KOS

HEXAGONAL HEAD BOLT

CE
EN 14592

CE MARKING
Metal connector with cylindrical shank with CE marking to EN 14592 to guarantee suitability for use.

HIGH RESISTANCE
Hexagonal head bolt in strength class 8.8 supplied with an incorporated nut (for the carbon steel version).

STAINLESS STEEL VERSION
Also available in A2 | AISI 304.austenitic stainless steel. Suitable for outdoor applications (SC3) up to 1 km from the sea and on class T4 acid wood.

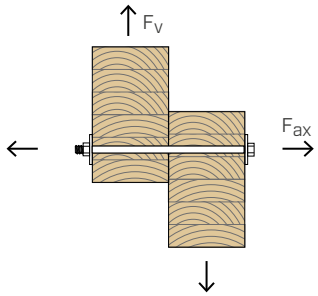
KOS | KOS A2

DIAMETER [mm]	7,5	12		20
LENGTH [mm]	55	100	500	1000

MATERIAL

Zn ELECTRO PLATED	electro-galvanised carbon steel class 8.8	SC2	C2	T2
A2 AISI 304	A2 stainless steel	SC3	C4	T4

EXTERNAL LOADS



FIELDS OF USE

Assembly and structural connection of timber components for timber-to-timber and timber-to-steel shear connections
- solid timber and glulam
- CLT, LVL
- timber based panels

CODES AND DIMENSIONS

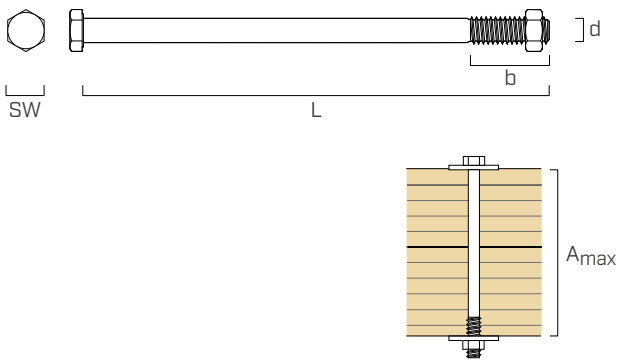
KOS - hexagonal head bolt with nut

steel class 8.8 - electrogalvanized - DIN 601

Zn ELECTRO PLATED

d [mm] *[in]*	CODE	L [mm]	*L [in]*	b [mm]	A_{max} [mm]	pcs
M12 SW19 *0.48*	KOS12100B	100	*4*	30	75	25
	KOS12120B	120	*4 3/4*	30	95	25
	KOS12140B	140	*5 1/2*	36	115	25
	KOS12160B	160	*6 1/4*	36	135	25
	KOS12180B	180	*7 1/8*	36	155	25
	KOS12200B	200	*8*	36	175	25
	KOS12220B	220	*8 5/8*	49	195	15
	KOS12240B	240	*9 1/2*	49	215	15
	KOS12260B	260	*10 1/4*	49	235	15
	KOS12280B	280	*11*	49	255	15
	KOS12300B	300	*11 3/4*	49	275	15
	KOS12320B	320	*12 5/8*	49	295	15
	KOS12340B	340	*13 3/8*	49	315	15
	KOS12360B	360	*14 1/4*	49	335	15
	KOS12380B	380	*15*	49	355	15
	KOS12400B	400	*15 3/4*	49	375	15
M16 SW24 *0.63*	KOS16140B	140	*5 1/2*	44	105	15
	KOS16160B	160	*6 1/4*	44	125	15
	KOS16180B	180	*7 1/8*	44	145	15
	KOS16200B	200	*8*	44	165	15
	KOS16220B	220	*8 5/8*	57	185	15
	KOS16240B	240	*9 1/2*	57	205	10
	KOS16260B	260	*10 1/4*	57	225	10
	KOS16280B	280	*11*	57	245	10
	KOS16300B	300	*11 3/4*	57	265	10
	KOS16320B	320	*12 5/8*	57	285	10
	KOS16340B	340	*13 3/8*	57	305	10
	KOS16360B	360	*14 1/4*	57	325	5
	KOS16380B	380	*15*	57	345	5
	KOS16400B	400	*15 3/4*	57	365	5
	KOS16420B	420	*16 9/16*	57	385	5
	KOS16440B	440	*17 1/4*	57	405	5
	KOS16460B	460	*18 1/8*	57	425	5
	KOS16500B	500	*19 3/4*	57	465	5

