Unilok

'UNILOK' High Strength Structural Fasteners

These are large series hexagon bolts, nuts and washers available in the range shown in Table 1. The bolts are having short thread lenghts, suitable for use in both friction type and bearing type structural steel joints.

Table 1: 'UNILOK' range of High Strength Structural Fasteners

Product	Specification	Size	Threads	Mechanical Properties
High Strength Structural Bolts	ISO: 7412 IS: 3757	M16to M36	Metric Coarse, 6g ISO: 261, ISO: 965 IS: 4218	Property Class 8.8 or 10.9 ISO: 898/1 IS: 1367, Part 3
High Strength Structural Nuts	ISO: 4775 IS: 6623	M16to M36	Metric Coarse, 6H ISO: 261, ISO: 965 IS: 4218	Property Class 8 or 10 ISO: 898/2 IS: 1367, Part 6
Hardened and Tempered Washers	ISO: 7415 IS: 6649	M16to M36 (Pain Hole, Circular)	—	Hardness HRC 35-45

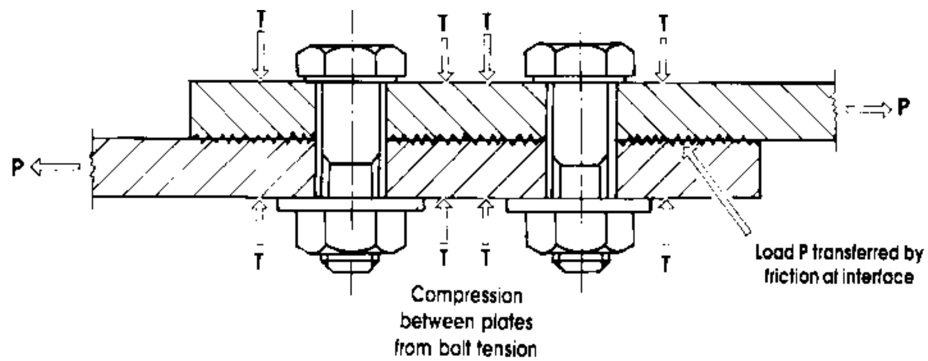
For details, refer Table: 6 and 7.

'UNILOK' High Strength Structural Bolts, Nuts and Washers in Friction Grip Joints

The use of high strength structural fasteners in friction grip joints has been one of the most important developments in structural engineering over the last about four decades.

It provides a simple method of transmitting loads through a structural joint by the friction on the contact face developed through the high clamping force from correctly tightened high strength bolts and nuts. (See Fig. 1)

Fig. 1: Principle of Friction Type Joint using H.S.S. Bolts and Nuts



The bolts are fitted in clearance holes and since the joint is designed to resist slip, they are not subject to bearing or shear forces and thus remain in virtually static tension throughout their working life, with fluctuating loads having very little, if any, effect on bolt stress.

The head dimensions (across flat sizes) of H.S.S. Bolts and Nuts are one step higher than those of the normal hexagon bolts and nuts of the same diameter. The bearing pressure under the head of H.S.S. Bolts will thus be necessarily lower than that of the conventional hexagon head bolts. Indentation of the hard bolt head into the softer structural steel is therefore prevented.

'UNILOK' high strength structural fasteners in friction grip joints are ideal for use on time-bound projects. Over the conventional methods of rivetting or welding, they offer the following advantages :

RELIABILITY:
Once tightened, the bolts will remain tight and maintain the permanent strength of the joint. Absence of heavy stress concentration due to absence of bearing between bolts and plates. As bolts are in tension, it does not permit loosening, thus making it most ideal where vibrations are involved.

ECONOMY :
Fewer high strength bolts are required than M.S. bolts and rivets. Drilling of close tolerance holes is not required. Overall weight of the structure will be very light.

SIMPLICITY :
A minimum of skill is required in tightening and the operators need only to follow a few simple rules.

CONVENIENCE :
Whether in the workshop or at site, H.S.S. Bolts enable joints to be made easily. Welding of site splices can be eliminated, avoiding the difficulties of welding in adverse weather conditions. Absence of pneumatic hammers used in rivetted joints reduce noise level considerably.

