

DIN 17455-85 GENERAL PURPOSE WELDED CIRCULAR STAINLESS STEEL TUBES

The subclauses marked with a single dot give specifications which are to be agreed upon at the time of ordering.

The subclauses marked with a two dots give specifications which optional and may be agreed upon at the time of ordering.

1. Field of application

1.1 This standard applies to general purpose welded circular tubes and pipes (hereinafter briefly referred to as tubes) made from the stainless steels listed in table 1. They are used for domestic installation a for decorative purposes.

Tubes conforming to requirements o this standard are intended to be used on the basic of an 80% utilization of the permissible design stress in weld.

1.2 This standard does not apply to general purpose welded circular austenitic stainless steel tubes subject to special requirements (see DIN 17457).

Grade	Mfg. Process	Chemical Composition (%)								
		C	Si	Mn	P	S	Ni	Cr	Mo	Others
X6CrTi12	W	0.08Max	-	-	-	-	-	10.5~12.5	-	Ti: 6×%C 1.00Max
X6Cr17	W	0.08Max	-	-	-	-	-	15.5~17.5	-	-
X6CrTi17	W	0.08Max	-	-	-	-	-	16.0~18.0	-	Ti: 7×%C 1.00Max
X5CrNi1810	W	0.07Max	-	-	-	-	-	17.0~19.0	-	-
X2CrNi1911	W	0.03Max	-	-	-	-	-	18.0~20.0	-	-
X2CrNiN1810	W	0.03Max	-	-	-	-	8.5~10.5	17.0~19.0	-	N: 0.12~0.22
X6CrNiTi1810	W	0.08Max	-	-	-	-	9.0~12.0	17.0~19.0	-	Ti: 5×%C 0.80Max
X5CrNiN61810	W	0.08Max	-	-	-	-	9.0~12.0	17.0~19.0	-	Nb: 10×%C 1.00Max
X5CrNiMo17122	W	0.07Max	-	-	-	-	10.5~13.5	16.5~18.5	2.0~2.5	-
X2CrNiMo17132	W	0.030Max	-	-	-	-	11.0~14.0	16.5~18.5	2.0~2.5	-
X2CrNiMoTi17122	W	0.08Max	-	-	-	-	10.5~13.5	16.5~18.5	2.0~2.5	Ti: 5×%C 0.80Max
X6CrNiMoN17133	W	0.030Max	-	-	-	0.025Max	11.5~15.0	16.5~18.5	2.5~3.0	N: 0.14~0.22
X2CrNiMo18143	W	0.030Max	-	-	-	0.025Max	12.5~15.5	17.0~18.5	2.5~3.0	-
X5CrNiMo17133	W	0.07Max	-	-	-	0.025Max	11.0~14.0	17.0~18.5	2.5~3.0	-
X2CrNiMoN17135	W	0.030Max	-	-	-	0.025Max	12.5~14.5	16.5~18.5	4.0~5.0	N : 0.12~0.22

Grade	Material Number	Tensile Test MPa or N/mm ²		Remarks (Similar to JIS)
		Min Yield point	Tensile Strength	
X6CrTi12	1.4512	190	390-560	-
X6Cr17	1.4018	270	450-600	-
X6CrTi17	1.4510	270	430-600	-
X5CrNi1810	1.4301	195	500-720	-
X2CrNi1911	1.4306	180	460-680	-
X2CrNiN1810	1.4311	270	550-760	-
X6CrNiTi1810	1.4541	200	500-730	-
X5CrNiN61810	1.4550	205	510-740	-
X5CrNiMo17122	1.4401	205	510-710	SUS316TB
X2CrNiMo17132	1.4404	190	490-690	SUS316THB
X2CrNiMoTi17122	1.4571	210	500-730	SUS321TB
X6CrNiMoN17133	1.4429	295	580-800	-
X2CrNiMo18143	1.4435	190	490-690	-
X5CrNiMo17133	1.4436	205	510-710	-
X2CrNiMoN17135	1.4439	285	580-800	-

When sequential castings are supplied as is possible in the case of continuously cast tubes, the term "cast" should be read as "casting unit".