d [mm] *[in]*	CODE	L [mm]	*L [in]*	b [mm]	A_{max} [mm]	pcs
M20 SW30 *0.79*	KOS20140B	140	*5 1/2*	52	95	10
	KOS20160B	160	*6 1/4*	52	115	10
	KOS20180B	180	*7 1/8*	52	135	10
	KOS20200B	200	*8*	52	155	5
	KOS20220B	220	*8 5/8*	65	175	5
	KOS20240B	240	*9 1/2*	65	195	5
	KOS20260B	260	*10 1/4*	65	215	5
	KOS20280B	280	*11*	65	235	5
	KOS20300B	300	*11 3/4*	65	255	5
	KOS20320B	320	*12 5/8*	65	275	5
	KOS20340B	340	*13 3/8*	65	295	5
	KOS20360B	360	*14 1/4*	65	315	5
	KOS20380B	380	*15*	65	335	5
	KOS20400B	400	*15 3/4*	65	355	5
	KOS20420B	420	*16 9/16*	65	375	5
	KOS20440B	440	*17 1/4*	65	395	5
	KOS20460B	460	*18 1/8*	65	415	5



The maximum fastening thickness that can be fastened A_{max} is calculated considering the use of MUT934 nut (see page 178) and two ULS 440 washers (see page 176).

KOS A2 | AISI304 - hexagonal head bolt[1]

A2 | AISI304 - DIN 931 stainless steel

A2 AISI 304

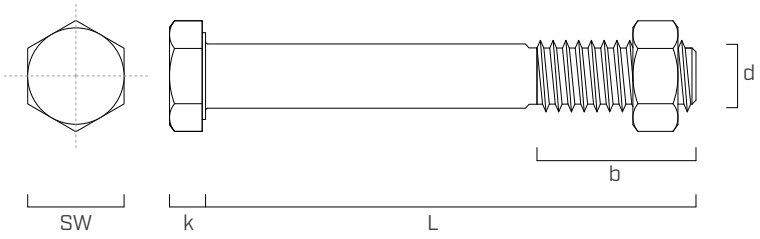
d [mm] *[in]*	CODE	L [mm]	*L [in]*	A_{max} [mm]	pcs
M12 SW19 *0.48*	AI60112100	100	*4*	75	25
	AI60112120	120	*4 3/4*	95	25
	AI60112140	140	*5 1/2*	115	25
	AI60112160	160	*6 1/4*	135	10
	AI60112180	180	*7 1/8*	155	10
	AI60112200	200	*8*	175	10
	AI60112220	220	*8 5/8*	195	10
	AI60112240	240	*9 1/2*	215	10
	AI60112260	260	*10 1/4*	235	10
M16 SW24 *0.63*	AI60116120	120	*4 3/4*	90	25
	AI60116140	140	*5 1/2*	110	25
	AI60116160	160	*6 1/4*	130	25
	AI60116180	180	*7 1/8*	150	10
	AI60116200	200	*8*	170	10
	AI60116220	220	*8 5/8*	190	10
	AI60116240	240	*9 1/2*	210	10
	AI60116260	260	*10 1/4*	230	10
	AI60116280	280	*11*	250	10
	AI60116300	300	*11 3/4*	270	10

d [mm] *[in]*	CODE	L [mm]	*L [in]*	A_{max} [mm]	pcs
M20 SW30 *0.79*	AI60120160	160	*6 1/4*	125	10
	AI60120180	180	*7 1/8*	145	10
	AI60120200	200	*8*	165	10
	AI60120220	220	*8 5/8*	185	10
	AI60120240	240	*9 1/2*	205	10
	AI60120260	260	*10 1/4*	225	10
	AI60120280	280	*11*	245	10
	AI60120300	300	*11 3/4*	265	10
	AI60120320	320	*12 5/8*	285	5
	AI60120340	340	*13 3/8*	305	5
	AI60120360	360	*14 1/4*	325	5
	AI60120380	380	*15*	345	5
	AI60120400	400	*15 3/4*	365	5

[1]Not holding CE marking

The maximum fastening thickness that can be fastened A_{max} is calculated considering the use of MUTAI934 nut (see page 178) and two ULS AI 9021 washers (see page 177).

GEOMETRY AND MECHANICAL CHARACTERISTICS | KOS



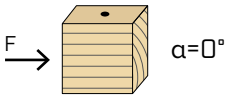
GEOMETRY

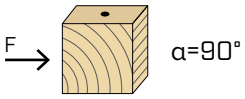
Nominal diameter	**d_1**	**[mm]**		**M12**	**M16**	**M20**
Wrench	SW	[mm]		SW 19	SW 24	SW 30
Head thickness	k	[mm]		7,50	10,00	12,50
Thread length	b	[mm]	L ≤ 125 mm	30	38	46
		[mm]	125 < L ≤ 200 mm	36	44	52
		[mm]	L > 200 mm	49	57	65

