Material grade tables

Table 3.1.2_1: Stainless steels (ferritic, chromium steels)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)							Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	0.2 % proof strength (N/mm²)	1 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.4003	X2CrNi12 / X2Cr11	S40977	0.030	1.00	1.5	10.5 12.5	–	0.3 1.0	N ≤ 0.03	≥ 250	–	450 650	7.7	Good corrosion resistance to atmospheric corrosion and neutral, low chloride waters, economic stainless steel with good weldability and abrasion resistance
1.4512	X2CrTi12	S40910	0.030	1.00	1.0	10.5 12.5	–	–	Ti = 6 x (C + N) up to 0.65	≥ 210	–	380 560	7.7	Also used as heat resistant steel
1.4002	X6CrAl13	405 / S40500	0.080	1.00	1.0	12.0 14.0	–	–	Al = 0.1 0.3	≥ 210	–	400 600	7.7	Petrochemical industry, construction of water turbines
1.4016	X6Cr17	430 / S43000	0.080	1.00	1.0	16.0 18.0	–	–	–	≥ 225	–	430 630	7.7	Also used as heat resistant steel
1.4510	X3CrTi17	439 / S43035	0.050	1.00	1.0	16.0 18.0	–	–	Ti = 4 x (C + N) + 0.15 up to 0.8	≥ 230	–	420 600	7.7	Also used as heat resistant steel
1.4511	X3CrNb17	430Cb S43040	0.050	1.00	1.0	16.0 18.0	–	–	NB = 12 x C up to 1.0	≥ 230	–	420 600	7.7	Welded parts for process equipment only exposed to weak acid and brine attacks, high stress corrosion resistance in hot low-chloride waters
1.4509	X2CrTiNb18	S43940	0.030	1.00	1.0	17.5 18.5	–	–	Ti = 0.1 up to 0.6 NB = 3 x C + 0.3 up to 1.0	≥ 230	–	430 630	7.7	Also used as heat resistant steel
1.4521	X2CrMoTi18-2	444 / S44400	0.025	1.00	1.0	17.0 20.0	1.8 2.5	–	N ≤ 0.03 Ti = 4 x (C + N) + 0.15 up to 0.8	≥ 280	–	400 640	7.7	High stress corrosion resistance in high-temperature water at low chloride level
1.4575	X1CrNiMoNb28-4-2	S32803	0.015	0.55	0.5	28.0 29.0	1.8 2.5	3.0 4.0	N ≤ 0.02 Nb ≥ 12 x (C + N) up to 0.5	≥ 500	–	≥ 600	7.7	High pitting, crevice and stress corrosion resistance

No guarantee for correctness

Table 3.1.2_2: Stainless steels (austenitic-ferritic)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)								Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements		0.2 % proof strength (N/mm²)	1 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.4362	X2CrNiN23-4 / LeanDuplex	2304 / S32304	0.03	1.00	2.00	22.0 24.0	0.10 0.60	3.50 5.50	N = 0.05 0.20	Cu = 0.10 0.60	≥ 385	–	600 850	7.8	Also used as heat resistant steel
1.4162	X2CrMnNiN22-5-2	S32101	0.04	1.00	4.00 6.00	21.0 23.0	1.35 1.70	0.10 0.80	N = 0.20 0.20	Cu = 0.10 0.80	≥ 450	–	≥ 650	7.7	Higher general corrosion resistance than group 1.4301 to 1.4550, combined with the greater strength of standard duplex steels, suitable for uses in the chemical, pulp and paper industry
1.4462	X2CrNiMoN22-5-3 / Duplex	2205 / S31803 / S32205	0.03	1.00	2.00	21.0 23.0	2.50 3.50	4.50 6.50	N = 0.10 0.22		≥ 445	–	640 950	7.8	Chemical and petrochemical industry, sea water desalinisation, shipbuilding, offshore and sour gas applications
1.4410	X2CrNiMoN25-7-4 / Superduplex	2507 / S32750	0.03	1.00	2.00	24.0 26.0	3.00 4.50	6.00 8.00	N = 0.20 0.35		≥ 515	–	730 1 000	7.8	Higher strength and corrosion resistance compared to 1.4462, especially in media containing chloride
1.4501	X2CrNiMoCuWN25-7-4 / Zeron 100, Superduplex	S32760	0.03	1.00	1.00	24.0 26.0	3.00 4.00	6.00 8.00	N = 0.20 0.30 W = 0.50 – 1.00	Cu = 0.50 1.00	≥ 515	–	730 930	7.8	Higher strength and corrosion resistance compared to 1.4462, especially in media containing chloride
1.4507	X2CrNiMoCuN25-6-3 / Superduplex	255 / S32550	0.03	0.70	2.00	24.0 26.0	3.00 4.00	6.00 8.00	N = 0.20 0.30	Cu = 1.00 2.50	≥ 475	–	690 940	7.8	Higher strength and corrosion resistance compared to 1.4462, especially in media containing chloride

