Orca Bolts

STAINLESS STEEL

Useful Information

Stainless Steel Grades - Chemical Composition (BS EN ISO 3506-1:2009 / BS EN ISO 3506-2:2009)

Steel group	Steel grade	Chemical composition[a] mass fraction, %									Footnotes
		C	Si	Mn	P	S	Cr	Mo	Ni	Cu	
Austenitic	A1	0,12	1	6,5	0,2	0,15 to 0,35	16 to 19	0,7	5 to 10	1,75 to 2,25	bcd
	A2	0,10	1	2	0,05	0,03	15 to 20	– [e]	8 to 19	4	fg
	A3	0,08	1	2	0,045	0,03	17 to 19	– [e]	9 to 12	1	h
	A4	0,08	1	2	0,045	0,03	16 to 18,5	2 to 3	10 to 15	4	gi
	A5	0,08	1	2	0,045	0,03	16 to 18,5	2 to 3	10,5 to 14	1	hi
Martensitic	C1	0,09 to 0,15	1	1	0,05	0,03	11,5 to 14	–	1	–	i
	C3	0,17 to 0,25	1	1	0,04	0,03	16 to 18	–	1,5 to 2,5	–	–
	C4	0,08 to 0,15	1	1,5	0,06	0,15 to 0,35	12 to 14	0,6	1	–	bi
Ferritic	F1	0,12	1	1	0,04	0,03	15 to 18	– [j]	1	–	kl

NOTE 1 A description of the groups and grades of stainless steels also entering into their specific properties and applications is given in Annex B.
NOTE 2 Examples of stainless steels standardized in accordance with ISO 683-13 and ISO 4954 are given in Annexes C and D, respectively.
NOTE 3 Certain materials for specific application are given in Annex E.

a Values are maximum, unless otherwise indicated.
b Sulfur may be replaced by selenium.
c If the nickel content is below 8 %, the minimum manganese content shall be 5 %.
d There is no minimum limit to the copper content, provided that the nickel content is greater than 8 %.
e Molybdenum may be present at the discretion of the manufacturer. However, if for some applications limiting of the molybdenum content is essential, this shall be stated at the time of ordering by the purchaser.
f If the chromium content is below 17 %, the minimum nickel content should be 12 %.
g For austenitic stainless steels having a maximum carbon content of 0,03 %, nitrogen may be present to a maximum of 0,22 %.
h This shall contain titanium B 5 x C up to 0,8 % maximum for stabilization and be marked appropriately as specified in this table, or shall contain niobium (columbium) and/or tantalum B 10 x C up to 1,0 % maximum for stabilization and be marked appropriately as specified in this table.
i At the discretion of the manufacturer, the carbon content may be higher where required in order to obtain the specified mechanical properties at larger diameters, but shall not exceed 0,12 % for austenitic steels.
j Molybdenum may be present at the discretion of the manufacturer.
k This may contain titanium B 5 x C up to 0,8 % maximum.
l This may contain niobium (columbium) and/or tantalum B 10 x C up to 1 % maximum.

Mechanical Properties for Bolts, Screws and Studs - Austenitic Steel Grades (BS EN ISO 3506-1:2009)

Steel group	Steel grade	Property class	Tensile strength R_m [a] min. MPa	Stress at 0,2 % permanent strain $R_{p0,2}$ [a] min. MPa	Elongation after fracture A [b] min. mm
Austenitic	A1, A2,	50	500	210	0,6d
	A3, A4,	70	700	450	0,4d
	A5	80	800	600	0,3d

[a] The tensile stress is calculated on the stress area (see Annex A).
[b] This is determined according to 7.2.4, on the actual screw length and not on a prepared test piece.

