Stainless Steel – EN Standards for Cold Rolled

The old BS1449 standard has been replaced by two EN Standards:

Standard	Scope
EN10088-2	Replaces BS1449-Part 2: 1983
EN10059	Cover Heat Resisting Grades
EN10259	Tolerances for COLD Rolled material

For those familiar with the old BS standard it is useful to highlight where the new EN standards differ:

- 27 grades in BS have been replaced by 68 grades in EN and thus many EN grades do not have an old BS equivalent
- Mechanical Properties have been changed
- Tensile strengths are now higher and a maximum is stipulated
- Chemical Compositions vary slightly with Nickel contents being slightly lower
- 304S15, 304S16 & 304S31 have all been replaced by 1.4301
- EN 10088-2 states that Class A thickness tolerances shall normally be produced
- Surface Finish Standards have been extended and some changed

Material Certification

Where multi-certification is required, a combination of EN10088-2, EN10029 or 10051 will appear together with the appropriate ASTM Standards.

Flatness Tolerances

Nominal Length (L) (mm)	Normal Tolerance (mm)
Up to 3000	10
Over 32000	12

Length Tolerances

Nominal Length (L) (mm)	Normal Tolerance (mm)
Up to 2000	+5 / –0
Over 2000	+0.0025 X L / –0

Thickness Tolerances – EN10259

Thickness	Tolerance in mm (+ or –) for given width in mm		
	1000	**1250**	**1500**
Under 0,30	0.03	-	-
0.30 to 0.49	0.04	0.04	-
0.50 to 0.59	0.045	0.05	-
0.6 to 0.79	0.05	0.05	-
0.8 to 0.99	0.055	0.06	0.06
1,0 to 1.19	0.06	0.07	0.07
1.2 to 1.49	0.07	0.08	0/08
1.5 to 1.99	0.08	0.09	0.10
2.0 to 2.49	0.09	0.10	0.11
2.5 to 2,.99	0.11	0.12	0.12
3.0 to 3.99	0.13	0.14	0.14

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Width Tolerances

Thickness (mm)	All Plus Tolerance in mm for given width in mm (i.e. – 0)	
	1000	1250 & 1500
Under 1.5	+ 1.5	+ 2.0
1.5 to 2.49	+ 2.0	+ 2.5
2.5 to 3.49	+ 3.0	+ 3.0
3.5 and over	+ 4.0	+ 4.0

Comparative Grades

AUSTENITIC				FERRITIC/MARTENSITIC	
BS 1449-2	EN 10088-2	BS 1449-2	EN 10088-2	BS 1449-2	EN 10088-2
284S16	-	316S13	1.4432	403S17	1.4000
301S21	1.4310	316S31	1.4401	405S17	1.4002
304S11	1.4307	316S33	1.4436	409S19	1.4512
304S15	1.4301	317S12	1.4438	430S17	1.4016
304S16	1.4301	317S16	-	434S17	1.4016
304S31	1.4301	320S31	1.4571	410S31	1.4006
305S19	1.4303	320S33	-	420S45	1.4028
315S16	-	321S31	1.4541		
316S11	1.4404	347S31	1.4550		
N.B. The grades stated are the nearest comparisons and not direct equivalents.					

Main Grade Differences

Grade	Carbon (%)		Chrome (%)		Nickel (%)		UTS (N/mm²)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
304S15	-	0.06	17.5	19.0	8.0	11.0	500	-
304S16	-	0.06	17.5	19.0	9.0	11.0	500	-
304S31	-	0.07	17.0	19.0	8.0	11.0	490	690
1.4301	-	0.07	17.0	19.5	8.0	10.5	540*	750*
304S11	-	0.03	17.0	19.0	9.0	12.0	480	-
1.4307	-	0.03	17.5	19.5	8.0	10.0	520*	670*
316S31	-	0.07	16.5	18.5	10.5	13.5	510	-
1.4401	-	0.07	16.5	18.5	10.0	13.0	530*	680*
316S11	-	0.03	16.5	18.5	11.0	14.0	490	-
1.4404	-	0.03	16.5	18.5	10.0	13.0	530*	680*
* Tensile properties stated apply to steels in the solution annealed condition.								

Stainless Steel – EN Standards for Cold Rolled

Finishes according to BS EN 10088-2 / 10028-7

BS EN Finish	Old BS Finish	Description
Hot Rolled		
1C	**0**	Hot rolled, heat treated, not descaled
1E	**1**	Hot rolled, heat treated, mechanically descaled
1D	**1**	Hot rolled, heat treated, pickled
1U	**-**	Hot rolled, not heat treated, not descaled
Cold Rolled		
2C		Cold rolled, heat treated, not descaled
2E		Cold rolled, heat treated, mechanically descaled
2D	**2D**	Cold rolled, heat treated, pickled
2B	**2B**	Cold rolled, heat treated, pickled, skin passed
2R	**2A / (BA)**	Cold rolled, bright annealed
2Q		Cold rolled, hardened and tempered, scale-free
Special Finishes*		
1G or 2G		Ground
1J or 2J	**3B**	Brushed or dull polished
1J or 2J	**4**	Polished with fine grit
1K or 2K	**5**	Satin polished
1P or 2P	**7**	Bright buffed
1P or 2P	**8**	Bright polished
1M or 2M		Patterned
2L		Coloured
2W		Corrugated
1S or 2S		Surface Coated (Metallic coatings such as tin, lead or aluminium)

***Note:** Special finishes indicate hot rolled (1) and cold rolled (2) sheets,
e.g. Ground polished hot rolled sheets = 1G
Ground polished cold rolled sheets = 2G

For more information on stainless steel finishes please refer to the Aalco technical datasheet on this subject.

