IN PRAISE OF QUALIY

تیوب های حرارتی

فولادهای ضد زنگ برای تیوب های حرارتی

		ASTM (USA)	UNS (USA)	B.S. (UK)	EN / DIN (Germany)	AFNOR NF (France)	UNI (Italy)	SS (Sweden)	JIS (Japan)	GB/PR (China)	KS (Korea)
General service and wet corrosion	Austenitic	304	S30400	304S31 / 304S15	1.4301	Z7 CN 18-09/ Z6 CN 18-09	X5CrNi18 10	2333	SUS 304	0Cr18Ni9	STS 304
		304L	S30403	304S11	1.4306	Z2 CN 18-10	X2CrNi18 11	2352	SUS 304L	00Cr19Ni10	STS 304L
					1.4307	Z3 CN 18-10					
		304LN	S30453	304S61	1.4311	Z3 CN 18-10 Az		2371	SUS 304LN	00Cr18Ni 10N	STS 304LN
		316	S31600	316S31	1.4401	Z7 CND 17-11-02	X5CrNiMo 17 12	2347	SUS 316	0Cr17Ni 12Mo2	STS 316
				316S33/ 316S31	1.4436	Z7 CND 18-12-03	X5CrNiMo 17 13	2343			
		316L	S31603	316S11/ 316S14	1.4404	Z3 CND 17-11-02 / Z3 CND 18-12-02	X5CrNiMo 17 12	2348	SUS 316L	00Cr17Ni 14Mo2	STS 316L
				316S13/ 316S11	1.4435	Z3 CND 18-14-03	X2CrNiMo 17 13	2353			
		316N	S31651	–	–	–		–	–	–	–
		316LN	S31653	316S61	1.4406	Z3 CND 17-11 Az		–	SUS 316LN	00Cr17Ni 12Mo2N	STS 316LN
		316Ti	S31635	320S31	1.4571	Z6 CNDT 17-12- 02	X6CrNiMo Ti17 13	2350	SUS 316Ti	0Cr18Ni12 Mo2Ti	STS 316Ti
		316H	S31609	316S52	1.4401/ 1.4919	Z6 CND 17-12- 02	X8CrNiMo 17 12	–	–	–	–
		321	S32100	321S31	1.4541	Z6 CNT 18-10	X6CrNiTi18 11	2337	SUS 321	1Cr18Ni9Ti	STS 321
		317	S31700	317S16	1.4449	–		–	SUS 317		
		317L	S31703	317S12	1.4438	Z3 CND 19-15-04		2367	SUS 317L	00Cr19Ni13 Mo3	STS 317L
		347	S34700	347S31	1.4550	Z6 CNNb 18-10	X6CrNiNb 18 11	2338	SUS 347	0Cr18Ni11 Nb	STS 347
		904L	N08904	904S13	1.4539	Z2 NCDU 25-20		2562	–	–	STS 317J5L
	Duplex	–	S31803	–	1.4462	Z2 CND 22-05 Az		2377	–	–	–
		–	S32205	318S13	1.4462	Z3 CND 22-05 Az		2377	SUS 329J3L	00Cr22 Ni5Mo3N	STS 329J3L
	Ferritic	405	S40500	405S17	1.4002	Z6 C Al 13		–	SUS 405		
		410	S41000	410S21	1.4006	Z12C13	X12Cr13	2302	SUS 410	1Cr12	STS 410
		430	S43000	430S17	1.4016	Z8 C17	X8Cr17	2320	SUS 430	1Cr17	STS 430
		430Ti	–	–	1.4510	Z8 CT17		–	SUS 430LX	–	–
	SuperDuplex	–	S32750	–	1.4410	–		–	–	–	–
		–	S32760	–	–	–		–	–	–	–
Heat resistant	Austenitic	304H	S30409	304S51	1.4948	Z6 CN 18-09	X8CrNi 18 10	2333	SUS 304	1Cr18Ni9	STS 304
		321H	S32109	321S51	1.4878	Z6 CNT 18-10	X8CrNiTi 18 11	2337	SUS 321		
		347H	S34709	347S51	–	–	X8CrNiNb 18 11	2347	–	–	–
		310S	S31008	310S16/ 310S24	1.4845	Z8 CN 25-20/ Z12 CN 25-20	X6CrNi 25 20	2361	SUS 310S	0Cr25Ni20	STS 310S
		310H	S31009	–	–	–		–	–	–	–
		314	S31400	–	1.4841	Z15 CNS 25-20	–	–	–	–	–