Mechanical Properties for Bolts, Screws and Studs - Martensitic and Ferritic Steel Grades (BS EN ISO 3506-1:2009)

Steel group	Steel grade	Property class	Tensile strength R_m [a] min. MPa	Stress at 0,2 % permanent strain $R_{p0,2}$ [a] min. MPa	Elongation after fracture A [b] min. mm	Hardness HB	Hardness HRC	Hardness HV
Martensitic	C1	50	500	250	0,2d	147 to 209	–	155 to 220
		70	700	410	0,2d	209 to 314	20 to 34	220 to 330
		110[c]	1 100	820	0,2d	–	36 to 45	350 to 440
	C3	80	800	640	0,2d	228 to 323	21 to 35	240 to 340
	C4	50	500	250	0,2d	147 to 209	–	155 to 220
		70	700	410	0,2d	209 to 314	20 to 34	220 to 330
Ferritic	F1[d]	45	450	250	0,2d	128 to 209	–	135 to 220
		60	600	410	0,2d	171 to 271	–	180 to 285

[a] The tensile stress is calculated on the stress area (see Annex A).
[b] This is determined according to 7.2.4, on the actual screw length and not on a prepared test piece.
[c] Hardened and tempered at a minimum tempering temperature of 275 °C.
[d] Nominal thread diameter $d \leq 24$ mm.

Mechanical Properties for Nuts - Austenitic Steel Grades (BS EN ISO 3506-2:2009)

Steel group	Steel grade	Property class		Stress under proof load S_p min. MPa	
		Nuts with $m \geq 0{,}8D$	Nuts with $0{,}5D \leq m < 0{,}8D$	Nuts with $m \geq 0{,}8D$	Nuts with $0{,}5D \leq m < 0{,}8D$
Austenitic	A1, A2,	50	025	500	250
	A3, A4,	70	035	700	350
	A5	80	040	800	400

Mechanical Properties for Nuts - Martensitic and Ferritic Steel Grades (BS EN ISO 3506-2:2009)

Steel group	Steel grade	Property class		Stress under proof load S_p min. MPa		Hardness		
		Nuts with $m \geq 0{,}8D$	Nuts with $0{,}5D \leq m < 0{,}8D$	Nuts with $m \geq 0{,}8D$	Nuts with $0{,}5D \leq m < 0{,}8D$	HB	HRC	HV
Martensitic	C1	50	025	500	250	147 to 209	–	155 to 220
		70	–	700	–	209 to 314	20 to 34	220 to 330
		110[a]	055[a]	1 100	550	–	36 to 45	350 to 440
	C3	80	040	800	400	228 to 323	21 to 35	240 to 340
	C4	50	–	500	–	147 to 209	–	155 to 220
		70	035	700	350	209 to 314	20 to 34	220 to 330
Ferritic	F1[b]	45	020	450	200	128 to 209	–	135 to 220
		60	030	600	300	171 to 271	–	180 to 285

[a] Hardened and tempered at a minimum tempering temperature of 275 °C.

[b] Nominal thread diameter $D \leq 24$ mm.

Unit Conversion Table

From imperial unit to metric unit

Symbol	When you know	Conversion Factor (Multiply By)	To Find	Symbol
		LENGTH		
in	inch	25.4	millimeter	mm
ft	foot	0.305	meter	m
		AREA		
in^2	square inch	645.2	square millimeter	mm^2
ft^2	square feet	0.093	square meter	m^2
		VOLUME		
fl oz	ounce (fluid imperial)	29.57	milliiter	mL
gal	gallon	3.785	liter	L
		MASS		
oz	ounce	28.35	gram	g
lb	pound	0.454	kilogram	kg
		TEMPERATURE		
°F	Fahrenheit	(F-32) x 5 / 9	Celsius	°C
		FORCE		
lbf	poundforce	4.45	netwon	N
kgf	kilogram-force	9.806	netwon	N
		PRESSURE		
kgf/mm^2	kilogram-force per square millimeter	9.806×10^6	pascal	Pa (N/m^2)
		TORQUE / MOMENT OF FORCE		
in lbf	inch-pound force	0.113	newton meter	N·m