Steel grade		% by mass				
Symbol 2)	Material number	C	Cr	Mo	Ni	Others 3
Ferritic steels						
x6CrTi 12	1.4512	0.08	10.5 to 12.5	-	-	Ti: 6x%C, up to 1.00
x6Cr 17	1.4016	0.08	15.5 to 17.5	-	-	-
x6CrTi 17	1.4510	0.08	16.0 to 18.0	-	-	Ti: 7 x %C, up to 1.20
Austenitic steels						

x5CrNi 1810	1.4301	0.07	17.0 to 19.0	-	8.5 to 10.5	-
x2CrNi 1911	1.4306	0.030	18.0 to 20.0	-	10.0 to 12.5	-
x2CrNi 1810	1.4311	0.030	17.0 to 19.0	-	8.5 to 11.5	N: 0.12 to 0.22
x6CrNiTi 1810	1.4541	0.08	17.0 to 19.0	-	9.0 to 12.0	Ti: 5x %C, up to 0.80
x6CrNiNb 1810	1.4550	0.08	17.0 to 19.0	-	9.0 to 12.0	Nb: 10 x %C, up to 1.00 4)
x5CrNiMo 17 122	1.4401	0.07	16.5 to 18.5	2.5 to 2.5	10.5 to 13.5	-
x2CrNiMo 17 132	1.4404	0.030	16.5 to 18.5	2.5 to 2.5	11.0 to 14.0	-
x6CrNiMoTi 17 122	1.4571	0.08	16.5 to 18.5	2.5 to 2.5	10.5 to 13.5	Ti: 5 x %C, up to 0.80
x2CrNiMoN 17 33	1.4429	0.030	16.5 to 18.5	2.5 to 3.0	11.5 to 14.5	N: 0.14 to 0.22; S ≤ 0.025
x2CrNiMo 18 143	1.4435	0.030	17.0 to 18.5	2.5 to 3.0	12.5 to 15.0	S ≤ 0.025
x5CrNiMo 17 133	1.4438	0.07	16.5 to 18.5	2.5 to 3.0	11.0 to 14.0	S ≤ 0.025
x2CrNiMoN 17 135	1.4439	0.030	16.5 to 18.5	4.0 to 5.0	12.5 to 14.5	N: 0.12 to 0.22; S ≤ 0.025

1) Elements not quoted in this table In respect of the Individual steel grades shall not be added deliberately to the steel without the purchaser's consent, except for the purpose of finishing the melt. Such elements shall in no way impair the usability or processability of the steel, e.g. its weldability, nor shall they affect the properties specified in this standard.

2) The symbols given in the December 1972 edition of DIN 17 440 may continue to be used during the period of validity of this standard (see table in the Explanatory notes).

3) Unless otherwise specified, P ≤ 0.045%, S ≤ 0.030%, Si ≤ 1.0%, for austenitic steels, Mn ≤ 2.0%, and for ferritic steels, Mn ≤ 1.0%.

4) Tantalum determined together with niobium and expressed in the form of niobium content.

Table2 Amounts by which the chemical composition in the product analysis may deviate from the limit values specified for the cast analysis

Element	Limit values specified for the cast analysis as in table 1 % by mass	Permissible deviations 1) % by mass
Carbon (C)	≤ 0.030 > 0.030 ≤ 0.12	+ 0.005 ± 0.01
Silicon (Si)	≤ 1.0	+ .05
Manganese (Mn)	≤ .0 > 1.0 ≤ 2.0	+ 0.03 + 0.04

Phosphorus (P)	≤0.045	+0.005
Sulfur (S)	≤0.030	+0.005
Nitrogen (N)	≤0.22	±0.01
Chromium (Cr)	≥10.5 < 15.0	±0.15
	≥15.0 ≤ 20.0	±0.20
Molybdenum (Mo)	≥2.0 ≤ 5.0	±0.10
Nickel (Ni)	≥ 8.5 < 10.0	±0.10
	≥ 10.0 ≤ 15.0	±0.15
Niobium (Nb)	≤ 1.00	±0.05
Titanium (Ti)	≤ 1.20	±0.05
1) If several product analyses are carried out for a single cast and if these elements show contents for a single element outside the range specified for the cast analysis, this content shall either exceed the permissible maximum content or be below the permissible minimum content, but not both at the same time for one cast.		