ترکیب شیمیایی انواع تیوب های حرارتی از جنس فولاد ضد زنگ

Steel grade	Tube standard	Chemical composition, %.				
		C	Mn	P	S	Si
Austenitic stainless steels						
TP 304	A269, A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 304L	A269, A213, A312	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00
TP 304H	A213, A312	0.04-0.10	≤2.00	≤0.045	≤0.030	≤1.00
TP 304N	A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 304LN	A269, A213, A312	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00
TP 310S	A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 310H	A213, A312	0.04-0.10	≤2.00	≤0.045	≤0.030	≤1.00
TP 316	A269, A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 316L	A269, A213, A312	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00
TP 316H	A213, A312	0.04-0.10	≤2.00	≤0.045	≤0.030	≤1.00
TP 316Ti	A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤0.75
TP 316N	A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 316LN	A269, A213, A312	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00
TP 317	A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 317L	A213, A312	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00
TP 321	A269, A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 321H	A213, A312	0.04-0.10	≤2.00	≤0.045	≤0.030	≤1.00
TP 347	A269, A213, A312	≤0.08	≤2.00	≤0.045	≤0.030	≤1.00
TP 347H	A213, A312	0.04-0.10	≤2.00	≤0.045	≤0.030	≤1.00
TP 347HFG	A213	0.06-0.10	≤2.00	≤0.045	≤0.030	≤1.00
N08904	A269, A312	≤0.02	≤2.00	≤0.040	≤0.030	≤1.00
1.4301	EN 10216-5	≤0.07	≤2.00	≤0.040	≤0.030	≤1.00
1.4306	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.030	≤1.00
1.4307	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.030	≤1.00
1.4311	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.030	≤1.00
1.4401	EN 10216-5	≤0.07	≤2.00	≤0.040	≤0.030	≤1.00
1.4404	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.030	≤1.00
1.4435	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.030	≤1.00
1.4429	EN 10216-5	≤0.03	≤2.00	≤0.040	≤0.015	≤1.00
1.4436	EN 10216-5	≤0.05	≤2.00	≤0.040	≤0.030	≤1.00
1,4541	EN 10216-5	≤0.08	≤2.00	≤0.040	≤0.015	≤1.00
1.4571	EN 10216-5	≤0.08	≤2.00	≤0.040	≤0.030	≤1.00
1.4828	SEW 470	≤0.20	≤2.00	≤0.045	≤0.030	1.5-2.5
1.4845	SEW 470	≤0.15	≤2.00	≤0.045	≤0.030	≤0.75
1.4878	SEW 470	≤0.12	≤2.00	≤0.045	≤0.030	≤1.00
TU Z 6 CN 18 9	NF A 49-117, NF A 49-217	≤0.09	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 2 CN 18 10	NF A 49-117, NF A 49-217	≤0.03	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 12 CN 25 20	NF A 49-117	≤0.16	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 6 CNT 18 10	NF A 49-117	≤0.09	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 6 CNDT 17 12	NF A 49-117	≤0.09	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 6 CNT 18 10	NF A 49-217	≤0.09	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 2 CND 17 12	NF A 49-117, NF A 49-217	≤0.03	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 6 CND 17 11	NF A 49-117, NF A 49-217	≤0.08	≤2.04	≤0.045	≤0.035	≤1.05
TU Z 2 CND 18 14	NF A 49-217	≤0.03	≤2.04	≤0.025	≤0.020	≤1.05
Ferritic stainless steels						
TP 405	A268	≤0.08	≤1.00	≤0.040	≤0.030	≤1.00
TP 410	A268	≤0.15	≤1.00	≤0.040	≤0.030	≤1.00
TP 430	A268	≤0.12	≤1.00	≤0.040	≤0.030	≤1.00
TP 430Ti	A268	≤0.10	≤1.00	≤0.040	≤0.030	≤1.00
1.4002	DIN EN 10297-2	≤0.08	≤1.00	≤0.040	≤0.030	≤1.00
1.4006	DIN EN 10297-2	0.08-0.15	≤1.50	≤0.040	≤0.030	≤1.00
1.4016	DIN EN 10297-2	≤0.08	≤1.00	≤0.040	≤0.030	≤1.00
1.4510	DIN EN 10297-2	≤0.05	≤1.00	≤0.040	≤0.030	≤1.00
TU Z 12 C 13	NF A 49-217	≤0.16	≤1.05	≤0.045	≤0.035	≤1.05
TU Z 10 C 17	NF A 49-217	≤0.13	≤1.05	≤0.045	≤0.035	≤1.05
Duplex stainless steels						
S31803	A789	≤0.03	≤2.00	≤0.030	≤0.020	≤1.00
S32205	A789	≤0.03	≤2.00	≤0.030	≤0.020	≤1.00
1.4462	EN 10216-5	≤0.03	≤2.00	≤0.035	≤0.015	≤1.00
TU Z 2 CND 22 05 03	NF A 49-217	≤0.03	≤2.04	≤0.035	≤0.025	≤1.05
Super duplex stainless steels						
S32750	A789	≤0.03	≤1.20	≤0.035	≤0.020	≤0.80
S32760	A789	≤0.05	≤1.00	≤0.030	≤0.010	≤1.00

