

## Atlas Tech Note No. 3

### Stainless Steels - Properties and Equivalent Grades

#### Comparison of Grade Specifications of Stainless Steels

Type	Grade	UNS No	Old British		Euronorm		Swedish	Japanese
			BS	En	No	Name	SS	JIS
<b>Austenitic</b>	201	S20100	-	-	1.4372	X12CrMnNiN17-7-5	-	SUS201
	202	S20200	-	-	1.4373	X12CrMnNiN18-9-5	-	SUS202
	301	S30100	301S21	-	1.4310	X10CrNi18-8	2331	SUS301
	302HQ	S30430	394S17	-	1.4567	X3CrNiCu18-9-4	-	SUSXM7
	303	S30300	303S31	58M	1.4305	X8CrNiS18-9	2346	SUS303
	304	S30400	304S31	58E	1.4301	X5CrNi18-10	2332	SUS304
	304L	S30403	304S11	-	1.4307	X2CrNi18-9	2352	SUS304L
	304H	S30409	-	-	1.4948	X6CrNi18-10	-	-
	304N	S30451	-	-	-	-	2371	SUS304N1
	309S	S30908	309S24	-	1.4833	X12CrNi23-13	-	SUS309S
	310H	S31009	310S24	-	-	-	-	SUH310
	310S	S31008	310S16	-	1.4845	X8CrNi25-21	2361	SUS310S
	316	S31600	316S31	58H,58J	1.4401	X5CrNiMo17-12-2	2347	SUS316
	316L	S31603	316S11	-	1.4404	X2CrNiMo17-12-2	2348	SUS316L
	316H	S31609	316S51	-	1.4919	-	-	-
	316N	S31651	-	-	1.4406	X2CrNiMoN17-11-2	2375	SUS316N
	316Ti	S31635	320S31	-	1.4571	X10CrNiMoTi18-10	2350	SUS316Ti
	317L	S31703	317S12	-	1.4438	X2CrNiMo18-16	2367	SUS317L
	321	S32100	321S31	58B,58C	1.4541	X6CrNiTi18-10	2337	SUS321
	347	S34700	347S31	58G	1.4550	X6CrNiNb18-10	2338	SUS347
904L	N08904	904S13	-	1.4539	X1NiCrMoCuN25-20-5	2562	-	
253MA	S30815	-	-	1.4835	X9CrNiSiNcCe21-11-2	2368	-	
4565S	S34565	-	-	1.4565	X2CrNiMnMoN24-17-6-4	-	-	
<b>Ferritic</b>	409	S40910	409S19	-	1.4512	X6CrTi12	-	SUH409
	3Cr12	S41003	-	-	1.4003	X2CrNi12	-	-
	3Cr12Ti	-	-	-	-	-	-	-
	430	S43000	430S17	60	1.4016	X8Cr17	2320	SUS430
	430F	S43020	-	-	1.4105	X6CrMoS17	2383	SUS430F
	F20S	-	-	-	-	-	-	-
	444	S44400	-	-	1.4521	X1CrMoTi18-2	2326	SUS444
	446	S44600	-	-	1.4749	X18CrN28	2322	SUH446

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Type	Grade	UNS No	Old British		Euronorm		Swedish	Japanese
			BS	En	No	Name	SS	JIS
Duplex	2101	S32101	-	-	1.4162	-	-	-
	2304	S32304	-	-	1.4362	X2CrNiN23-4	2327	-
	2205	S32250	318S13	-	1.4462	X2CrNiMoN22-5-3	2377	SUS329J3L
	329	S32900	-	-	1.4460	X8CrNiMo27-5	2324	SUS329J1
	2507	S32750	-	-	1.4410	X2CrNiMoN25-7-4	2328	-
	2507Cu	S32520	-	-	1.4507	X2CrNiMoCuN25-6-3	-	-
	Zeron100	S32760	-	-	1.4501	X2CrNiMoCuWN25-7-4	-	-
Martensitic	410	S41000	410S21	56A	1.4006	X12Cr13	2302	SUS410
	416	S41600	416S21	56AM	1.4005	X12CrS13	2380	SUS416
	420	S42000	420S37	56C	1.4021	X20Cr13	2303	SUS420J1
	431	S43100	431S29	57	1.4057	X17CrNi16-2	2321	SUS431
	440C	S44004	-	-	1.4125	X105CrMo17	-	SUS440C
P.H	630	S17400	-	-	1.4542	X5CrNiCuNb16-4	-	SUS630
	631	S17700	460S52	-	1.4568	X7CrNiAl17-7	2388	SUS631

The above comparisons are approximate only - in some instances they are very close, in others much less so. The list is intended as a comparison of functionally similar materials not as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.