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Stainless Steel Grades, Compositions & Typical Mechanical Properties

EN	BS	AISI	EN No.	Composition Guide					Typical Mechanical Properties (Rolled Products)		
			Obsolete	C	Cr	Ni	Mo	Others	Proof Strength 0.2% Nmm$_2$	Tensile Strength Nmm$_2$	Elongation %
1.4000	403S17	410S	–	0.08x	12	.	.	.	220-250	400-600	19
1.4002	405S17	405	–	0.08x	12	.	.	0.2 Al	210-250	400-600	17
1.4003	–	–	–	0.03x	11	0.5	.	.	250-320	450-650	18-20
1.4016	430S17	430	60	0.08x	17	.	.	.	240-280	430-630	18-20
1.4113	434S17	434	–	0.08x	17	.	1	.	260-280	450-630	18
1.4509	–	–	–	0.015x	18	.	.	Nb, Ti			
1.4510	–	430Ti	–	0.05x	17	.	.	0.6 Ti	230-240	420-600	23
1.4511	–	430Nb	–	0.05x	17	.	.	0.6Nb	230-240	420-600	23
1.4512	409S19	409	–	0.03x	11	.	.	0.5 Ti	210-220	380-560	25
1.4521	–	(444)	–	0.025x	17	.	2	0.6 Ti			
1.4006	410S21	410	56A	.08-.15	12	.	.	.	400-450	550-850	12-20
1.4005	416S21	416	56AM	.08-.15	12	.	.	.35xS	450	650-850	12
1.4021	420S29	420	56B	.16-.25	12	.	.	.	450-550	650-950	10-15
1.4028	420S45	420	56D	.26-.35	12	.	.	.	600	740-1000	10-15
1.4029	416S37	416	56CM	.25-.32	12	.	.	.35xS			
1.4057	431S29	431	57	.12-.22	15	2	.	.			
1.4104	416S29	416	56BM	.10-.17	16	.	0.4	.35xS	500	650-850	10
1.4112	–	440B	–	.85-.95	17	.	1.0	0.1V		900 max	12
1.4125	–	440C	–	.95-1.2	17	.	0.6	.		900 max	12
1.4594	460S52	–	–	0.7x	14	5	1.5	1.5Cu	700-1000	930-1270	10
1.4749	–	446	–	.15-.20	26	.	.	0.2N			
1.4301	304S31	304	58E	0.07x	18	8	.	.	210-260	520-750	45
1.4303	305S19	305	–	0.06x	18	11	.	.	200-250	500-650	45
1.4305	303S31	303	58M	0.10x	18	8	.	0.35xS	190-230	500-700	35
1.4306	–	304L	–	0.030x	18	10	.	.	200-250	500-670	45
1.4307	304S11	304L	–	0.030x	18	8	.	.	200-250	500-670	45
1.4310	301S21	301	–	0.05/0.1	517	6	.	.	250-280	600-950	40
1.4311	304S61	304LN	–	0.030x	18	9	.	0.22xN	270-320	550-750	40
1.4372	–	201	–	0.15x	17	4.5	.	6.5Mn	330-380	750-950	40
1.4401	316S31	316	58J	0.07x	17	11	2	.	220-270	520-680	40
1.4404	316S11	316L	–	0.030x	17	11	2	.	220-270	520-680	40
1.4406	316S61	316LN	–	0.030x	17	11	2	0.22xN	280-330	580-780	40
1.4432	316S13	316L	–	0.030x	17	11	2.5	.	220-270	520-700	40
1.4435	316S13	316L	–	0.030x	17	13	2.5	.	220-270	520-700	40
1.4436	316S33	316	58J	0.05	17	11	2.5	.	220-270	500-730	40
1.4438	317S12	317L	–	0.030x	18	13	3	.	220-270	520-720	35
1.4439	–	–	–	0.030x	17	13	4	0.22xN	270-320	580-780	35
1.4541	321S31	321	58B	0.08x	18	9	.	0.5Ti	200-250	500-720	40
1.4550	347S31	347	58F	0.08x	18	9	.	0.5Nb	200-250	500-720	40
1.4571	320S31	(316Ti)	–	0.08x	17	11	2	0.5Ti	220-270	520-690	40
1.4539	904S13	–	–	0.020x	19	24	4	2xCu	220-270	520-730	35
1.4547	–	–	–	0.020x	20	18	6	1xCu	300-350	650-850	35
1.4833	309S16	309	–	0.15x	22	12	.	.			
1.4845	310S24	310	–	0.10x	25	20	.	.			
1.4878	321S51	321H	–	0.10x	18	9	.	0.6Ti			