Table3 Mechanical properties of the steels at ambient temperature in the as delivered condition specified in table 5(with the exception of condition 10) and their resistance to intercrystalline corrosion (applicable to wall thicknesses up to 50mm in the case of austenitic steel tubes and up to 5mm in the case of ferritic steel tubes *)

Steel grade		Heat treatment condition 2)	Maximum HB or HV hardness 3)	Minimum yield stress or 0.2% proof stress N/m²	Minimum 1% proof stress N/m²	Tensile strength 2) N/m²	Minimum elongation after fracture 2) (Lo=5do) %		Resistance to intercrystalline corrosion 4)	
Symbol	Material						Longitudinal	Transverse	in the as delivered condition	after further processing by welding without heat treatment
Ferritic steels										
X6 CrTi 12	1.4512	Annealed	175	190	-	390 to 560	20	18	n.g.	n.g.
X6 Cr 17	1.4016		185	270	-	450 to 600	20	18	g. 5)	n.g.
X6 CrTi 17	1.4510		185	270	-	430 to 600	20	18	g.	g.

Austenitic steels										
X5 CrNi 1810	1.4301	Solution annealed and quenched		195	230	500 to 720	40	35	g. 6)	g. 8)
X2 CrNi 1911	1.4306		180	215	460 to 680	40	35	g.	g.	
X6 CrNiNi 1810	1.4311		270	305	550 to 760	35	30	g.	g.	
X6CrNiTi 1810	1.4541		200	235	500 to 730	35	30	g.	g.	
X6CrNiNb 1810	1.4550		205	240	510 to 740	35	30	g.	g.	
X5 CrNiMo 17 122		Solution annealed and quenched							g. 6)	g. 6)
X2 CrNiMo 17 132	1.4401		205	240	510 to 710	40	35	g.	g.	
X6 CrNiMoTi 17 1227)	1.4404		190	225	490 to 690	40	35	g.	g.	
X6CrNiMoTi 17 122 7)	1.4571		210	245	500 to 730	35	30	g.	g.	
X6CrNiMoNb 17 122 8)									g.	g.
X2CrNiMoN 17 133	1.4429	Solution annealed and quenched		295	330	580 to 800	35	30	g.	g.
X2CrNiMo 18 143	1.4435		190	225	490 to 690	40	35	g.	g.	
X5CrNiMo 17 133	1.4436		205	240	510 to 710	40	35	g. 6)	g. 6)	
X2CrNiMoN 17 135	1.4439	Solution annealed and quenched		285	315	580 to 800	35	30	g.	g.

- 1) For greater wall thicknesses, the values shall be specified by agreement.
- 2) The values specified do not apply for condition f described in table 6. For this condition, they shall be agreed at the time of ordering, if required.
- 3) Average value from three test pieces at ambient temperature. Only one individual value of the test unit may be less than this value by a maximum of 30%.
- 4) When tested in accordance with DIN 50 914, G. means existing up to the limit temperatures listed in the last column of table 4.
- 5) Only for wall thicknesses not exceeding 6 mm.
- 6) Not to be used for tubes manufactured by hot working or subjected to further processing.
- 7) To be used for tubes manufactured by hot working or subjected to further processing.

Table4 Minimum values of elevated temperature 0.2% and 1% proof stresses and guideline values for the limit temperature in the case of intercrystalline corrosive stress