### Specified Compositions

Type	Grade	UNS	C	Mn	Si	P	S	Cr	Mo	Ni	N	Other
Austenitic	201	S20100	0.15	5.50-7.50	1.00	0.06	0.030	16.0-18.00		3.5-5.5		
	202	S20200	0.15	7.50-10.00	1.00	0.06	0.030	17.0-19.00		4.0-6.0		
	301	S30100	0.15	2.00	1.00	0.045	0.030	16.0-18.00		6.0-8.0	0.10	
	302HQ	S30430	0.030	2.00	1.00	0.045	0.030	17.0-19.00		8.0-10.0		3.0-4.0 Cu
	303	S30300	0.15	2.00	1.00	0.2	0.15 min	17.0-19.00		8.0-10.0		
	304	S30400	0.07	2.00	0.75	0.045	0.030	17.5-19.5	-	8.0-10.5	0.10	
	304L	S30403	0.030	2.00	0.75	0.045	0.030	17.5-19.5	-	8.0-10.5	0.10	
	304H	S30409	0.04-0.10	2.00	0.75	0.045	0.030	18.0-20.0		8.0-10.5		
	304N	S30451	0.08	2.00	0.75	0.045	0.030	18.0-20.0		8.0-10.5	0.10 - 0.16	

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Type	Grade	UNS	C	Mn	Si	P	S	Cr	Mo	Ni	N	Other
Austenitic	305	S30500	0.12	2.00	0.75	0.045	0.030	17.0-19.00		10.5-13.0		
	309S	S30908	0.08	2.00	0.75	0.045	0.030	22.0-24.00		12.0-15.0		
	310H	S31009	0.04-0.10	2.00	0.75	0.045	0.030	24.0-26.00		19.0-22.0		
	310S	S31008	0.08	2.00	1.50	0.045	0.030	24.0-26.00		19.0-22.0		
	316	S31600	0.08	2.00	0.75	0.045	0.030	16.0-18.00	2.00-3.00	10.0-14.0	0.10	
	316L	S31603	0.030	2.00	0.75	0.045	0.030	16.0-18.00	2.00-3.00	10.0-14.0	0.10	
	316H	S31609	0.04-0.10	2.00	0.75	0.045	0.030	16.0-18.00	2.00-3.00	10.0-14.0		
	316N	S31651	0.08	2.00	0.75	0.045	0.030	16.0-18.00	2.00-3.00	10.0-14.0	0.10 - 0.16	
	316Ti	S31635	0.08	2.00	0.75	0.045	0.030	16.0-18.00	2.00-3.00	10.0-14.0	0.10	5x(C+N)min, 0.70 max Ti
	317L	S31703	0.030	2.00	0.75	0.045	0.030	18.0-20.0	3.00-4.00	11.0-15.0	0.10	
	321	S32100	0.08	2.00	0.75	0.045	0.030	17.0-19.00		9.0-12.0	0.10	5x(C+N)min, 0.70 max Ti
	347	S34700	0.08	2.00	0.75	0.045	0.030	17.0-19.00		9.0-13.0		10x(C+N)min, 1.0 max Nb
	904L	N08904	0.020	2.00	1.00	0.045	0.035	19.0-23.00	4.00-5.00	23.0-28.0	0.10	1.00-2.00 Cu
	253MA	S30815	0.05-0.10	0.8	1.40-2.00	0.040	0.030	20.0-22.00		10.0-12.0	0.14 - 0.20	0.03-0.08 Ce
Ferritic	409*	S40910	0.030	1.00	1.00	0.040	0.020	10.5-11.7	-	0.50	0.03	6x(C+N)min, 0.50 max Ti
	3Cr12	S41003	0.030	1.50	1.00	0.040	0.015	10.5-12.5	-	0.30-1.00	0.03	
	3Cr12Ti	-	0.030	2.00	1.00	0.040	0.030	10.5-12.5	-	1.50	-	4x(C+N)min, 0.60 max Ti
	430	S43000	0.12	1.00	1.00	0.040	0.030	16.0-18.0	-	0.75	-	
	430F	S43020	0.12	1.25	1.00	0.060	0.15 min	16.0-18.0	-	-	-	
	F20S	-	0.030	1.00	1.00	0.040	0.030	19.0-21.0	-	-	0.03	4x(C+N)min, 0.60 max Ti
	444	S44400	0.025	1.00	1.00	0.040	0.030	17.5-19.5	1.75-2.50	1.00	0.035	0.20+4x(C+N) Ti+Nb, 0.80max
446	S44600	0.20	1.50	1.00	0.040	0.030	23.0-27.0	-	0.75	0.25		