No guarantee for correctness

Table 3.1.2_3: Stainless steels (austenitic)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)							Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	0.2 % proof strength (N/mm²)	1 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.4301	X5CrNi18-10	304 / S30400	0.07	1	2	17.5 19.5	–	8.0 10.5	N ≤ 0.11	≥ 195	≥ 235	520 750	7.9	Pipelines for food and beverage industry, medical technology, chemical industry, also used as heat resistant steel
1.4306	X2CrNi19-11	304L / S30403	0.03	1	2	18.0 20.0	–	10.0 12.0	N ≤ 0.11	≥ 185	≥ 225	500 670	7.9	Higher IC-resistance than 1.4301, food and beverage industry, medical technology, chemical and pharmaceutical industry
1.4307	X2CrNi18-9	304L / S30403	0.03	1	2	17.5 19.5	–	8.0 10.5	N ≤ 0.11	≥ 185	≥ 225	500 670	7.9	Higher IC-resistance than 1.4301, food and beverage industry, medical technology, chemical and pharmaceutical industry
1.4541	X6CrNiTi18-10 / Alloy 321	321 / S32100	0.08	1	2	17.0 19.0	–	9.0 12.0	Ti = 5 x C up to 0.7	≥ 185	≥ 225	500 720	7.9	Chemical industry, waste water treatment, food and beverage industry, medical technology
1.4550	X6Cr-NiNb18-10	347 / S34700	0.08	1	2	17.0 19.0	–	9.0 12.0	Nb = 10 x C up to 1	≥ 185	≥ 225	500 720	7.9	IC-resistance through Nb additive up to 400 °C, applications in nuclear power plants
1.4401	X5CrNi-Mo17-12-2	316 / S31600	0.07	1	2	16.5 18.5	2.0 2.5	10.0 13.0	N ≤ 0.11	≥ 205	≥ 245	520 680	8.0	Higher chloride resistance than stainless steels of type 304, chemical and textile industry, pulp and paper industry, transportation of corrosive media containing chloride
1.4404	X2CrNi-Mo17-12-2 / X2CrNi-Mo17-13-2	316L / S31603	0.03	1	2	16.5 18.5	2.0 2.5	10.0 13.0	N ≤ 0.11	≥ 205	≥ 245	520 680	8.0	Higher chloride resistance than stainless steels of type 304, chemical and textile industry, pulp and paper industry, transportation of corrosive media containing chloride
1.4571	X6CrNiMo-Ti17-12-2	316Ti / S31635	0.08	1	2	16.5 18.5	2.0 2.5	10.5 13.5	Ti = 5 x C up to 0.7	≥ 205	≥ 245	520 690	8.0	Chemical and petrochemical industry, textile, pulp and paper industry, waste water treatment
1.4580	X6CrNiMo-Nb17-12-2	316Cb / S31640	0.08	1	2	16.5 18.5	2.0 2.5	10.5 13.5	Nb = 10 x C up to 1.0	≥ 220	≥ 260	520 720	8.0	Higher general corrosion resistance than group 1.4301 to 1.4550. Preferred in chemical equipment construction, waste water treatment plants and the paper industry, mainly in case of higher chloride contents
1.4436	X3CrNi-Mo17-13-3 / X5CrNi-Mo17-13-3	316 / 316L / S31600 / S31603	0.05	1	2	16.5 18.5	2.5 3.0	10.5 13.0	N ≤ 0.11	≥ 205	≥ 245	530 730	8.0	Higher chloride resistance than stainless steels of type 304, chemical and textile industry, pulp and paper industry, transportation of corrosive media containing chloride
1.4435	X2CrNi-Mo18-14-3	316L / S31603	0.03	1	2	17.0 19.0	2.5 3.0	12.5 15.0	N ≤ 0.11	≥ 205	≥ 215	520 700	8.0	Higher chloride resistance than stainless steels of type 304, chemical and textile industry, pulp and paper industry, transportation of corrosive media containing chloride
1.4438	X2CrNi-Mo18-15-4	317L / S31703	0.03	1	2	17.5 19.5	3.0 4.0	13.0 16.0	N ≤ 0.11	≥ 205	≥ 245	520 720	8.0	Textile industry, pulp and paper industry, nautical applications
1.4311	X2CrNiN18-10	304LN / S30453	0.03	1	2	17.5 19.5	–	8.5 11.5	N = 0.12 0.22	≥ 255	≥ 295	550 750	7.9	Very high IC-resistance up to 400 °C, with higher strength than 1.4306
1.4406	X2CrNi-MoN17-11-2	316LN / S31653	0.03	1	2	16.5 18.5	2.0 2.5	10.0 12.5	N = 0.12 0.22	≥ 265	≥ 305	580 780	8.0	Higher resistance than the group from 1.4436 to 1.4438 in oxidizing media, high microstructure stability and strength
1.4432	X2CrNi-Mo17-12-3	316 / 316L / S31600 / S31603	0.03	1	2	16.5 18.5	2.5 3.0	10.5 13.0	N ≤ 0.11	≥ 205	≥ 245	520 700	8.0	Higher chloride resistance than stainless steels of type 304, chemical and textile industry, pulp and paper industry, transportation of corrosive media containing chloride