Reference standards
BS: 4395 Specification for HSFG Bolts/Nuts/Washers
BS: 4604 The use of HSFG Bolts/Nuts/Washers in Structural Steel Works
IS: 4000 Code of practice for use of HSFG Fasteners
IS: SP6 (4) Handbook for Structural Engineers
ASTM A325/A563/F436 Specifications for High Strength Bolts/Nuts/Washers

Determining the Slip Factor:

The friction grip joint depends for its performance on tightening of bolts to high preload so that the adjoining members are brought into contact and the shear load transmitted by friction between them.

The resistance to Slip (P) is expressed by $P = \mu x T$

where JI is the experimentally determined Slip Factor and T is the initial Bolt Preload. (Ref. Fig. 1).

It is desirable that before designing a structural joint, a series of slip factor tests are carried out to determine the actual Slip Factor, creating contact surface conditions similar to be used at site.

Table 9 gives Slip Factor values for various contact surfaces.

Table 9: Slip Factor Values for various Contact Surfaces

Surface Condition	Average Slip Factor
Untreated tight mill scale	0.45
Grit Blast Surface	0.50 - 0.55
Hot Dip Galvanised	0.21 -0.35
Hot Dip Galvanised + Wire Brush	0.35
Hot Dp Galvanised + Sand Blast	0.40 - 0.45

Tightening:

a. Torque Control Method

Part of the torque effort in tightening is absorbed in overcoming friction between threads and nut bearing surface. The friction varies considerably depending upon the thread condition, oil coating on bolt and nut etc., and, consequently, shank tensions induced by a particular torque differ widely. Even under the best conditions, a variation of 30% can be expected. Therefore, it is not possible to recommend torque values that can relate reliably to shank tensions. It is therefore, of utmost importance to control initial calibration of tools under site conditions, and also frequent checking.

The torque wrench should be calibrated at least once each shift by tightening a bolt in a load cell or similar device, to a tension 10% above the required minimum, noting the torque at which this tension is reached. A change in the bolt diameter or length requires re-calibration of the tool.

b. Part Turn Method

This method is more practical, economical and reliable. Installed bolts are tightened to bring the surfaces in close contact (snug fit). A matching mark is then made on each nut and bolt shank end and tightening completed by turning the nut a half or three-quarter turn depending on bolt length. (See Table 10 and Fig. 2).

With the amount of nut rotation specified in the table, a bolt tension at least equal to the Proof Load will be attained.

Since the part turn method will often give rise to tensions above the yield point, it is not recommended for BS Higher Grade (10.9) bolts as these will have relatively reduced ductility and fracture could result from excess tension.

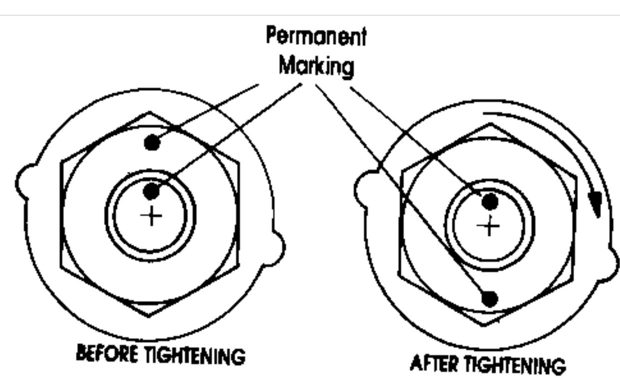
c. Other Methods

Load Indicating Devices : These methods are designed to give a direct indication of the load induced along the axis of the bolt with the help of Load Indicating Devices incorporated in the bolt, nut or washer assembly.