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Type	Grade	UNS	C	Mn	Si	P	S	Cr	Mo	Ni	N	Other
<b>Duplex</b>	2101	S32101	0.04	4.00-6.00	1.00	0.040	0.030	21.0-22.0	0.10-0.80	1.35-1.70	0.20-0.25	0.10-0.80 Cu
	2304	S32304	0.030	2.50	1.00	0.040	0.030	21.5-24.5	0.05-0.60	3.0-5.5	0.05-0.20	0.05-0.60 Cu
	2205	S32250	0.030	2.00	1.00	0.030	0.020	22.0-23.0	3.0-3.5	4.5-6.5	0.14-0.20	
	329	S32900	0.08	1.00	0.75	0.040	0.030	23.0-28.0	1.00-2.00	2.0-5.0	-	
	2507	S32750	0.030	1.20	0.80	0.035	0.020	24.0-26.0	3.0-5.0	6.0-8.0	0.24-0.32	0.50 Cu
	2507Cu	S32520	0.030	1.50	0.80	0.035	0.020	24.0-26.0	3.0-4.0	5.5-8.0	0.20-0.35	0.50-2.00 Cu
	Zeron100	S32760	0.030	1.00	1.00	0.030	0.010	24.0-26.0	3.0-4.0	6.0-8.0	0.20-0.30	0.50-1.00 Cu, 0.50-1.00 W
<b>Martensitic</b>	410	S41000	0.08-0.15	1.00	1.00	0.040	0.030	11.5-13.5	-	0.75	-	
	416	S41600	0.15	1.25	1.00	0.060	0.15 min	12.0-14.0	-	-	-	
	420	S42000	0.15 min	1.00	1.00	0.040	0.030	12.0-14.0	-	-	-	
	431	S43100	0.20	1.00	1.00	0.040	0.030	15.0-17.0	-	1.25-2.50	-	
	440C	S44004	0.95-1.20	1.00	1.00	0.040	0.030	16.0-18.0	0.75	-	-	
<b>P.H</b>	630	S17400	0.07	1.00	1.00	0.040	0.030	15.0-17.5	-	3.00-5.00	-	3.00-5.00 Cu, 0.15-0.45Nb+Ta
	631	S17700	0.09	1.00	1.00	0.040	0.030	16.00-18.00	-	6.50-7.75	-	0.75-1.50 Al

Single values are maxima.

Values listed are from ASTM A240M for flat rolled product, except for those grades only available in other products such as bar or wire, where limits in these ASTM specifications for these products are quoted.

\* Grade 409 now largely replaced by S40910, S40920 and S40930– refer to specifications for details.

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#### Specified Mechanical Properties

Type	Grade	UNS No	Tensile Strength (MPa) min.	Yield Strength (MPa) min.	Elongation (50% in 50mm) min.	Harness max.	
						Rockwell (HR B)	Brinell (HB)
Austenitic	201	S20100	515	260	40	95	217
	202	S20200	620	260	40	-	241
	301	S30100	515	205	40	95	217
	302HQ	S30430	(450)	(205)	(70)	-	-
	303	S30300	-	-	-	-	262
	304	S30400	515	205	40	92	201
	304L	S30403	485	170	40	92	201
	304H	S30409	515	205	40	92	201
	304N	S30451	550	240	30	95	217
	309S	S30908	515	205	40	95	217
	310H	S31009	515	205	40	95	217
	310S	S31008	515	205	40	95	217
	316	S31600	515	205	40	95	217
	316L	S31603	485	170	40	95	217
	316H	S31609	515	205	40	95	217
	316N	S31651	550	240	35	95	217
	316Ti	S31635	515	205	40	95	217
	317L	S31703	515	205	40	95	217
	321	S32100	515	205	40	95	217
	347	S34700	515	205	40	92	201
904L	N08904	490	220	35	90	-	
253MA	S30815	600	310	40	95	217	
4565S	S34565	795	415	35	100	241	
Ferritic	409	S40910	380	207	20	95	207
	3Cr12	S41003	455	275	18	20HRC	223
	3Cr12Ti	-	460	300	18	-	220
	430	S43000	450	205	22	89	180
	430F	S43020	(552)	(380)	(25)	-	262
	F20S	-	(510)	(360)	(29)	(78)	-
	444	S44400	415	275	20	96	217
	446	S44600	450	276	20	-	219