Table 3.1.2_3: Stainless steels (austenitic) (Continuation)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)							Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	0.2% proof strength (N/mm²)	1% proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.4429	X2CrNi-MoN17-13-3	316LN / S31653	0.030	1.00	1.0	16.5 18.5	2.5 3.0	11.0 14.0	N = 0.12 0.22	≥ 265	≥ 305	580 780	8.0	High resistance to non-oxidising acids and media containing chloride, such as sea water and hypochlorite solutions
1.4439	X2CrNi-MoN17-13-5	317LMN / S31726	0.030	1.00	2.0	16.5 18.5	4.0 5.0	12.5 14.5	N = 0.12 0.22	≥ 255	≥ 295	580 780	8.0	
1.4335	X1CrNi25-21	310L	0.020	0.25	2.0	24.0 26.0	≤ 0.2	20.0 22.0	N ≤ 0.11	≥ 200	≥ 240	470 670	7.9	High resistance to nitric acid
1.4465	X1CrNi-MoN25-25-2	N08310	0.020	0.70	2.0	24.0 26.0	2.0 2.5	22.0 25.0	N = 0.08 0.16	≥ 260	≥ 295	540 740	8.0	Increased resistance to organic, non-oxidizing acids, textile industry and coal derivatives industry
1.4577	X3CrNiMo-Ti25-25		0.040	0.50	2.0	24.0 26.0	2.0 2.5	24.0 26.0	Ti = 10 x C up to 0.6	≥ 205	≥ 245	490 740	8.0	
1.4505	X4NiCrMo-CuNb20-18-2		0.050	1.00	2.0	16.5 18.5	2.0 2.5	19.0 21.0	Cu = 1.80 2.20 Nb + Ta ≥ 8 x C	≥ 225	≥ 265	490 740	8.0	Enhanced resistance to sulphuric and phosphoric acid, chemical industry
1.4586	X5NiCrMo-CuNb22-18		0.070	0.25 0.45	0.7 1.0	17.0 18.0	3.0 4.0	22.0 23.0	Cu = 1.60 2.00 Nb ≥ 8 x C	≥ 275	–	540 740	8.0	
1.4565	X2CrNiMn-MoN25-18-6-5 / Superaustenit	S34565	0.030	1.00	5.0 7.0	24.0 26.0	4.0 5.0	16.0 19.0	Nb + Ta ≤ 0.15 N = 0.30 0.60	≥ 420	≥ 460	800 950	8.0	High strength and very good local and general corrosion resistance, offshore applications, flue gas desulphurization plants
1.4529	X1NiCrMo-CuN25-20-7 / 6% Moly	N08926	0.020	0.50	1.0	19.0 21.0	6.0 7.0	24.0 26.0	N = 0.15 0.25 Cu = 0.50 1.50	≥ 300	≥ 340	650 850	8.1	Very good stress, pitting, crevice and general corrosion resistance, chemical and petrochemical industry, offshore applications, flue gas desulphurization plants, fertilizer industry, pulp and paper industry
1.4539	X1NiCr-MoCu25-20-5 / Alloy 904L	904L / N08904	0.020	0.70	2.0	19.0 21.0	4.0 5.0	24.0 26.0	N ≤ 0.15 Cu = 1.20 2.00	≥ 205	≥ 245	520 730	8.0	Chemical industry, production of phosphoric acid and added sulphuric acid processes, pulp and paper industry, fertilizer production, flue gas desulphurization plants
1.4563	X1NiCr-MoCu31-27-4 / Alloy 28	N08028	0.020	0.70	2.0	26.0 28.0	3.0 4.0	30.0 32.0	N ≤ 0.11 Cu = 0.70 1.50	≥ 220	≥ 260	500 700	8.0	Processes involving sulphuric acid with added chloride, flue gas desulphurization plants, pulp and paper industry, fertilizer production
1.4562	X1NiCr-MoCu32-28-7 / Alloy 31	N08031	0.015	0.30	2.0	26.0 28.0	6.0 7.0	30.0 32.0	Cu = 1.00 1.40 N = 0.15 0.25	≥ 280	≥ 310	650 850	8.0	Processes involving sulphuric acid with added chloride, flue gas desulphurization plants, pulp and paper industry, fertilizer production
1.4361	X1CrNi-Si18-15-4	S30600	0.015	3.70 4.50	2.0	16.5 18.5	≤ 0.2	14.0 16.0	N ≤ 0.11	≥ 220	≥ 260	530 730	7.7	Resistance to highly concentrated nitric acid (HOKO acid in German)
1.4558	X2NiCrAl-Ti32-20	N08880	0.030	0.70	1.0	20.0 23.0	–	32.0 35.0	Al = 0.15 0.45 Ti = 8 x (C + N) up to 0.6	≥ 180	≥ 210	450 700	8.0	Applications up to 550 °C
1.4547	X1CrNiMo-CuN20-18-7 / 6% Moly	S31254	0.020	0.70	1.0	19.5 20.5	6.0 7.0	17.5 18.5	N = 0.18 0.25 Cu = 0.50 1.00	≥ 285	≥ 325	650 850	8.0	
1.4591	X1CrNiMo-CuN33-32-1 / Alloy 33	R20033	0.015	0.50	2.0	31.0 35.0	0.5 2.0	30.0 33.0	Cu = 0.30 1.20 N = 0.35 0.60	≥ 380	≥ 420	720 920	7.9	Production and transport of concentrated sulphuric acid also at higher temperatures, sea water and brackish water plants, pickling plants, concentrated caustic soda at high temperatures