Table 10: Part Turn Method - Amount of Nut Rotation

Bolt dia	Bolt Grip length/Rotation of Nut Relative to Shank	
	Not less than **1/2**	Not less than 3/4
M16	upto 115 mm	over 115 mm
M20	upto 115 mm	over 115 mm
M22	upto 115 mm	over 115 mm
M24	upto 160 mm	over 160 mm
M27	upto 160 mm	over 160 mm
M30	upto 160 mm	over 160 mm
M36	upto 160 mm	over 160 mm

Fig. 2: Part Turn Method - Tightening Procedure



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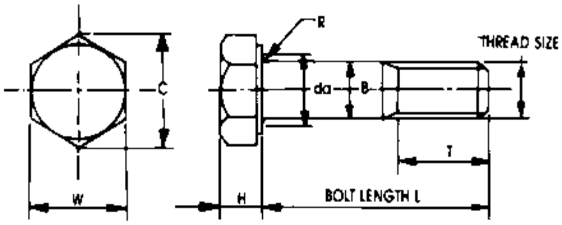
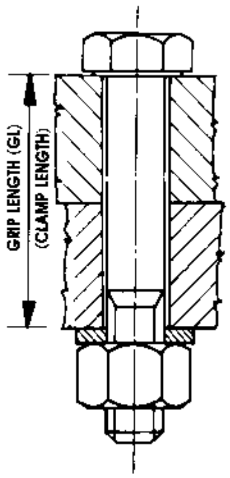


Sizes in brackets are at second preference
• T1 Ref. - For lengths ≤ 100mm
T2 Ref. - For lengths > 100mm



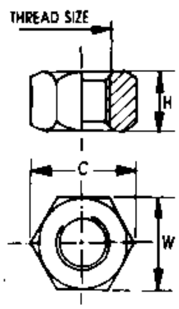


Table 2: 'UNILOK' High Strength Structural Bolts - Dimensions

Thread Size		M16	M20	(M22)	M24	(M27)	M30	M36
Pitch		2.0	2.50	2.50	3.00	3.00	3.50	4.00
B	Max.	16.70	20.84	22.84	24.84	27.84	30.84	37 00
	Min.	15.30	19.16	21.16	23.16	26.16	29.16	35.00
da	Max.	18.70	23.24	25.24	27.64	30.40	33.40	39.40
W	Max.	27.00	34.00	36.00	41.00	46.00	50.00	60.00
	Min.	26.16	33.00	35.00	40.00	45.00	49.00	58.80
C	Min.	29.56	37.29	39.55	45.20	50.85	55.37	66.44
H	Max.	10.75	13.40	14.90	15.90	17.90	19.75	23.55
	Min.	9.25	11.60	13.10	14.10	16.10	17.65	21.45
R	Min.	0.60	0.80	0.80	1.00	1.20	1.20	1.50
T*	T1 Ref.	31	36	38	41	44	49	56
	T2 Ref.	38	43	45	48	51	56	63

Table 3: 'UNILOK' High Strength Structural Nuts - Dimensions

Thread Size		M16	M20	(M22)	M24	(M27)	M30	M36
Pitch		2.0	2.50	2.50	3.00	3.00	3.50	4.00
W	Max.	27.00	34.00	36.00	41.00	46.00	50.00	60.00
	Min.	26.16	33.00	35.00	40.00	45.00	49.00	58.80
C	Min.	29.56	37.29	39.55	45.20	50.85	55.37	66.44
H	Max.	17.10	20.70	23.60	24.20	27.60	30.70	36.60
	Min.	16.40	19.40	22.30	22.90	26.30	29.10	35.00
Weight Kg./lOOOPcs.		60.4	115.3	142.8	197.7	282.3	365.0	281.8

Table 4: Grip Lengths and Weight of Bolts (Kgs per 1000 pcs.)

