

# TMS

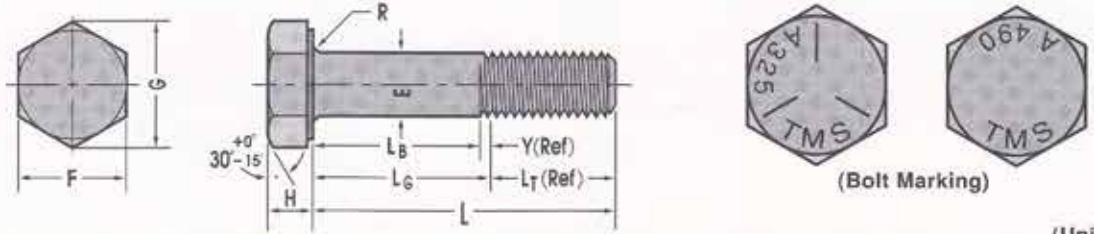
**HIGH STRENGTH STRUCTURAL BOLT**



**ANSI B18.2.1 - 1998, ASTM A325 AND A490  
HEAVY HEXAGON STRUCTURAL BOLT, HEAVY HEXAGON NUT  
AND PLAIN WASHERS**

# 1. DIMENSION AND TOLERANCES

## ● HIGH STRENGTH STRUCTURAL BOLTS



(Bolt Marking)

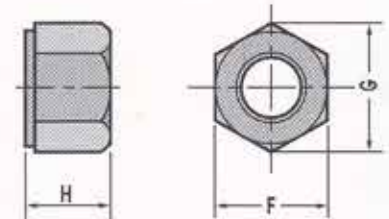
(Unit : inch)

Nominal Size or Basic Bolt Dia		E		F			G		H			R		L (Ref)	Y (Ref)
		Body Diameter		Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length	Transition Thread Length
		Max.	Min.	Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.	Max.	Min.	Basic	Max.
1/2	0.5000	0.515	0.482	7/8	0.875	0.850	1.010	0.969	5/16	0.323	0.302	0.031	0.009	1.00	0.19
5/8	0.6250	0.642	0.605	1-1/16	1.062	1.031	1.227	1.175	25/64	0.403	0.378	0.062	0.021	1.25	0.22
3/4	0.7500	0.768	0.729	1-1/4	1.250	1.212	1.443	1.383	15/32	0.483	0.455			1.38	0.25
7/8	0.8750	0.895	0.852	1-7/16	1.438	1.394	1.660	1.589	35/64	0.563	0.531			1.50	0.28
1"	1.0000	1.022	0.976	1-5/8	1.625	1.575	1.876	1.796	39/64	0.627	0.591	0.093	0.062	1.75	0.31
1 - 1/8	1.1250	1.149	1.098	1-13/16	1.812	1.756	2.093	2.002	11/16	0.718	0.658			2.00	0.34
1 - 1/4	1.2500	1.277	1.223	2"	2.000	1.938	2.309	2.209	25/32	0.813	0.749			2.00	0.38
1 - 3/8	1.3750	1.404	1.345	2-3/16	2.188	2.119	2.526	2.416	27/32	0.878	0.810			2.25	0.44
1 - 1/2	1.5000	1.531	1.470	2-3/8	2.375	2.300	2.742	2.622	15/16	0.974	0.902			2.25	0.44

## ● HEAVY HEX NUTS (2H NUTS)

(Unit : inch)

Nominal Size or Basic Major Dia Thread		F			G		H		
		Width Across Flats			Width Across Corners		Thickness Heavy Hex. Nuts		
		Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.
1/2	0.5000	7/8	0.875	0.850	1.010	0.969	31/64	0.504	0.464
5/8	0.6250	1 - 1/16	1.062	1.031	1.227	1.175	39/64	0.631	0.587
3/4	0.7500	1 - 1/4	1.250	1.212	1.443	1.382	47/64	0.758	0.710
7/8	0.8750	1 - 7/16	1.438	1.394	1.660	1.589	55/64	0.885	0.833
1"	1.0000	1 - 5/8	1.625	1.575	1.876	1.796	63/64	1.012	0.956
1 - 1/8	1.1250	1 - 13/16	1.812	1.756	2.093	2.002	1 - 7/64	1.139	1.079
1 - 1/4	1.2500	2"	2.000	1.938	2.309	2.209	1 - 7/32	1.251	1.187
1 - 3/8	1.3750	2 - 3/16	2.188	2.119	2.526	2.416	1 - 11/32	1.378	1.310
1 - 1/2	1.5000	2 - 3/8	2.375	2.300	2.742	2.622	1 - 15/32	1.505	1.433