Table 3.1.2_4: Heat resistant steels (ferritic)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%) C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	Mechanical and physical properties 0.2% proof strength (N/mm²)	1% proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	Special qualifications and abbreviations (The following details are guidelines only)
1.4713	X10CrAlSi7		0.12	0.5 1.0	1.00	6.0 8.0	–	–	Al = 0.50 1.00	≥ 220	–	420 620	7.70	Oxidizing sulphuric gases Application temperature: 800 °C*
1.4724	X10CrAlSi13 / X10CrAl13	405 / S40500	0.12	0.7 1.4	1.00	12.0 14.0	–	–	Al = 0.70 1.20	≥ 250	–	450 650	7.70	Petro-chemical plants Application temperature: 850 °C*
1.4762	X10CrAlSi25		0.12	0.7 1.4	1.00	23.0 26.0	–	–	Al = 1.20 1.70	≥ 280	–	520 720	7.70	Industrial furnace construction, Oxidizing sulphuric gases Application temperature: 1 150 °C*

No guarantee for correctness

Table 3.1.2_5: Heatrestistant steels (austenitic)

Material grade no.	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%) C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	Mechanical and physical properties 0.2% proof strength (N/mm²)	1% proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	Special qualifications and abbreviations (The following details are guidelines only)
1.4835	X9CrNiSi-NCe21-11-2	S30815	0.05 0.12	1.4 2.5	1.0	20.0 22.0	–	10.0 12.0	N = 0.12 0.20 Ce = 0.03 0.08	≥ 310	≥ 350	650 850	7.8	Highest application temperature: 1 150 °C
1.4878	X8CrNiTi18-10	321 / 321H / S32100 / S32109	0.10	1.0	2.0	17.0 19.0	–	9.0 12.0	Ti = 5 x C bis 0.8	≥ 190	≥ 230	500 720	7.9	Highest application temperature: 850 °C
1.4828	X15CrNiSi20-12	309 / S30900	0.20	1.5 2.0	2.0	19.0 21.0	–	11.0 13.0	N ≤ 0.11	≥ 230	≥ 270	550 750	7.9	Nitrogenous gases with low oxygen content Highest application temp.: 1 100 °C
1.4841	X15CrNiSi25-21 / X15CrNiSi25-20	310 / 314 / S31000 / S31400	0.20	1.5 2.5	2.0	24.0 26.0	–	19.0 22.0	N ≤ 0.11	≥ 230	≥ 270	550 750	7.9	Highest application temperature: 1 150 °C
1.4845	X8CrNi25-21 X12CrNi25-21	310S / 310H / S31008 / S31009	0.10	1.5	2.0	24.0 26.0	–	19.0 22.0	N ≤ 0.11	≥ 210	≥ 250	500 700	7.9	Highest application temperature: 1 050 °C
1.4833	X12CrNi23-13 / X12CrNi23-12 / X7CrNi23-14	309S / 309H / S30908 / S30909	0.15	1.0	2.0	22.0 24.0	–	12.0 14.0	N ≤ 0.11	≥ 210	≥ 250	500 700	7.9	Similar to 1.4845, good weldability Highest air application temperature: 1 000 °C
1.4864	X12NiCrSi35-16	N08330	0.15	1.0 2.0	2.0	15.0 17.0	–	33.0 37.0	N ≤ 0.11	≥ 230	≥ 270	550 750	8.0	Nitrogenous gases with very low oxygen content and carburising gases Highest air application temperature: 1 100 °C
1.4876	X10NiCrAl-Ti32-21 / X10NiCrAl-Ti32-20 / Alloy 800	800 / N08800	0.12	1.0	2.0	19.0 23.0	–	30.0 34.0	Al = 0.15 0.60 Ti = 0.15 0.60	≥ 170	≥ 210	450 680	8.0	Application temperature up to 950 °C, resistant to oxidation, carburising and nitriding, good creep rupture properties Highest application temperature: 1 100 °C