ترکیب شیمیایی تیوب های حرارتی از جنس فولاد ضد زنگ

Chemical composition, %.						
Cr	Ni	Mo	N	Nb	Ti	Others
Austenitic stainless steels						
18.0-20.0	8.0-11.0	-	-	-	-	-
18.0-20.0	8.0-12.0	-	-	-	-	-
18.0-20.0	8.0-11.0	-	-	-	-	-
18.0-20.0	8.0-11.0	-	0.10-0.16	-	-	-
18.0-20.0	8.0-11.0	-	0.10-0.16	-	-	-
24.0-26.0	19.0-22.0	-	-	-	-	-
24.0-26.0	19.0-22.0	-	-	-	-	-
16.0-18.0	11.0-14.0	2.00-3.00	-	-	-	-
16.0-18.0	10.0-14.0	2.00-3.00	-	-	-	-
16.0-18.0	11.0-14.0	2.00-3.00	-	-	-	-
16.0-18.0	10.0-14.0	2.00-3.00	≤0.10	-	5*(C+N)-0.70	-
16.0-18.0	10.0-13.0	2.00-3.00	0.10-0.16	-	-	-
16.0-18.0	10.0-13.0	2.00-3.00	0.10-0.16	-	-	-
18.0-20.0	11.0-14.0	3.00-4.00	-	-	-	-
18.0-20.0	11.0-15.0	3.00-4.00	-	-	-	-
17.0-19,0	9.0-12.0	-	-	-	5*C-0.70	-
17.0-19.0	9.0-12.0	-	-	-	4*C-0.60	-
17.0-19.0	9.0-13.0	-	-	10*C-1.00	-	-
17.0-19.0	9.0-13.0	-	-	8*C-1.00	-	-
17.0-19.0	9.0-13.0	-	-	8*C-1.10	-	-
19.0-23.0	23.0-28.0	4.0-5.0	≤0.10	-	-	Cu 1.00-2.00
17.0-19.5	8.0-10.5	-	≤0.11	-	-	-
18.0-20.0	10.0-12.0	-	≤0.11	-	-	-
17.5-19.5	8.0-10.0	-	≤0.11	-	-	-
17.0-19.5	8.5-11.5	-	0.12-0.22	-	-	-
16.5-18.5	10.0-13.0	2.0-2.5	≤0.11	-	-	-
16.5-18.5	10.0-13.0	2.0-2.5	≤0.11	-	-	-
17.0-19.0	12.5-15.0	2.5-3.0	-	-	-	-
16.5-18.5	11.0-14.0	2.5-3.0	0.12-0.22	-	-	-
16.5-18.5	10.5-13.0	2.5-3.0	-	-	-	-
17.0-19.0	9.0-12.0	-	-	-	5*C-0.70	-
16.5-18.5	10.5-13.5	2.0-2.5	-	-	5*C-0.70	-
19.0-21.0	11.0-13.0	-	-	-	-	-
24.0-26.0	19.0-22.0	-	-	-	-	-
17.0-19.0	9.0-12.0	-	-	-	4*C-0.80	1.4878
17.0-20.2	8.00-11.10	-	-	-	-	-
17.0-20.2	9.00-12.15	-	-	-	-	-
24.0-26.2	19.00-22.15	-	-	-	-	-
17.0-20.2	9.00-12.15	-	-	-	5*C-0.65	-
16.0-18.2	10.50-13.15	1.9-2.5	-	-	5*C-0.65	-
17.0-20.2	9.00-12.15	-	-	-	5*C-0.65	-
16.0-18.2	10.50-13.15	2.0-2.5	-	-	-	-
16.0-18.2	10.00-12.65	2.0-2.5	-	-	-	-
17.0-18.7	13.00-16.15	2.2-3.1	-	-	-	-
Ferritic stainless steels						
11.5-14.5	≤0.50	-	-	-	-	Al 0.10-0.30
11.5-13.5	-	-	-	-	-	-
16.0-18.0	-	-	-	-	-	-
16.00-19.50	0.75	-	-	-	5*C-0.75	-
12.0-14.0	-	-	-	-		Al 0.10-0.30
11.5-13.5	≤0.75	-	-	-		-
16.0-18.0	-	-	-	-		Al 0.10-0.30
16.0-18.0	-	-	-	-	(4(C+N)+0.15) - 0,80	-
11.5-13.7	≤0.55	-	-	-	-	-
16.0-18.2	≤0.55	-	-	-	-	-
Duplex stainless steels						
21.0-23.0	4.5-6.5	2.5-3.5	0.08-0.20	-	-	-
22.0-23.0	4.5-6.5	3.0-3.5	0.14-0.20	-	-	-
21.0-23.0	4.5-6.5	2.5-3.5	0.10-0.22	-	-	-
21.0-23.2	4.50-6.65	2.5-3.6	0.07-0.21	-	-	-
Super duplex stainless steels						
24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	-	-	Cu ≤0.50
24.0-26.0	6.0-8.0	3.0-4.0	0.20-0.30	-	-	W 0.50-1.00

