	...	...		

TABLE 1 *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
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	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	0.35 max	0.02	0.02	...		...		...	...	...	...	...	1.5-2.2		

[A] The composition of the remainder shall be determined arithmetically by difference.

5. Materials and Manufacture

5.1 The pipe shall be made from ¯at-rolled alloy by an automatic welding process with no addition of ®ller metal.

5.2 Subsequent to welding and prior to ®nal heat treatment, Class II pipes shall be cold worked either in both weld and base metal or in weld metal only. The method of cold working may be speci®ed by the purchaser.

8. Dimensions and Permissible Variations

8.1 *Wall Thickness*Ð Variations in wall thickness shall not exceed the speci®ed nominal wall thickness by more than 6 12½ %, except as follows:

8.1.1 If weld beads are present on the inner surface of the pipe, they shall not exceed the wall thickness of the pipe by more than 20 % or 0.050 in. (1.27 mm), whichever is less, of the speci®ed nominal wall thickness for Class I pipe, and 5 % or 0.005 in. (0.127 mm), whichever is less, of the speci®ed nominal wall thickness for Class II pipe.

8.1.2 Sunken welds in Class I pipe shall not be deeper than 15 % of the speci®ed nominal wall thickness and never deeper than 0.030 in. (0.79 mm). Class II pipe shall not have sunken welds.

8.2 *Outside Diameter*Ð The permissible variations in outside diameter shall not exceed the limits prescribed in Table 4, except as provided for in 8.1.2.

TABLE 2 Dimensions of Welded Pipe

NOTE 1ÐThe following table is a partial reprint of Table 1 of ANSI B36.19.
NOTE 2ÐThe decimal thickness listed for the respective pipe sizes represents their nominal or average wall dimensions.

Nominal Pipe Size,	Outside Diameter		Nominal Wall Thickness							
			Schedule 5S[A]		Schedule 10S[A]		Schedule 40S		Schedule 80S	
in.	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
⅛	0.405	10.29	...	...	0.049	1.24	0.068	1.73		
¼	0.540	13.72	...	...	0.065	1.65	0.088	2.24		
⅜	0.675	17.15	...	...	0.065	1.65	0.091	2.31		
½	0.840	21.34	0.065	1.65	0.083	2.11	0.109	2.77		
¾	1.050	26.67	0.065	1.65	0.083	2.11	0.113	2.87		
1.0	1.315	33.41	0.065	1.65	0.109	2.77	0.133	3.38		
1¼	1.660	42.16	0.065	1.65	0.109	2.77	0.140	3.56		
1½	1.900	48.26	0.065	1.65	0.109	2.77	0.145	3.68		
2	2.375	60.03	0.065	1.65	0.109	2.77	0.154	3.91	0.218	5.54
2½	2.875	73.03	0.083	2.11	0.120	3.05	0.203	5.16	0.276	7.01
3	3.500	88.90	0.083	2.11	0.120	3.05	0.216	5.33		
3½	4.000	101.60	0.083	2.11	0.120	3.05	0.226	5.74		
4	4.500	114.30	0.083	2.11	0.120	3.05	0.237	6.02		
5	5.563	141.30	0.109	2.77	0.134	3.40	0.258	6.55		
6	6.625	168.28	0.109	2.77	0.134	3.40	0.280	7.11		
8	8.625	219.18	0.109	2.77	0.148	3.76	0.322	8.18		

[A] Schedules 5S and 10S wall thicknesses do not permit threading in accordance with ANSI B2.1-1960.

6. Chemical Composition

6.1 The material shall conform to the composition limits speci®ed in Table 1.

6.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements speci®ed in Table 1 subject to the permissible tolerances in Speci®cation B 775.

7. Mechanical Properties and Other Requirements

7.1 *Tension Test*Ð The tensile properties of the material at room temperature shall conform to those shown in Table 3.

7.1.1 One tension test shall be made on each lot of pipe.

7.2 *Flattening Test*Ð One ¯attening test shall be made on a specimen from one end of one pipe from each lot.

7.3 *Hydrostatic or Nondestructive Electric Test*ÐEach pipe shall be subjected to either the hydrostatic or the nondestructive electric test at the manufacturer's option.