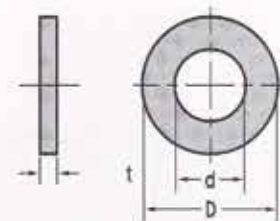


(Nut Marking)

## ● CIRCULAR WASHERS

(Unit : inch)

Bolt Size		d	D	t	
		Nominal Diameter of Hole	Nominal Outside Diameter	Thickness	
				Max.	Min.
1/2	12.700	17/32	1 - 1/16	0.097	0.177
5/8	15.875	11/16	1 - 5/16	0.122	0.177
3/4	19.050	13/16	1 - 15/32	0.122	0.177
7/8	22.225	15/16	1 - 3/4	0.136	0.177
1"	25.400	1 - 1/8	2"	0.136	0.177
1 - 1/8	28.575	1 - 1/4	2 - 1/4	0.136	0.177
1 - 1/4	31.750	1 - 3/8	2 - 1/2	0.136	0.177
1 - 3/8	34.925	1 - 1/2	2 - 3/4	0.136	0.177
1 - 1/2	38.100	1 - 5/8	3"	0.136	0.177



## 2. MECHANICAL PROPERTIES

### ● TENSILE REQUIREMENTS FOR FULL-SIZE BOLTS

Bolt Size Threads per inch and Series Designation	Stress Area in <sup>2</sup>	Tensile Strength <sup>a</sup> lbf.			Proof Load <sup>b</sup> Length Measurement Method (lbf.)		Min. Alternate Proof Load <sup>b</sup> Yield Strength Method (lbf.)		Hardness Number							
		A 325		A 490	A 325		A 490	A 325		A 490		A 325		A 490		
		Min.	Min.	Max.	A 325	A 490	A 325	A 490	Brinell	Rockwell	Brinell	Rockwell	Brinell	Rockwell		
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/2 - 13 UNC	0.142	17050	21300	24150	12050	17050	13050	18500	241	331	23	35	302	341	32	36
5/8 - 11 UNC	0.226	27100	33900	38400	19200	27100	20800	29400	241	331	23	35	302	341	32	36
3/4 - 10 UNC	0.334	40100	50100	56800	28400	40100	30700	43400	241	331	23	35	302	341	32	36
7/8 - 9 UNC	0.462	55450	69300	78550	39250	55450	42500	60100	241	331	23	35	302	341	32	36
1" - 8 UNC	0.606	72700	90900	103000	51500	72700	55750	78800	241	331	23	35	302	341	32	36
1 - 1/8 - 7 UNC	0.763	80100	114450	129700	56450	91550	61800	99200	223	293	19	31	302	341	32	36
1 - 1/4 - 7 UNC	0.969	101700	145350	164750	71700	116300	78500	126000	223	293	19	31	302	341	32	36
1 - 3/8 - 6 UNC	1.155	121300	173250	196350	85450	138600	93550	150200	223	293	19	31	302	341	32	36
1 - 1/2 - 6 UNC	1.405	147500	210750	238850	104000	168600	113800	182600	223	293	19	31	302	341	32	36

a The stress area is calculated as follows :  $A_s = 0.7854 [ D - (0.9743/n) ]^2$       Where :  $A_s$  = Stress area  
 $D$  = Nominal bolt size  
 $n$  = Threads per inch

b Loads tabulated are based on the following :

Bolt Size	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
1/2 to 1, incl.	120000 psi (825 MPa)	150000 psi (1035 MPa)	170000 psi (1170 MPa)	85000 psi (585 MPa)	120000 psi (825 MPa)	92000 psi (635 MPa)	130000 psi (895 MPa)
1-1/8 to 1-1/2, incl.	105000 psi (725 MPa)			74000 psi (510 MPa)		81000 psi (560 MPa)	

### ● NUT

Bolt Size Threads per inch and Series Designation	Minimum Proof Load lb <sup>f</sup>	Brinell Hardness Number		Rockwell C Hardness Number	
		Min.	Max.	Min.	Max.
1/2 - 13 UNC	24850	248	352	24	38
5/8 - 11 UNC	39550	248	352	24	38
3/4 - 10 UNC	58450	248	352	24	38
7/8 - 9 UNC	80850	248	352	24	38
1" - 8 UNC	106000	248	352	24	38
1 - 1/8 - 7 UNC	133500	248	352	24	38
1 - 1/4 - 7 UNC	169600	248	352	24	38
1 - 3/8 - 6 UNC	202100	248	352	24	38
1 - 1/2 - 6 UNC	245900	248	352	24	38