From metric unit to imperial unit

Symbol	When you know	Conversion Factor (Multiply By)	To Find	Symbol
		LENGTH		
mm	millimeter	0.039	inch	in
m	meter	3.28	foot	ft
		AREA		
mm^2	square millimeter	0.0016	square inch	in^2
m^2	square meter	10.764	square feet	ft^2
		VOLUME		
mL	milliliter	0.034	ounce (fluid imperial)	fl oz
L	liter	0.264	gallon	gal
		MASS		
g	gram	0.035	ounce	oz
kg	kilogram	2.202	pound	lb
		TEMPERATURE		
°C	Celsius	1.8C + 32	Fahrenheit	°F
		FORCE		
N	netwon	0.225	poundforce	lbf
N	netwon	0.102	kilogram-force	kgf
		PRESSURE		
Pa (N/m^2)	pascal	0.102×10^{-6}	kilogram-force per square millimeter	kgf/mm^2
		TORQUE / MOMENT OF FORCE		
N·m	newton meter	8.85	inch-pound force	in lbf

Normative Reference:

BS 192:Part 1:1996, Specification for open-ended wrenches. Part 1. Metric and unified
BS 3692:2001, ISO metric precision hexagon bolts, screws and nuts. Specification
BS 4190:2001, ISO metric black hexagon bolts, screws and nuts. Specification
BS 4320:1968, Specification for metal washers for general engineering purposes. Metric series
BS 4929-1:1973, Specification for steel hexagon prevailing-torque type nuts. Metric series
BS 7371-3:1993, Coatings on metal fasteners. Specification for electroplated zinc and cadmium coatings
BS 7371-6:1998, Coatings on metal fasteners. Specification for hot dipped galvanized coatings
BS EN 20273:1992, Fasteners. Clearance holes for bolts and screws
BS EN ISO 898-1:2009, Mechanical properties of fasteners made of carbon steel and alloy steel.
Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread
BS EN ISO 1461:2009, Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
BS EN ISO 2320:2008, Prevailing torque type steel nuts. Mechanical and performance properties
BS EN ISO 3506-1:2009, Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs
BS EN ISO 3506-2:2009, Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts
BS EN ISO 4014:2001, Hexagon head bolts. Product grades A and B
BS EN ISO 4017:2001, Hexagon head screws. Product grades A and B
BS EN ISO 4032:2001, Hexagon nuts, style 1. Product grades A and B
BS EN ISO 7089:2000, Plain washers. Normal series. Product grade A
BS EN ISO 8044:2000, Corrosion of metals and alloys. Basic terms and definitions
DIN 931-1:1987-09, M 1,6 to M 39 hexagon head bolts; product grades A and B
DIN 931-2:1987-09, M 42 to M 160 x 6 hexagon head bolts; product grade B
DIN 933:1987-09, M 1,6 to M 52 hexagon head screws threaded up to the head; product grades A and B
DIN 934:1987-10 ,Hexagon nuts with metric coarse and fine pitch thread; product grades A and B

WRENCH SIZE FOR HEXAGON HEAD SCREWS/BOLTS

M6 wrench **10mm**

M8 wrench **13mm**

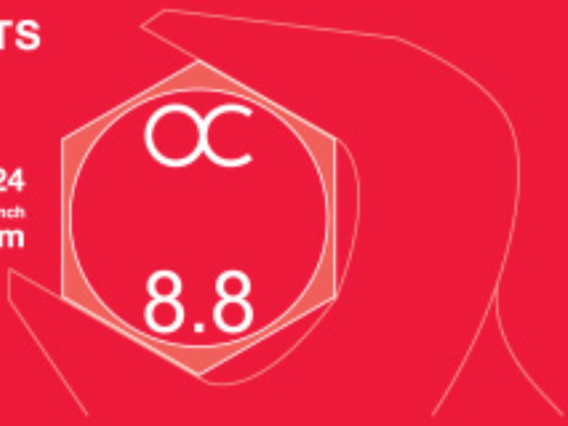
M10 wrench **17mm**

M12 wrench **19mm**

M16 wrench **24mm**

M20 wrench **30mm**

M24 wrench **36mm**



M30 wrench **46mm**

M36 wrench **55mm**

All drawings are in 1:1 ratio
Reference: BS 192: Part 1:1996

Orca Bolts
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