

Mechanical requirements of fasteners made of non-ferrous metals

Designation system and materials

Table 195 lists the symbols for the material to be used in the designation and for marking purposes, reference is made to the relevant International Standard.

Table 195 Symbols for materials

Symbol	Designation of material	Relevant International Standard		Old SS-number
		ISO	EN	
CU1	Cu-ETP or Cu-FRHC (Copper)	1337	CW004A	5010
CU2	CuZn37 (Brass)	426/1	CW508L	5150
CU3	CuZn39Pb3 (Brass)	426/2	CW614N	5170
CU4	CuSn6 (Tin bronze)	427	CW452K	5428
CU5	CuNi1Si (Tin bronze)	1187	—	—
CU6	CuZn40Mn1Pb (Brass)	—	—	—
CU7	CuAl10Ni5Fe4 (Nickel brass)	428	CC333G	5716
AL1	AlMg3 (Aluminium)	209	AW5754	4125
AL2	AlMg5 (Aluminium)	209	AW5019	—
AL3	AlSi1MgMn (Aluminium)	209	AW6082	4212
AL4	AlCu4MgSi (Aluminium)	209	AW2014	4338
AL5	AlZnMgCu 0,5 (Aluminium)	—	—	—
AL6	AlZn5,5MgCu (Aluminium)	209	AW7075	4425

Source: SS-ISO 8839.

Mechanical properties

When tested at the standard reference temperature of 20°C using the methods described in section about test

methods, the bolts, screws, studs and nuts shall have the mechanical properties set out in the table below.

Table 196 Mechanical properties

Material		Nominal thread diameter d	Tensile strength	Stress at permanent set limit	Percentage elongation after fracture
Symbol	Designation		R_m min. N/mm ²	$R_{p0.2}$ min. N/mm ²	A min. %
CU1	Cu-ETP or Cu-FRHC	$d \leq M39$	240	160	14
CU2	CuZn37	$d \leq M6$	440	340	11
		$M6 < d \leq M39$	370	250	19
CU3	CuZn39Pb3	$d \leq M6$	440	340	11
		$M6 < d \leq M39$	370	250	19
CU4	CuSn6	$d \leq M12$	470	340	22
		$M12 < d \leq M39$	400	200	33
CU5	CuNi1Si	$d \leq M39$	590	540	12
CU6	CuZn40Mn1Pb	$M6 < d \leq M39$	440	180	18
CU7	CuAl10Ni5Fe4	$M12 < d \leq M39$	640	270	15
AL1	AlMg3	$d \leq M10$	270	230	3
		$M10 < d \leq M20$	250	180	4
AL2	AlMg5	$d \leq M14$	310	205	6
		$M14 < d \leq M36$	280	200	6
AL3	AlSi1MgMn	$d \leq M6$	320	250	7
		$M6 < d \leq M39$	310	260	10
AL4	AlCu4MgSi	$d \leq M10$	420	290	6
		$M10 < d \leq M39$	380	260	10
AL5	AlZnMgCu 0,5	$d \leq M39$	460	380	7
AL6	AlZn5,5MgCu	$d \leq M39$	510	440	7

Source: SS-ISO 8839.

Torsional strength test

In general for torsional strength testing, a full size bolt or screw shall be used and the test shall be carried out as described in ISO 898/7. The accuracy of the measuring device

shall lie within $\pm 7\%$ of the minimum breaking torque to be tested. The bolt or screw shall meet the minimum breaking torque laid down in table 197.