No guarantee for correctness

Table 3.1.2_6: Highly corrosion resistant nickel alloys

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)							Mechanical and physical properties					Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	Condition	0.2 % proof strength (N/mm²)	1 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
2.4816	NiCr15Fe / Alloy 600	N06600	0.025 0.100	0.50	1.0	14.0 17.0	–	≥ 72	Fe = 6 10 Al ≤ 0.3 Ti ≤ 0.3 Cu ≤ 0.5 Co	solution annealed soft annealed	≥ 180 ≥ 200	≥ 210 ≥ 230	≥ 500 ≥ 550	8.5	High stress corrosion resistance in high temperature water, construction of nuclear reactors
2.4851	NiCr23Fe / Alloy 601	N06601	0.100	0.50	1.0	21.0 25.0	–	58 63	Fe ≤ 18 Al = 1.0 1.7 Cu ≤ 0.5 B ≤ 0.006 Ti ≤ 0.5 Co	solution annealed	≥ 205	≥ 235	≥ 550	8.2	Oxidation resistant up to 1 100 °C, good resistance in carburising conditions and in oxidising sulphur containing atmospheres
2.4633	NiCr25FeAlY / Alloy 602 / 602 CA	N06025	0.150 0.250	0.50	0.5	24.0 26.0	–	Rest	Al = 1.8 2.4 Cu ≤ 0.1 Fe = 8 11 Ti = 0.1 0.2 Y = 0.05 0.12 Zr = 0.01 0.10	solution annealed	≥ 270	≥ 330	≥ 680	7.9	Oxidation resistant up to 1 200 °C also under cyclical stress, uncooled furnace rollers, pipes in "metal dusting"-threatened plants
2.4858	NiCr21Mo / Alloy 825	N08825	0.025	0.50	1.0	19.5 23.5	2.5 3.5	38 46	Al ≤ 0.2 Co ≤ 1 Cu = 1.5 3.0 Fe = Rest Ti = 0.6 1.2	soft annealed	≥ 240	≥ 270	≥ 550	8.1	Plants using sulphuric acid, phosphoric acid production, sea water and sour gas applications
2.4856	NiCr22Mo9Nb / Alloy 625	N06625	0.030 0.100	0.50	0.5	20.0 23.0	8.0 10.0	≥ 58	Fe ≤ 5 Al ≤ 0.4 Ti ≤ 0.4 Cu ≤ 0.5 Co ≤ 1 Nb + Ta = 3.15 4.15	solution annealed soft annealed	≥ 275 ≥ 380	≥ 305 ≥ 410	≥ 690 ≥ 760	8.4	Chemical and pharmaceutical industry, flue gas desulphurization plants, offshore and sour gas applications, high abrasion resistance and good mechanical values
2.4610	NiMo16Cr16Ti / Alloy C4	N06455	0.015	0.08	1.0	14.0 18.0	14.0 17.0	Rest	Co ≤ 2 Cu ≤ 0.5 Fe ≤ 3 Ti ≤ 0.7	solution annealed	≥ 280	≥ 315	≥ 690	8.6	Chemical and pharmaceutical industry, flue gas desulphurization plants, offshore and sour gas applications
2.4819	NiMo16Cr15W / Alloy C276	N10276	0.010	0.08	1.0	14.5 16.5	15.0 17.0	Rest	Co ≤ 2.5 Cu ≤ 0.5 Fe = 4 7 V ≤ 0.35 W = 3.0 4.5	solution annealed	≥ 280	≥ 300	≥ 690	8.9	Chemical and pharmaceutical industry, flue gas desulphurization plants, offshore and sour gas applications
2.4602	NiCr21Mo14W / Alloy 22	N06022	0.010	0.08	0.5	20.0 22.5	12.5 14.5	Rest	Co ≤ 2.5 Fe = 2 6 V ≤ 0.35 W = 2.5 3.5	solution annealed	≥ 310	≥ 335	≥ 690	8.7	Particularly high resistance to aggressive oxidising and reducing media, also at increased temperatures
2.4605	NiCr23Mo16Al / Alloy 59	N06059	0.010	0.10	0.5	22.0 24.0	15.0 16.5	Rest	Al = 0.1 0.4 Co ≤ 0.3 Cu ≤ 0.5 Fe ≤ 1.5	solution annealed	≥ 320	≥ 360	≥ 690	8.6	Highest pitting and crevice corrosion resistance, very good microstructural stability and weldability, pharmaceutical industry, polycarbonate production, flue gas desulphurization plants, pesticide production

