

Stainless Steel – EN Standards for Bar

The old BS970 Parts 1 & 3: 1991 standards have been replaced by a number of EN Standards, the most important of which are shown below.

Standard	Scope
EN10088-3	Replaces BS970 Part 1: 1991 & BS970 Part 3: 1991 covering chemical composition & mechanical properties
EN10058	Tolerances for Hot Rolled Flat Bars
EN10059	Tolerances for Hot Rolled Square Bars
EN10060	Tolerances for Hot Rolled Round Bars
EN10061	Tolerances for Hot Rolled Hexagonal Bars
EN10278	Tolerances for Bright Bars (Drawn, Turned or Ground)
ISO186 Parts 1 & 2	Tolerance Classifications (see page 4)

Tolerances

- ◆ The ISO tolerances shown on page 4 are taken from ISO 286.
- ◆ All other tolerances shown in this document are those specified by Aalco based upon the relevant part/s of the applicable EN Standard/s.

Diameter Tolerances – Rough Turned

Diameter (mm)	Tolerance (mm)
75 to 150	-0 / +1.5
151 to 225	-0 / +2.0
226 to 410	-0 / +3.0

Diameter Tolerances – Smooth Turned

Diameter (mm)	Tolerance (mm)
18 to 30	+0 / -0.084
31 to 50	+0 / -0.100
51 to 79	+0 / -0.200

Diameter Tolerances – Bright Drawn

Diameter (mm)	Tolerance (mm)
6 to 10	+0 / -0.036
11 to 18	+0 / -0.043
19 to 30	+0 / -0.052

Thickness Tolerances – Hot Rolled Flat

Size (mm)	Tolerance (mm)
Up to 10	+ / - 0.4
10 to 20	+ / - 0.5
20 to 40	+ / - 0.6
40 to 60	+ / - 0.8
Over 60	+ / - 1.0

Width Tolerances – Hot Rolled Flat

Size (mm)	Tolerance (mm)
10 to 35	+ / - 0.5
35 to 75	+ / - 0.8
75 to 100	+ / - 1.0
100 to 125	+ / - 1.3
125 to 150	+ / - 1.5

Tolerances – Hot Rolled Square Bars

Diameter (mm)	Tolerance (mm)
75 to 150	-0 / + 1.5
151 to 225	-0 / + 2.0
226 to 410	-0 / + 3.0

Tolerances – Rolled Edge Flat Bars

Width	+ / - 1.0mm
Thickness	+ / - 0.5 mm
Flatness across width	1mm Max Variation
Flatness across length	12-40mm: 25mm Max Variation 41-100mm: 20mm Max Variation
Edge Bow across length	12-40mm: 15mm Max Variation 41-100mm: 10mm Max Variation



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All Data is indicative only and must not be seen as a substitute for the full specification from which it is drawn. In particular, the Mechanical property requirements vary widely with product form and product dimensions. For more complete details please refer to the relevant specification – The BS EN Specifications for Stainless Steel are listed on a separate Datasheet.

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Tolerances – Angle Bars

Leg Size	Leg Tolerance + / – mm	Thickness Tolerance + / – mm	Max Internal Radius mm
20 x 20	1.5	0.4	4
25 x 25	1.5	0.5	4
30 x 30	2.0	0.5	4
40 x 40	2.0	0.6	5
50 x 50	2.0	0.6	7
60 x 60	3.0	0.75	7
65 x 65	3.0	0.75	9
70 x 70	3.0	0.75	9
75 x 75	3.0	0.75	9
80 x 80	3.0	0.75	9
90 x 90	3.0	0.75	10
100 x 100	3.0	0.75	10

Comparative Grades

AUSTENITIC				MARTENSITIC	
BS 1449-2	EN 10088-2	BS 1449-2	EN 10088-2	BS 1449-2	EN 10088-2
303S31	1.4305	321S31	1.4541	410S21	1.4006
304S11	1.4307	316S11	1.4404	416S21	1.4005
304S15/S31	1.4301	316S31	1.4401	431S29	1.4057

N.B. The grades stated are the nearest comparisons and not direct equivalents.

Main Grade Differences

Grade	Carbon (%)		Chrome (%)		Nickel (%)		UTS (N/mm ²)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
303S31	-	0.12	17.0	19.0	8.0	10.0	510	-
1.4305	-	0.10	17.0	19.0	8.0	10.0	500*	750*
304S31	-	0.07	17.0	19.0	8.0	11.0	490	-
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 strengths stated apply to steels in the solution annealed condition**

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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
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			

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ISO 286 Tolerances in mm

Diameters (mm)	Tolerance in mm for given Tolerance Number							
	6	7	8	9	10	11	12	13
> 1 – 3 inc.	0.007	0.009	0.014	0.025	0.040	0.060	0.090	0.140
> 3 – 6 inc.	0.008	0.012	0.018	0.030	0.048	0.075	0.120	0.180
> 6 – 10 inc.	0.009	0.015	0.022	0.036	0.058	0.090	0.150	0.220
> 10 – 18 inc.	0.011	0.018	0.027	0.043	0.070	0.110	0.180	0.270
> 18 – 30 inc.	0.013	0.021	0.033	0.052	0.084	0.130	0.210	0.330
> 30 – 50 inc.	0.016	0.025	0.039	0.062	0.100	0.160	0.250	0.390
> 50 – 80 inc.	0.019		0.046	0.074	0.120	0.190	0.300	0.460
> 80 – 120 inc.	0.022			0.087	0.140	0.220	0.350	0.540
> 120 – 180 inc.	0.025			0.100	0.160	0.250	0.400	0.630
> 180 – 250 inc.				0.115	0.185	0.290	0.460	0.720
> 250 – 315 inc.						0.320	0.520	0.810
> 315 – 400 inc.						0.360	0.570	0.890
> 400 – 500 inc..						0.400	0.630	0.970
> 500						0.440	0.700	1.100

EXAMPLES:

H = Minus tolerance e.g. 45 mm dia **H9** = + 0 / - 0.062

J = Tolerance divided e.g. 45 mm dia **J9** = + / - 0.031

K = Plus tolerance e.g. 45 mm dia **K9** = + 0.062 / - 0

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Straightness Tolerances for BRIGHT Bars

Taken from BS EN 10278:1999, these tolerances apply only to bright bars

Deviation from Straightness

Product	Dimension	Max Deviation in mm within a 1 metre length measured at least 150mm away from either end of the bar
Round		1.0mm
Square & Hexagon	< or = 75mm	1.0mm
Square & Hexagon	> 75mm	1.5mm
Flat	Width < 120mm	On Width: 1.5mm
Flat	Width < 120mm	On Thickness: 2.0mm
Flat	Width > or = 120mm With/thickness < 10:1	On Width: 2.0mm
Flat		On Thickness: 2.5mm
Flat	Width > or = 120mm With/thickness > or = 10:1	On Width: 2.5mm
Flat		On Thickness: 3.0mm

Method of measuring deviation – Preferred Method B.1 from BS EN 10278

1. The bar shall be supported on a suitable surface so as to eliminate or minimize sagging.
2. A 1 metre long straight edge shall be placed on the surface of the bar at any position along its length. No part of the straight edge shall be within 150mm of the ends of the bar.
3. Straightness shall be determined by measuring the gap between the bar and the straight edge by suitable means such as a feeler gauge.

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