Table 197 Minimum breaking torque

Nominal thread diameter d	Symbols for materials										
	CU1	CU2	CU3	CU4	CU5	AL1	AL2	AL3	AL4	AL5	AL6
	Min. breaking torque										
	N • m										
M1,6	0,06	0,10	0,10	0,11	0,14	0,06	0,07	0,08	0,1	0,11	0,12
M2	0,12	0,21	0,21	0,23	0,28	0,13	0,15	0,16	0,2	0,22	0,25
M2,5	0,24	0,45	0,45	0,5	0,6	0,27	0,3	0,3	0,43	0,47	0,5
M3	0,4	0,8	0,8	0,9	1,1	0,5	0,6	0,6	0,8	0,8	0,9
M3,5	0,7	1,3	1,3	1,4	1,7	0,8	0,9	0,9	1,2	1,3	1,5
M4	1	1,9	1,9	2	2,5	1,1	1,3	1,4	1,8	1,9	2,2
M5	2,1	3,8	3,8	4,1	5,1	2,4	2,7	2,8	3,7	4	4,5

Source: SS-ISO 8839.

Test methods

Tensile test applicable to bolts, screws and studs

In general for tensile testing, a full size bolt, screw or stud shall be used and the test shall be carried out as specified in ISO 898-1. For minimum breaking loads, see table 198.

Proof load test applicable to nuts

For proof load testing of nuts the method described in ISO 898-2 shall be used. The nuts shall meet the proof loads which are equal to the minimum breaking loads of the respective bolts, screws or studs laid down in table 198.

Table 198 Minimum breaking loads

Nom. thread diameter	Pitch of the thread	Nom. stress area	Symbols for materials												
			CU1	CU2	CU3	CU4	CU5	CU6	CU7	AL1	AL2	AL3	AL4	AL5	AL6
			Min. breaking loads ¹⁾ $A_s \cdot R_m$												
d	P	A_s	N												
mm	mm	mm ²													
M3	0,5	5,03	1210	2210	2210	2360	2970	-	-	1360	1560	1610	2110	2310	2570
M3,5	0,6	6,78	1630	2980	2980	3190	4000	-	-	1830	2100	2170	2850	3120	3460
M4	0,7	8,78	2110	3860	3860	4130	5180	-	-	2370	2720	2810	3690	4040	4480
M5	0,8	14,2	3410	6250	6250	6670	8380	-	-	3830	4400	4540	5960	6530	7240
M6	1	20,1	4820	8840	8840	9450	11860	-	-	5430	6230	6430	8440	9250	10250
M7	1	28,9	6940	10690	10690	13580	17050	12720	-	7800	8960	8960	12140	13290	14740
M8	1,25	36,6	8780	13540	13540	17200	21590	16100	-	9880	11350	11350	15370	16840	18670
M10	1,5	58,0	13920	21460	21460	27260	34220	25520	-	15660	17980	17980	24360	26680	29580
M12	1,75	84,3	20230	31190	31190	39620	49740	37090	-	21080	26130	26130	32030	38780	42990
M14	2	115	27600	42550	42550	46000	67850	50600	73600	28750	35650	35650	43700	52900	58650
M16	2	157	37680	58090	58090	62800	92630	69080	100500	39250	43960	48670	59660	72220	80070
M18	2,5	192	46080	71040	71040	76800	113300	84480	122900	48000	53760	59520	72960	88320	97920
M20	2,5	245	58800	90650	90650	98000	144500	107800	156800	61250	68600	75950	93100	112700	124900
M22	2,5	303	72720	112100	112100	121200	178800	133300	193900	-	84840	93930	115100	139400	154500
M24	3	353	84720	130600	130600	141200	208300	155300	225900	-	98840	109400	134100	162400	180000
M27	3	459	110200	169800	169800	183600	270800	202000	293800	-	128500	142300	174400	211100	234100
M30	3,5	561	134600	207600	207600	224400	331000	246800	359000	-	157100	173900	213200	258100	286100
M33	3,5	694	166600	256800	256800	277600	-	305400	444200	-	194300	215100	263700	319200	353900
M36	4	817	196100	302300	302300	326800	-	359500	522900	-	228800	253300	310500	375800	416700
M39	4	976	234200	361100	361100	390400	-	429400	624600	-	-	302600	370900	449000	497800

¹⁾ For nuts, proof load.

Source: SS-ISO 8839.