Table 3.1.2_6: Highly corrosion resistant nickel alloys (Continuation)

Material grade no.:	Abbreviation / Usual market designation	AISI / UNS	Chemical composition (%)							Mechanical and physical properties					Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	Condition	0.2% proof strength (N/mm^2)	1% proof strength (N/mm^2)	Tensile strength (N/mm^2)	Density (g/cm^3)	
2.4600	NiMo29Cr / Alloy B3 / Alloy B4	N10675	0.01	0.10	3.00	0.5 3.0	26.0 32.0	≥ 65.0	Al = 0.1 0.5 Co ≤ 3 Cu ≤ 0.5 Fe = 1 6 Nb + Ta ≤ 0.4 Ti ≤ 0.2 V ≤ 0.2 W ≤ 3	solution annealed	≥ 340	≥ 380	≥ 750	9.2	
2.4617	NiMo28 / Alloy B2	N10665	0.01	0.08	1.00	≤ 1.0	26.0 30.0	Rest	Co ≤ 1 Cu ≤ 0.5 Fe ≤ 2	solution annealed	≥ 340	≥ 380	≥ 750	9.2	High resistance to HCl (hydrochloric acid)
CW352H (previously: 2.0872)	CuNi10Fe1Mn / Cunifer 10	C70600	0.05	–	0.50 1.00	–	–	9.0 11.0	Cu = Rest Fe = 1 2 Pb ≤ 0.02 Zn ≤ 0.5	R300	≥ 100	–	≥ 300	8.9	High resistance to sea water
CW354H (previously: 2.0882)	CuNi30Mn1Fe / Cunifer 30	C71500	0.05	–	0.50 1.50	–	–	30.0 32.0	Cu = Rest Fe = 0.4 1.0 Pb ≤ 0.02 Zn ≤ 0.5	R350	≥ 120	–	≥ 350	8.9	High resistance to sea water
2.4360	NiCu30Fe / Monel 400 / Alloy 400	N04400	0.15	0.50	2.00	–	–	≥ 63.0	Al ≤ 0.5 Co ≤ 1 instead of Ni Cu = 28 34 Fe = 1.0 2.5 Ti ≤ 0.3	soft annealed	≥ 175	≥ 205	≥ 450	8.8	Corrosion resistant to sea water and chemical plants, stress corrosion resistant, feed water and steam raising unit pipes in power plants, saline water heaters and evaporators in salt works, sulphuric and hydrofluoric acid alkylation plants, splash pipes at offshore platforms, piping for production facilities of perchlorethylene and other chloride synthetics
2.4068	LC-Ni99 / Alloy 201	N02201	0.02	0.25	0.35	–	–	99.0	Co ≤ 1 instead of Ni Cu < 0.25 Fe ≤ 0.4 Mg ≤ 0.15 Ti ≤ 0.1	soft annealed	≥ 80	≥ 105	≥ 340	8.9	Reduced carbon content compared to 2.4066 with therefore higher IC-resistance, excellent resistance to alkaline media
2.4066	Ni99,2 / Alloy 200	N02200	0.10	0.25	0.35	–	–	99.2	Co ≤ 1 instead of Ni Cu ≤ 0.25 Fe ≤ 0.4 Mg ≤ 0.15 Ti ≤ 0.1	soft annealed	≥ 100	≥ 125	≥ 370	8.9	Excellent resistance to alkaline media
2. 4650	NiCo20Cr-20MoTi / Alloy C263	N07263	0.04 0.08	0.40	0.60	19.0 21.0	5.6 6.1	Rest	Al = 0.3 0.6 B ≤ 0.005 Co = 19 21 Cu ≤ 0.2 Fe ≤ 0.7 Ti = 1.9 2.4	solution annealed and heat treated (hardened)	≥ 570	–	≥ 970	8.4	Heat treatable Ni-Cr-Co-Mo-alloy with high permanent stability, excellent oxidation resistance up to 1 000 °C, good weldability and very good abrasion qualities