Dia	M16		M20		(M22)		M24		(M27)		M30		M36	
L	Gl	Wt.	Gl	Wt.	Gl	Wt.	Gl	Wt.	Gl	Wt.	Gl	Wt.	Gl	Wt.
40	10 to 14	102.8												
45	15 to 19	110.7	11 to 15	180.3										
50	20 to 24	118.6	16 to 20	192.6	12"to 16	252.0								
55	25 to 29	126.5	21 to 25	205.0	17to21	266.9	15 to 19	337.4						
60	30 to 34	134.4	26 to 30	217.3	22 to 26	281.8	20 to 24	355.2	17to21	480.9				
65	35 to 39	142.3	31 to 35	229.6	27 to 31	296.7	25 to 29	372.9	22 to 26	503.4				
70	40 to M	150.2	36 to 40	241.9	32 to 36	311.6	30 to 34	390.7	27 to 31	525.8	24 to 28	672.5		
75	45 to 49	158.1	41 to45	254.3	37 to 41	326.6	35 to 39	408.4	32 to 36	548.3	29 to 33	700.3	23 to 27	1089.1
80	50 to 54	166.0	46 to 50	266.6	42 to 46	341.5	40 to 44	426.2	37 to 41	570.8	34 to 38	728.0	28 to 32	1129.0
85	55 to 59	173.9	51 to 55	278.9	47 to 51	356.4	45 to 49	443.9	42 to 46	593.2	39 to 43	755.7	33 to 37	1169.0
90	60 to 64	181.7	56 to 60	291.3	52 to 56	371.3	50 to 54	461.7	47 to 51	615.7	44 to 48	783.5	38 to 42	1209.0
95	65 to 69	189.6	61 to 65	303.6	57 to 61	386.2	55 to 59	479.4	52 to 56	638.2	49 to 53	811.2	43 to 47	1248.9
100	70 to 74	197.5	66 to 70	315.9	62 to 66	401.2	60 to 64	497.2	57 to 61	660.7	54 to 58	839.0	48 to 52	1288.9
110	75 to 84	211.4	71 to 80	337.7	67 to 76	427.8	65 to 74	528.5	62 to 71	685.6	59 to 68	888,4	53 to 62	1362.0
120	85 to 94	227.2	81 to 90	362.4	77 to 86	457.7	75 to 84	564.1	72 to 81	730.6	69 to 78	943.9	63 to 72	1441.9
130	95 to 104	243.0	91 to 100	387.0	87 to 96	487.5	85 to 94	599.6	82 to 91	775.5	79 to 88	999.4	73 to 82	1521.8
140	105toll4	258.8	101 to 110	411.7	97 to 106	517.3	95 to 104	635.1	92 to 101	820.5	89 to 98	1054.9	83 to 92	1601.7
150	115 to 124	274.6	111 to 120	436.3	107 to 116	547.2	105 to 114	670.6	102to 111	865.4	99 to 108	1110.4	93 to 102	1681.6
160	125 to 134	290.3	121 to 130	461.0	117 to 126	577.0	115 to 124 .	706.1	112 to 121	910.4	109 to 118	1165.8	103 to 112	1761.5
170	135 to 144	306.1	131 to 140	485.7	127 to 136	606.9	125 to 134	741.6	122 to 131	955.3	119 to 128	1221.3	113 to 122	1841.4
180	145 to 154	321.9	141 to 150	510.3	137 to 146	636.7	135 to 144	777.1	132 to 141	1000.2	129 to 138	1276.8	123 to 132	1921.3
190	155 to 164	337.7	151 to 160	535.0	147 to 156	666.5	145 to 154	812.6	142 to 151	1045.2	139 to 148	1332.3	133 to 142	2001.2
200	165 to 174	353.5	161 to 170	559.6	157 to 166	694.4	155 to 164	848.2	152 to 161	1090.2	149 to 158	1387.8	143 to 152	2081.1
210									162 to 171	1135.2	159 to 168	1443.3	153 to 162	2161.0
220									172 to 181	1180.1	169 to 178	1498.8	163 to 172	2240.9
230									182 to 191	1225.0	179 to 188	1554.3	173 to 182	2320.8
240									192 to 201	1270.0	189 to 198	1609.8	183 to 192	2400.7
250									202 to 211	1314.0	199 to 208	1665.3	193 to 202	2480.6
260									212 to 221	1359.9	209 to 218	1720.7	203 to 212	2560.5
270									222 to 231	1404.9	219 to 228	1776.2	213 to 222	2640.4
280									232 to 241	1449.8	229 to 238	1831.7	223 to 232	2720.3
290									242 to 251	1493.9	239 to 248	1887,2	223 to 242	2800.2
300									252 to 261	1538.9	249 to 258	1942.7	243 to 252	2880.1