CHARACTERISTIC MECHANICAL PARAMETERS

			KOS			KOS A2		
Nominal diameter	**d_1**	**[mm]**	**M12**	**M16**	**M20**	**M12**	**M16**	**M20**
Yield moment	$M_{y,k}$	[Nm]	153,0	324,0	579,0	134,0	284,0	507,0
Steel ultimate strength	$f_{u,k}$	[N/mm^2]	800	800	800	700	700	700
Steel type	-	-	8,8	8,8	8,8	A2-70	A2-70	A2-70

MINIMUM DISTANCES FOR BOLTS SUBJECT TO SHEAR

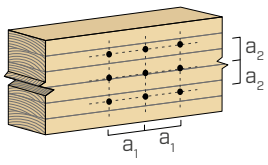




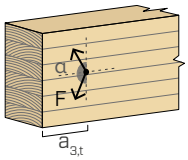
d	**[mm]**		**12**	**16**	**20**
a_1	[mm]	**5·d**	60	80	100
a_2	[mm]	**4·d**	48	64	80
$a_{3,t}$	[mm]	**max (7·d ; 80 mm)**	84	112	140
$a_{3,c}$	[mm]	**4·d**	48	64	80
$a_{4,t}$	[mm]	**3·d**	36	48	60
$a_{4,c}$	[mm]	**3·d**	36	48	60

d	**[mm]**		**12**	**16**	**20**
a_1	[mm]	**4·d**	48	64	80
a_2	[mm]	**4·d**	48	64	80
$a_{3,t}$	[mm]	**max (7·d ; 80 mm)**	84	112	140
$a_{3,c}$	[mm]	**7·d**	84	112	140
$a_{4,t}$	[mm]	**4·d**	48	64	80
$a_{4,c}$	[mm]	**3·d**	36	48	60

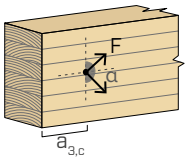
α = load-to-grain angle
d = nominal bolt diameter



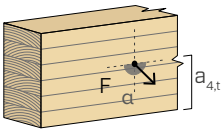
stressed end
-90° < α < 90°



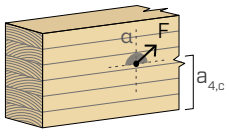
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

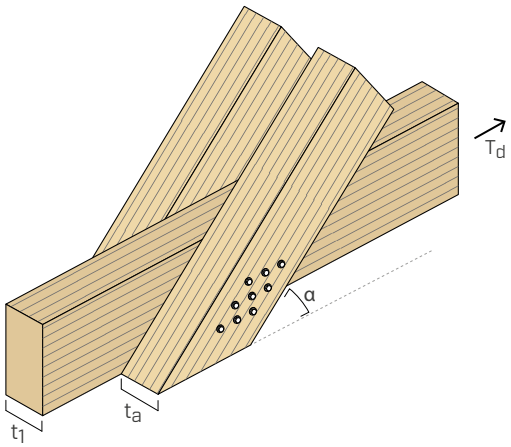


NOTES

- The minimum distances are compliant with EN 1995-1-1.

STRUCTURAL VALUES | KOS

NODE WITH 3 WOODEN ELEMENTS



d [mm]	L [mm]	t_a [mm]	t_1 [mm]	$R_{v,k,0°}$ [kN]	$R_{v,k,30°}$ [kN]	$R_{v,k,45°}$ [kN]	$R_{v,k,60°}$ [kN]	$R_{v,k,90°}$ [kN]
12	220	60	60	20,00	20,00	20,00	19,27	18,53
	240	60	80	22,46	21,18	20,14	19,27	18,53
	260	60	100	22,46	21,18	20,14	19,27	18,53
	280	60	120	22,46	21,18	20,14	19,27	18,53
	300	80	100	26,02	24,27	22,84	21,65	20,64
	320	80	120	26,02	24,27	22,84	21,65	20,64
	340	80	140	26,02	24,27	22,84	21,65	20,64
	360	80	160	26,02	24,27	22,84	21,65	20,64
	380	100	140	26,76	26,03	25,36	24,42	23,14
	400	120	120	26,76	26,03	25,36	24,75	24,19
16	280	80	80	33,94	33,94	33,81	32,16	30,52
	300	80	100	38,13	35,73	33,81	32,16	30,52
	320	80	120	38,13	35,73	33,81	32,16	30,52
	340	80	140	38,13	35,73	33,81	32,16	30,52
	360	80	160	38,13	35,73	33,81	32,16	30,52
	380	100	140	42,67	39,60	37,16	35,16	33,48
	400	100	160	42,67	39,60	37,16	35,16	33,48
	420	100	180	42,67	39,60	37,16	35,16	33,48
	440	100	200	42,67	39,60	37,16	35,16	33,48
	460	120	180	44,65	43,32	40,91	38,47	36,44
	500	120	220	44,65	43,32	40,91	38,47	36,44
20	340	80	120	51,04	48,00	45,53	43,11	41,09
	360	100	100	50,51	50,51	48,85	46,39	43,97
	380	100	120	55,80	51,90	48,85	46,39	43,97
	400	100	140	55,80	51,90	48,85	46,39	43,97
	420	100	160	55,80	51,90	48,85	46,39	43,97
	440	100	180	55,80	51,90	48,85	46,39	43,97
	460	120	160	61,20	56,44	52.72	49,72	47,24