Steel grade		Heat treatment condition	0.2% proof stress at a temperature, in °C, of											1% proof stress at a temperature, in °C, of											Limit temperature 1) °C
Symbol	Material number		50	100	150	200	250	300	350	400	450	500	550	50	100	150	200	250	300	350	400	450	500	550	
			N/mm ²											N/mm ²											
X5 CrNi 1810	1.4301	Solution annealed and quenched	177	157	142	127	118	110	104	98	95	92	90	211	191	172	157	145	135	129	125	122	120	120	300 2)
X2 CrNi 1911	1.4306		162	147	132	118	108	100	94	89	85	81	80	201	181	162	147	137	127	121	116	112	109	108	350
X2 CrNiN 1810	1.4311		245	205	175	157	145	136	130	125	121	119	118	280	240	210	187	175	167	161	156	152	149	147	400
X6 CrNiTi 1810	1.4541		190	176	167	157	147	136	130	125	121	119	118	222	208	195	185	175	167	161	156	152	149	147	400
X6 CrNiNb 1810	1.4550		191	177	167	157	147	136	130	125	121	119	118	226	211	196	186	177	167	161	156	152	149	147	400
X5 CrNiMo 17 122	1.4401	Solution annealed and quenched	196	177	162	147	137	127	120	115	112	110	108	230	211	191	177	167	156	150	144	141	139	137	300 2)
X2 CrNiMo 17 132	1.4404		182	166	152	137	127	118	113	108	103	100	98	217	199	181	167	157	145	139	135	130	128	127	400
X6 CrNiMoTi 17 122	1.4571		202	185	177	167	157	145	140	135	131	129	127	234	218	206	196	186	175	169	164	160	158	157	400
X2CrNiMoN 17 133	1.4429	Solution annealed and quenched	265	225	197	178	165	155	150	145	140	138	136	300	260	227	208	195	185	180	175	170	168	166	400
X2CrNiMo 18 143	1.4435		182	166	152	137	127	118	113	108	103	100	98	217	199	181	167	157	145	139	135	130	128	127	400
X5CrNiMo 17 133	1.4436		196	177	162	147	137	127	120	115	112	110	108	230	211	191	177	167	156	150	144	141	139	137	300 2)
X2CrNiMoN 17 135	1.4439	Solution annealed and quenched	260	225	200	185	175	165	155	150	-	-	-	290	255	230	210	200	190	180	175	-	-	-	400

1) Up to these temperatures, the material will, within 100000 hours, not have changed so as to show susceptibility to intercrystalline corrosion.
 2) Only for wall thicknesses not exceeding 6 mm.

Table5 Guideline data for the heat treatment during fabrication and further processing of tubes and guideline data for hot working as part of further processing

Steel grade		Heat treatment during fabrication and further processing of tubes				Hot working during further processing	
Symbol	Material Number	Recrystallization or solution annealing temperature			Type of cooling	Temperature	
		°C				°C	

Ferritic steels					
x6CrTi 12	1.4512	750 to 850	Air, water	1100 to 800	Air
x6Cr 17	1.4016				
x6CrTi 17	1.4510				
Austenitic steels					
X5CrNi 1810	1.4301	1000 to 1080 1)	Quenching in water, air 2)	1150 to 750	Air
X2CrNi 1911	1.4306				
x2CrNi 1810	1.4311				
x6CrNiTi 1810	1.4541	1020 to 1100 1)			
x6CrNiNb 1810	1.4550				
x5CrNiMo 17 122	1.4401				
x2CrNiMo 17132	1.4404				
x6CrNiMoTi 17 122	1.4571				
x2CrNiMoN 17 133	1.4429	1040 to 1120 1)			
x2CrNiMo 16 143	1.4435	1020 to 1100 1)			
x5CrNiMo 17 133	1.4436				
x2CrNiMoN 17 135	1.4439	1040 to 1120 1)			
1) When heat treatment forms part of further processing of the product, an attempt shall be made to achieve the lower values of the range specified for solution annealing. If hot working has been carried out at a temperature of at least 850°C or if the product has been cold worked, the temperature of renewed solution annealing may be 20 K less than the lower limit for solution annealing. 2) If the cooling is sufficiently rapid.					

5.8. Type of condition, appearance of surface and weld

5.8.1. The tubes shall be supplied in one of the conditions listed in table 6.

The selection of condition is left to the manufacturer's discretion.