Table 3.1.2_7 Creep-resistant steels (austenitic)

Material grade no.:	Abbreviation/ Usual market designation	AISI/ UNS	Chemical composition (%)							Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	0.2% proof strength (N/mm²)	1% proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.4948	X6CrNi18-10 / X6CrNi18-11	304H / S30409	0.04 0.08	1.00	2.0	17.0 19.0	–	8.0 11.0	N ≤ 0.11	≥ 190	≥ 230	490 740	7.90	Also used as heat resistant steel
1.4941	X6CrNiTiB18-10 / X8CrNiTi18-10	321H / S32109	0.04 0.08	1.00	2.0	17.0 19.0	–	9.0 12.0	Ti = 5 x C up to 0.8 B = 0.0015 / 0.005	≥ 175	≥ 210	490 710	7.90	Also used as heat resistant steel
1.4910	X3CrNi-MoBN17-13-3 / X3CrNiMoN17-13	316LN / S31653	0.04	0.75	2.0	16.0 18.0	2.0 3.0	12.0 14.0	N = 0.10 / 0.18 B = 0.0015 / 0.005	≥ 245	≥ 285	550 780	8.00	High creep rupture characteristics up to 700 °C
1.4961	X8CrNiNb16-13	347H / S34709	0.04 0.10	0.30 0.60	1.5	15.0 17.0	–	12.0 14.0	Nb = 10 x C up to 1.2	≥ 200	≥ 240	510 690	7.95	High creep rupture characteristics in welded condition
1.4958	X5NiCrAlTi31-20 / Alloy 800H	N8800	0.03 0.08	0.70	1.5	19.0 22.0	–	30.0 32.5	N ≤ 0.03 Cu ≤ 0.5 Nb ≤ 0.1 Ti = 0.2 / 0.5 Al = 0.2 / 0.5 Co ≤ 0.5	≥ 170	≥ 200	500 750	8.00	
1.4959	X8NiCrAlTi32-21 / Alloy 800HP	N08810 / N08811	0.05 0.10	0.70	1.5	19.0 22.0	–	30.0 34.0	N ≤ 0.03 Ti = 0.25 / 0.65 Al = 0.25 / 0.65 Cu ≤ 0.5	≥ 170	≥ 200	500 750	8.00	

No guarantee for correctness

Table 3.1.2_8 Non-magnetic steels

Material grade no.:	Abbreviation/ Usual market designation	AISI/ UNS	Chemical composition (%)							Mechanical and physical properties				Special qualifications and abbreviations (The following details are guidelines only)
			C ≤	Si ≤	Mn ≤	Cr	Mo	Ni	Other elements	0.2% proof strength (N/mm²)	1% proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)	
1.3952	X2CrNi-MoN18-14-3	316LN / S31653	0.03	1	2.0	16.5 18.5	2.5 3.0	13.0 15.0	N = 0.15 / 0.25	≥ 280	–	580 800	7.95	Applications in submarine construction
1.3964	X2CrNiMn-MoNNb21-16-5-3		0.03	1	4.0 6.0	20.0 21.5	3.0 3.5	15.0 17.0	N = 0.20 / 0.35 Nb ≤ 0.25	≥ 365	–	700 950	7.90	High-strength non-magnetic steel which is also sea water resistant, permeability ≤ 1.005
1.3974	X2CrNiMn-MoNNb23-17-6-3		0.03	1	4.5 6.5	21.0 24.5	2.8 3.4	15.5 18.0	N = 0.3 / 0.5 Nb = 0.1 / 0.3	≥ 460	–	800 1 050	7.90	Very high-strength non-magnetic steel which is also sea water resistant, permeability ≤ 1.005