GENERAL PRINCIPLES

- Characteristic values according to EN 1995:2014.
- Design values can be obtained from characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- Mechanical strength values and bolts geometry comply with CE marking according to EN 14592.
- The values given are calculated considering a force-grain angle in the side elements of 0°, 30°, 45°, 60° and 90°. Values are relative to a single KOS bolt.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- The bolts must be positioned in accordance with the minimum distances.

NOTES

- For the calculation process a timber characteristic density ρ_k = 385 kg/m^3 has been considered.

  For different ρ_k values, the strength on the table on the timber side can be converted by the $k_{dens,v}$ coefficient.

$$R'_{V,k} = k_{dens,v} \cdot R_{V,k}$$

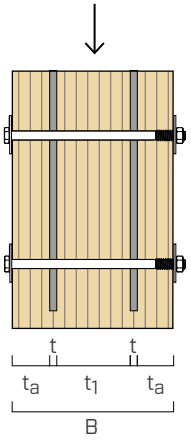
ρ_k [kg/m^3]	350	380	**385**	405	425	430	440
C-GL	*C24*	*C30*	*GL24h*	*GL26h*	*GL28h*	*GL30h*	*GL32h*
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

- The calculation was made taking into account the rope effect of the bolt with DIN 9021 washers.

STRUCTURAL VALUES | KOS

NODE WITH 2 METAL PLATES IN A WOODEN ELEMENT



d_1	L	B	t_a	t_1	$R_{v,k}$ [kN] load-to-grain angle				
[mm]	[mm]	[mm]	[mm]	[mm]	0°	30°	45°	60°	90°
12	140	100	29	30	29,34	25,90	23,19	20,99	19,17
	160	120	39	30	34,10	31,54	28,46	25,76	23,53
	180	140	39	50	40,77	37,42	33,73	30,53	27,89
	200	160	39	70	47,43	43,31	39,00	35,31	32,25
	220	180	49	70	48,52	44,13	40,64	37,81	35,45
	240	200	49	90	51,95	48,89	45,91	42,58	39,81
	260	220	59	90	53,50	50,14	46,94	43,42	40,51
	280	240	59	110	53,50	50,14	49,04	46,52	44,38
16	140	100	29	30	37,34	32,54	28,83	25,88	23,48
	160	120	29	50	45,82	39,93	35,39	31,77	28,82
	180	140	39	50	54,31	47,33	41,94	37,65	34,16
	200	160	39	70	62,80	54,72	48,49	43,53	39,49
	220	180	39	90	71,28	62,12	55,04	49,42	44,83
	240	200	49	90	78,33	69,52	61,60	55,30	50,17
	260	220	59	90	79,56	71,82	65,81	61,00	55,51
	280	240	59	110	86,02	79,21	72,36	66,88	60,84
20	160	100	28	32	37,34	32,54	28,83	25,88	23,48
	180	120	29	50	45,82	39,93	35,39	31,77	28,82
	200	140	29	70	54,31	47,33	41,94	37,65	34,16
	220	160	39	70	62,80	54,72	48,49	43,53	39,49
	240	180	49	70	71,28	62,12	55,04	49,42	44,83
	260	200	49	90	78,33	69,52	61,60	55,30	50,17
	280	220	59	90	79,56	71,82	65,81	61,00	55,51
	300	240	59	110	86,02	79,21	72,36	66,88	60,84

GENERAL PRINCIPLES

- Characteristic values according to EN 1995:2014.
- Design values can be obtained from characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.

- Mechanical strength values and bolts geometry comply with CE marking according to EN 14592.
- The values given are calculated considering a force-grain angle of 0°, 30°, 45°, 60° and 90°. Values are relative to a single KOS bolt.
- The values provided are calculated using 5 mm thick plates and a 6 mm thick milled cut in the wood.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.
- The bolts must be positioned in accordance with the minimum distances.

NOTES

- For the calculation process a timber characteristic density ρ_k = 385 kg/m^3 has been considered.

  For different ρ_k values, the strength on the table on the timber side can be converted by the $k_{dens,v}$ coefficient.

$$R'_{V,k} = k_{dens,v} \cdot R_{V,k}$$

ρ_k [kg/m^3]	350	380	**385**	405	425	430	440
C-GL	*C24*	*C30*	*GL24h*	*GL26h*	*GL28h*	*GL30h*	*GL32h*
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

- The calculation was made taking into account the rope effect of the bolt with DIN 9021 washers.