Table 6. Types of condition of tubes

Symbol	Type of condition	Surface finish 1)
d0 2)	Tubes welded from surface finish c1 *) or c2 *) plate, sheet or strip, not pickled	Metallic clean.
d1 2)	Tubes welded from surface c1*) or c2 *) plate, sheet or strip, pickled	Metallically bright.

d2 2)	Tubes welded from surface finish c1 *) or c2 *) plate, sheet or strip, heat treated, pickled	
d3 2)	Tubes welded from surface finish c1) or c2 *) plate, sheet or strip, bright heat treated.	
k0 2)	Tubes welded from surface finish h *) . m *) or n*) plate, sheet or strip not pickled	Metallically clean, except that the weld is substantially smoother than for type d0.
k1 2)	Tubes welded from surface finish h*), m*) or n*) plate, sheet or strip, pickled	
k2 2)	Tubes welded from surface finish h*), m*) or n*) plate, sheet or strip, heat treated, pickled.	Metallically bright, except that the weld is substantially smoother than for types d1 to d3
k3 2)	Tubes welded from surface finish h*), m*), or n*) plate, if appropriate	
l0 3)	Tubes welded from surface finish h*), m*) or n*) plate, sheet or strip, heat treated, pickled or bright heat treated, if appropriate, cold worked	
l1	Tubes welded from surface finish c1*), c2*), h*), m*) or n*) plate, sheet or strip, heat treated if appropriate, at least 20% cold worked, heat treated, with re-crystallized weld metal, pickled	Metallically bright, weld almost indistinguishable.
l2	Tubes welded from surface finish c1*), c2*), h*), m*) or n*) plate, sheet or strip, heat treated if appropriate, at least 20% cold worked, bright heat treated, with re-crystallized weld metal	
o	Ground 4)	Ground metallically bright, type and degree of grinding shall be agreed at the time of ordering 5)
p	Polished 4)	Polished metallically bright, type and quality of polishing shall be agreed at the time of ordering 5)
<p>*) See DIN 17 440 or DIN 17 441.</p> <p>1) See also subclauses 5 .8.3</p> <p>2) A "g" is appended to the symbol for the type of condition of tubes having smoothed welds (see subclause 5.1.2)</p> <p>3) The mechanical properties specified in table 3 do not apply for this condition. If required, they shall be agreed at the time of ordering.</p> <p>4) Condition k1, k2, k3 l1 or l2 are usually used as the starting condition.</p> <p>5) The order shall specify whether grinding or polishing is to be internal or external, or internal and external.</p>		

As the symbols or the steel grades differ from those specified in DIN 17440. December 1972 edition, following the specifications for the chemical composition, and in accordance with DIN 17440. July 1985 edition, a compilation of the material numbers, which have not changed, and the previous and new symbols is given below in tabular form. It shall be noted that the symbols used in DIN 17440. December 1972 edition. may still be used during the period of validity of this standard.

Material number	Previous symbol from DIN 17440. December 1972 edition	New symbol
1.4016	X8Cr 17	X6Cr 17

	SUS		A213	TP304H	SUS	3059	CFS304S59	SUS							2604/2	TS48	SUS
	304HTB	SUS	A249	TP304H	SUS	3606	304S59	SUS									
	SUS		A213	TP304L	SUS	3605	304S14	SUS	2462	X2CrNi189	SUS	A49-207	TSZ2CN 18.10	SUS	2604/2	TS46	SUS
	304LTB	SUS	A249	TP304L	SUS	"	304S22	SUS	2463	X2CrNi189	SUS	"	TSZ2CN 18.10	SUS			
			A269	TP304L	SUS	3606	LWHT304S22	SUS				A49-230	TSZ2CN 18.10	SUS			
			A632	TP304L	SUS	"	LWCF304S22	SUS									
			A688	TP304L	SUS	"	LWBC304S22	SUS									
						"	CFS304S22	SUS									
	SUS																
	309TB	SUS															
	SUS																
	309STB	SUS	A213	TP309S	SUS												
	SUS														2604/2	TS68	SUS
	310TB	SUS	A632	TP310	SUS												
	SUS																
	310STB	SUS	A213	TP310S	SUS												
	SUS		A213	TP316	SUS				2462	X5CrNiMo 1810	SUS	A49-230	TUZ6CN 18.09	SUS	2604/2	TS60	SUS
	316TB	SUS	A249	TP316	SUS	3605	316S18	SUS	2463	X5CrNiMo 1810	SUS						
			A269	TP316	SUS				"	X5CrNiMo 1812							
			A632	TP316	SUS	3606	LWHT316S25	SUS	17455	X5CrNiMo 17122							