ابعاد تیوب های حرارتی

NPS	Outside diameter, mm	Nominal wall thickness, mm							
		Sch. 5S (1)	Sch. 10S (1)	Sch. 30	Sch. 40S/STD	Sch. 80S/XS	Sch. 120	Sch. 160	Sch. XXS
⅛	10.29		1.24	1.45	1.73	2.41			
¼	13.72		1.65	1.85	2.24	3.02			
⅜	17.15		1.65	1.85	2.31	3.20			
½	21.34	1.65	2.11	2.41	2.77	3.73		4.78	
¾	26.67	1.65	2.11	2.41	2.87	3.91		5.56	7.82
1	33.40	1.65	2.77	2.90	3.38	4.55		6.35	9.09
1 ¼	42.16	1.65	2.77	2.97	3.56	4.85		6.35	9.70
1 ½	48.26	1.65	2.77	3.18	3.68	5.08		7.14	10.15
2	60.33	1.65	2.77	3.18	3.91	5.54		8.74	11.07
2 ½	73.03	2.11	3.05	4.78	5.16	7.01		9.53	14.02
3	88.90	2.11	3.05	4.78	5.49	7.62		11.13	15.24
3 ½	101.60		3.05	4.78	5.47	8.08		12.70	16.15
4	114.30		3.05	4.78	6.02	8.56	11.13	13.49	17.12
5	141.30				6.55	9.53	12.70	15.88	19.05
6	168.28				7.11	10.97	14.27	18.26	21.95
8	219.08				8.18	12.70	18.26	23.01	22.23

رواداری و حد پذیرش در ابعاد تیوب های حرارتی

ASTM A213/A 213M ASME SA 213/SA 213M (ASTM A450, ASTM A1016)

Outside diameter, mm	Wall thickness, mm	Tolerance limits of		
		outside diameter	wall thickness MW	wall thickness AW
<25.4	0.4-4.5	+0.10 mm, -0.10 mm	+20%, 0%	±10%
25.40-38.10	1.0-6.0	+0.15 mm, -0.15 mm	+20%, 0%	±10%
38.20-50.80	1.2-7.0	+0.20 mm, -0.20 mm	+22%, 0%	±11%
50.90-63.50	1.8-8.0	+0.25 mm, -0.25 mm	+22%, 0%	±11%
63.60-76.20	2.0-8.5	+0.30 mm, -0.30 mm	+22%, 0%	±11%
76.30-101.60	3.0-8.5	+0.38 mm, -0.38 mm	+22%, 0%	±11%

ASTM A269/A 269M

Outside diameter, inch (mm)	Outside diameter tolerance, inch (mm)	Admissible wall thickness tolerance, %	Length tolerance, inch (mm)		Thin wall tubes
			more	less	
up to ½ (D<12.7)	±0.005 (±0.13)	±15	⅛ (3.2)	0	–
½ - 1 ½ excl. (12.7≤D<38.1)	±0.005 (±0.13)	±10	⅛ (3.2)	0	under 0.065" (1.65 mm) nominal
1½ - 3 ½ excl. (38.1≤D<88.9)	±0.010 (±0.25)	±10	3⁄16 (4.8)	0	under 0.095" (2.41 mm) nominal
3½ - 5 ½ excl. (88.9≤D<139.7)	±0.015 (±0.38)	±10	3⁄16 (4.8)	0	under 0.150" (3.81 mm) nominal
5½ - 8 excl. (139.7≤D<203.2)	±0.015 (±0.38)	±10	3⁄16 (4.8)	0	under 0.150" (3.81 mm) nominal

IN PRAISE OF QUALIY

ISO 9001 ISO 14001 ISO 45001 ISO 29001 ISO 9001 ISO 14001 ISO 45001 ISO 29001 ISO 9001 ISO 14