9. Keywords

9.1 UNS N06002; UNS N06007; UNS N06022; UNS N06030; UNS N06035; UNS N06058; UNS N06059; UNS N06200; UNS N06210; UNS N06230; UNS N06455; UNS N06975; UNS N06985; UNS N08031; UNS N08320; UNS N10001; UNS N10242; UNS N10276; UNS N10624; UNS N10629; UNS N10665; UNS N10675; UNS R30556; welded pipe

TABLE 3 Mechanical Properties of Pipe

Alloy	Tensile Strength, min, ksi (MPa)	Yield Strength (0.2 % Offset), min, ksi (MPa)	Elongation in 2 in. (50.8 mm) or 4*D*,[A] min, %
Ni-Mo Alloys			
alloy N10001	100 (690)	45 (310)	40
alloy N10665	110 (760)	51 (350)	40
alloy N10675	110 (760)	51 (350)	40
alloy N10629	110 (760)	51 (350)	40
alloy N10624	104 (720)	46 (320)	40
Ni-Mo-Cr-Fe Alloy			
alloy N10242	105 (725)	45 (310)	40
Low C Ni-Cr-Mo Alloys			
alloy N10276	100 (690)	41 (283)	40
alloy N06022	100 (690)	45 (310)	45
alloy N06035	85 (586)	35 (241)	30
alloy N06455	100 (690)	40 (276)	40
Ni-Cr-Fe-Mo-Cu Alloys			
alloy N06007	90 (621)	35 (241)	35
alloy N06975	85 (586)	32 (221)	40
alloy N06985	90 (621)	35 (241)	45
alloy N06030	85 (586)	35 (241)	30
Ni-Fe-Cr-Mo Alloy (N08320)	75 (517)	28 (193)	35
Ni-Cr-Mo-Fe Alloy (N06002)	100 (690)	40 (276)	35
Ni-Fe-Cr-Co Alloy (R30556)	100 (690)	45 (310)	40
Ni-Cr-W-Mo Alloy (N06230)[B]	110 (760)	45 (310)	40
Low C-Ni-Cr-Mo Alloys			
alloy N06058	110 (760)	52 (360)	40
alloy N06059	100 (690)	45 (310)	45
Low C-Ni-Cr-Mo-Cu Alloy (N06200)	100 (690)	41 (283)	45
Ni-Fe-Cr-Mo-Cu Low Carbon Alloy (N08031)	94 (650)	40 (276)	40
Low C Ni-Cr-Mo-W Alloy (N06686)	100 (690)	45 (310)	45
Ni-Co-Cr-Si alloy (N12160)	90 (620)	35 (240)	40
Cr-Ni-Fe-N Low Carbon Alloy (R20033)	109 (750)	55 (380)	40
Low C Ni-Cr-Mo-Ta Alloy (N06210)	100 (690)	45 (310)	45

[A] *D* refers to the diameter of the tension specimen.

[B] Solution annealed at a temperature between 2200 to 2275°F (1204 to 1246°C) followed by a water quench or rapidly cooled by other means.

TABLE 4 Permissible Variations in Outside Diameter

Nominal Pipe Size, in.	Permissible Variation in Outside Diameter[A]			
	in.		mm	
1¤8	+ 0.002	−0.006	+ 0.05	−0.15
1¤4	+ 0.003	−0.008	+ 0.08	−0.20
3¤8	+ 0.004	−0.008	+ 0.08	−0.20
1¤2	+ 0.004	−0.010	+ 0.10	−0.25
3¤4	+ 0.005	−0.012	+ 0.13	−0.30
1	+ 0.005	−0.012	+ 0.13	−0.30
1 1¤4	+ 0.005	−0.012	+ 0.13	−0.30
1 1¤2	+ 0.008	−0.015	+ 0.20	−0.38
2	+ 0.010	−0.016	+ 0.25	−0.41
2 1¤2	+ 0.010	−0.016	+ 0.25	−0.41
3	+ 0.012	−0.018	+ 0.30	−0.46
3 1¤2	+ 0.012	−0.018	+ 0.30	−0.46
4	+ 0.014	−0.020	+ 0.36	−0.51
5	+ 0.063	0.031	+ 1.60	−0.79
6	+ 0.063	0.031	+ 1.60	−0.79
8	+ 0.063	0.031	+ 1.60	−0.79

[A] The permissible variations in the above table apply to individual measurements, including out of roundness (ovality).