No guarantee for correctness

Table 3.1.2_9 Aluminium and aluminium alloys

Numeric designation EN 573-1	Designation with chemical symbols EN 573-1	Chemical composition (%)							Mechanical and physical properties			
		Si	Fe	Cu	Mn	Mg	Cr	Other Elements	Condition	0.2 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)
EN AW-1080A (previously: 3.0285)	EN AW-Al 99.8 (A)	≤ 0.15	≤ 0.15	≤ 0.03	≤ 0.02	≤ 0.02	–	Zn ≤ 0.06 Ga ≤ 0.03 Ti ≤ 0.02	O/H111	≥ 15	60 90	2.70
EN AW-1050A (previously: 3.0255)	EN AW-Al 99.5	≤ 0.25	≤ 0.40	≤ 0.05	≤ 0.05	≤ 0.05	–	Zn ≤ 0.07 Ti ≤ 0.05	O/H111	≥ 20	65 95	2.70
EN AW-5754 (previously 3.3535)	EN AW-Al Mg3	≤ 0.40	≤ 0.40	≤ 0.10	≤ 0.50	2.60 3.60	≤ 0.30	Zn ≤ 0.20 Ti ≤ 0.15	O/H111	≥ 80	190 240	2.66
EN AW-5049 (previously: 3.3527)	EN AW-Al Mg2Mn0.8	≤ 0.40	≤ 0.50	≤ 0.10	0.50 1.10	1.60 2.50	≤ 0.30	Zn ≤ 0.20 Ti ≤ 0.10	O/H111	≥ 80	190 240	2.71
EN AW-5083 (previously: 3.3547)	EN AW-Al Mg4,5Mn0.7	≤ 0.40	≤ 0.40	≤ 0.10	0.40 1.00	4.00 4.90	0.05 0.25	Zn ≤ 0.25 Ti ≤ 0.15	O/H111	≥ 125	275 350	2.66
EN AW-6060 (previously: 3.3206)	EN AW-Al MgSi	0.30 0.60	0.10 0.30	≤ 0.10	≤ 0.10	0.35 0.60	≤ 0.05	Zn ≤ 0.15 Ti ≤ 0.10	T4	≥ 60	≥ 120	2.70
EN AW-6082 (previously: 3.2315)	EN AW-Al Si1MgMn	0.70 1.30	≤ 0.50	≤ 0.10	0.40 1.20	0.60 1.20	≤ 0.25	Zn ≤ 0.20	0	≥ 85	≤ 155	2.70

No guarantee for correctness

Table 3.1.2_10: Copper and copper-zinc alloys

Material grade no.	Abbreviation	UNS	Chemical composition (%)					Mechanical and physical properties		
			Cu	P	Zn	Al	Other elements	0.2 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)
CW008A (previously: 2.0040)	Cu-OF (previously: OF-Cu)	C10200	≥ 99.95	–	–	–	Pb ≤ 0.0050 Bi ≤ 0.0005	–	≥ 200	8.9
CW021A (previously: 2.0070)	Cu-HCP (previously: SE-Cu)		≥ 99.95	0.002 0.007	–	–	Pb ≤ 0.0050 Bi ≤ 0.0005	–	≥ 200	8.9
CW024A (previously: 2.0090)	Cu-DHP (previously: SF-Cu)	C12200	≥ 99.90	0.015 0.040	–	–	–	–	≥ 200	8.9
CW702R (previously: 2.0460)	CuZn20Al2As (previously: CuZn20Al2)	C68700	76.00 79.00	≤ 0.010	Rest	1.8 2.3	As = 0.02 0.06 Fe ≤ 0.07 Pb ≤ 0.05	≥ 90	≥ 330	8.4

No guarantee for correctness

Table 3.1.2_11: Titanium and titanium alloys

Material grade no.	Abbreviation	ASTM / UNS	Chemical composition (%)					Mechanical and physical properties			
			Fe	O	Pd	Ni	Mo	0.2 % proof strength (N/mm²)	1 % proof strength (N/mm²)	Tensile strength (N/mm²)	Density (g/cm³)
3.7025	Ti1	Grade 1 / R50250	≤ 0.15	≤ 0.12	–	–	–	≥ 180	≥ 200	290 410	4.5
3.7035	Ti2	Grade 2 / R50400	≤ 0.20	≤ 0.18	–	–	–	≥ 250	≥ 270	390 540	4.5
3.7235	Ti2Pd	Grade 7 / R52400	≤ 0.20	≤ 0.18	0.15 0.25	–	–	≥ 250	≥ 270	390 540	4.5
3.7105	TiNi0,8 Mo0,3	Grade 12 / R53400	≤ 0.25	≤ 0.25	–	0.6 0.9	0.2 0.4	≥ 345	≥ 370	≥ 480	4.7

No guarantee for correctness