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Type	Grade	UNS No	Tensile Strength (MPa) min.	Yield Strength (MPa) min.	Elongation (50% in 50mm) min.	Harness max.	
						Rockwell (HR B)	Brinell (HB)
Duplex	2101	S32101	680	480	30	-	290
	2304	S32304	600	400	25	32HRC	290
	2205	S32250	620	450	25	31HRC	293
	329	S32900	620	485	15	28HRC	269
	2507	S32750	795	550	15	32HRC	310
	2507Cu	S32520	770	550	25	-	310
	Zeron100	S32760	750	550	25	-	270
Martensitic	410	S41000	480	275	16	-	-
	416	S41600	(517)	(276)	(30)	-	262
	420	S42000	(655)	(345)	(25)	-	241
	431 (H&T)	S43100	850-1000	635	11	-	248-302
	440C	S44004	(758)	(448)	(14)	-	269
P.H	630 (H900)	S17400	1310	1170	10	40HRC min	388 min
	631 (CH900)	S17700	1585	-	-	-	-

The above properties are specified for each grade's most common product - generally plate or bar in the solution treated condition. Different limits apply to some other products.

Values in parentheses are typical; no values are specified. Original specifications must be consulted for definitive values.

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#### Typical Physical Properties

Grade	UNS No	Density kg/m <sup>3</sup>	Elastic Modulus (a) GPa	Mean Coefficient of Thermal Expansion (b)			Thermal Conductivity		Specific Heat 0-100°C J/kg.K	Elect. Resistivity nΩ.m
				0-100°C μm/m/°C	0-315°C μm/m/°C	0-538°C μm/m/°C	at 100°C W/m.K	at 500°C W/m.K		
201	S20100	7800	197	15.7	17.5	18.4	16.2	21.5	500	690
202	S20200	7800	-	17.5	18.4	19.2	16.2	21.6	500	690
301	S30100	8000	193	17.0	17.2	18.2	16.2	21.5	500	500
302HQ	S30430	8000	193	17.2	17.8	18.8	16.3	21.5	500	500
303	S30300	8000	193	17.3	17.8	18.4	16.2	21.5	500	500
304	S30400	8000	193	17.2	17.8	18.4	16.2	21.5	500	500
304L	S30403	8000	193	17.2	17.8	18.4	16.2	21.5	500	500
304H	S30409	8000	193	17.2	17.8	18.4	16.2	21.5	500	500
304N	S30451	8000	196	17.2	17.8	18.4	16.3	21.5	500	500
309S	S30908	8000	200	15.0	16.6	17.2	15.6	18.7	500	780
310H	S31009	7750	200	15.9	16.2	17.0	14.2	18.7	500	720
310S	S31008	7750	200	15.9	16.2	17.0	14.2	18.7	500	720
316	S31600	8000	193	15.9	16.2	17.5	16.3	21.5	500	740
316L	S31603	8000	193	15.9	16.2	17.5	16.3	21.5	500	740
316H	S31609	8000	193	15.9	16.2	17.5	16.3	21.5	500	740
316N	S31651	8000	196	15.9	16.2	17.5	14.4	-	500	740
316Ti	S31635	8000	193	15.9	16.2	17.5	16.3	21.5	500	740
317L	S31703	8000	200	16.5	17.0	18.1	14.4	-	500	790
321	S32100	8000	193	16.6	17.2	18.6	16.1	22.2	500	720
347	S34700	8000	193	16.6	17.2	18.6	16.1	22.2	500	720
904L	N08904	8000	200	15.0	-	-	13.0	-	500	850
253MA	S30815	7800	200	17.0	17.2	18.0	14.0	18.0	500	850
4565S	S34565	8000	190	14.5	16.3	17.2	14.5	-	510	920
409	S40910	7600	208	11.0	11.7	12.4	25.8	27.5	460	600
3Cr12	S41003	7740	200	10.8	11.3	12.5	30.5	40.0	480	570
3Cr12Ti	-	7740	200	10.8	11.3	12.5	30.5	40.0	480	570
430	S43000	7750	200	10.4	11.0	11.4	23.9	26.0	460	600
430F	S43020	7750	200	10.4	11.0	11.4	26.1	26.3	460	600
F20S	-	7700	210	11.5	12.0	12.5	21.3	-	450	700
444	S44400	7800	200	10.0	10.6	11.4	26.8	-	420	620
446	S44600	7800	200	10.4	10.8	11.2	20.9	24.4	500	670



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Grade	UNS No	Density kg/m <sup>3</sup>	Elastic Modulus (a) GPa	Mean Coefficient of Thermal Expansion (b)			Thermal Conductivity		Specific Heat 0-100°C J/kg.K	Elect. Resistivity nΩ.m
				0-100°C μm/m/°C	0-315°C μm/m/°C	0-538°C μm/m/°C	at 100°C W/m.K	at 500°C W/m.K		
2101	S32101	7800	200	13.0	14.0	-	16.0	-	500	800
2304	S32304	7800	200	13.0	-	-	16.0	-	470	850
2205	S32250	7805	200	13.7	14.7	-	19.0	-	450	850
329	S32900	7800	186	10.1	11.5	-	-	-	460	750
2507	S32750	7800	200	13.0	14.0	-	17.0	-	470	-
2507Cu	S32520	7810	205	13.5	14.0	14.5	17.0	-	450	850
Zeron100	S32760	7840	190	12.6	13.9	-	14.4	-	480	850
410	S41000	7750	200	9.9	11.4	11.6	24.9	28.7	460	570
416	S41600	7750	200	9.9	11.0	11.6	24.9	28.7	460	570
420	S42000	7750	200	10.3	10.8	11.7	24.9	-	460	550
431	S43100	7750	200	10.2	12.1	-	20.2	-	460	720
440C	S44004	7650	200	10.1	10.3	11.7	24.2	-	460	600
630	S17400	7750	196	10.8	11.6	-	18.4	22.7	460	800
631	S17700	7800	204	11.0	11.6	-	16.4	21.8	460	830

**Notes:**

(a) 1 GPa = 1000 MPa (b) μm/m/°C = microns/metre/°C = x10-6/°C

Properties given are typical for the annealed condition.

Magnetic Permeability of all 300 series austenitic steels in the annealed condition is approximately 1.02.

### Specifications & Grade Designations

Australian “common usage” grades are based upon the ASTM (American Society for Testing and Materials) designations; variations of this system have also been adopted in many other countries, including USA, Canada and Japan, and are well-recognised throughout the rest of the world.

Certain grades of stainless steel have no equivalents in this system, particularly some European and newer grades. All metals in regular production have been allocated UNS (Unified Numbering System) designations by ASTM and SAE; these are often referred to in ASTM and other national specifications. “Euronorms” are increasingly used across the European Union; the grades are usually functionally compatible with ASTM/UNS grades, but may vary in their details.

Note that “AISI” was the organisation that first codified the three-digit designation system, and steels are still widely referred to as e.g. “AISI 304”, but AISI is not a standards-writing body – such designations are well recognised but should not be used as specifications for products. Product specifications (such as ASTM A240M for stainless steel flat rolled) do use the same grade designations but have clear requirements for composition limits, and also for mechanical properties, dimensions, testing procedures etc.



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#### References & Further Information

- Stahlschlüssel “Key to Steel”.
- Iron and Steel Society “Steel Products Manual – Stainless Steels”, 1999 edition.
- ASM Alloy Digest Sourcebook – Stainless Steels.
- ASTM A240/A240M-11a “Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications”.
- EN 10088-1:2005 “Stainless steels – Part 1: List of stainless steels”.

#### **Limitation of Liability**

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