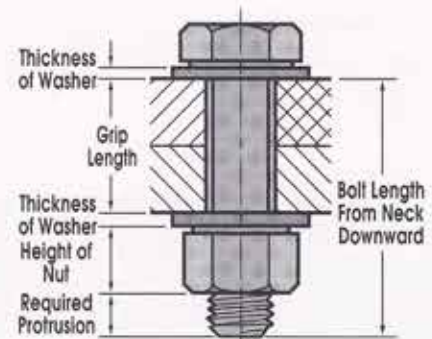
### ● WASHER

Bolt Size Threads per inch and Series Designation	Rockwell C Hardness Number	
	Min.	Max.
1/2 to 1 - 1/2, incl.	38	45

### DETERMINATION OF BOLT LENGTH

Nominal Diameter of Bolt	Additional Value
1/2	3/4
5/8	7/8
3/4	1"
7/8	1 - 1/8
1"	1 - 1/4
1 - 1/8	1 - 3/8
1 - 1/4	1 - 1/2
1 - 3/8	1 - 5/8
1 - 1/2	1 - 3/4

The length is determined by  
adding the corresponding values  
to grip length



### 3. WEIGHTS

Approximate weight of 100 bolts and nuts in pounds

#### ● BOLT

Diameter Length	1/2	5/8	3/4	7/8	1"	1 - 1/8	1 - 1/4	1 - 3/8	1 - 1/2
1	16.5	29.4	47.0	-	-	-	-	-	-
1 - 1/4	17.8	31.1	49.6	74.4	104	-	-	-	-
1 - 1/2	19.2	33.1	52.2	78.0	109	148	197	-	-
1 - 3/4	20.5	35.3	55.3	81.9	114	154	205	261	333
2	21.9	37.4	58.4	86.1	119	160	212	270	344
2 - 1/4	23.3	39.8	61.6	90.3	124	167	220	279	355
2 - 1/2	24.7	41.7	64.7	94.6	130	174	229	290	366
2 - 3/4	26.1	43.9	67.8	98.8	135	181	237	300	379
3	27.4	46.1	70.9	103.0	141	188	246	310	391
3 - 1/4	28.8	48.2	74.0	107.0	146	195	255	321	403
3 - 1/2	30.2	50.4	77.1	111.0	151	202	263	332	416
3 - 3/4	31.6	52.5	80.2	116.0	157	209	272	342	428
4	33.0	54.7	83.3	120.0	162	216	280	353	441
4 - 1/4	34.3	56.9	86.4	124.0	168	223	289	363	453
4 - 1/2	35.7	59.0	89.5	128.0	173	230	298	374	465
4 - 3/4	37.1	61.2	92.7	133.0	179	237	306	384	478
5	38.5	63.3	95.8	137.0	184	244	315	395	490
5 - 1/4	39.9	65.5	98.9	141.0	190	251	324	405	503
5 - 1/2	41.2	67.7	102.0	146.0	196	258	332	416	515
5 - 3/4	42.6	69.8	105.0	150.0	201	265	341	426	527
6	44.0	71.9	108.0	154.0	207	272	349	437	540
6 - 1/4	45.4	74.1	111.0	158.0	212	279	358	447	552
6 - 1/2	46.8	76.3	114.0	163.0	218	286	367	458	565
6 - 3/4	48.1	78.5	118.0	167.0	223	293	375	468	577
7	49.5	80.6	121.0	171.0	229	300	384	479	589
7 - 1/4	50.9	82.8	124.0	175.0	234	307	392	489	602
7 - 1/2	52.3	84.9	127.0	179.0	240	314	401	500	614
7 - 3/4	53.6	87.1	130.0	183.0	246	321	410	510	626
8	55.0	89.2	133.0	187.0	251	328	418	521	639
8 - 1/4	56.4	91.4	136.0	192.0	257	335	427	531	651
8 - 1/2	57.8	93.5	139.0	196.0	262	342	435	542	664
8 - 3/4	59.1	95.7	142.0	200.0	268	349	444	552	676
9	60.5	97.8	145.0	204.0	273	356	453	563	689
Per inch additional add	5.5	8.6	12.4	16.9	22.1	28.0	34.4	42.5	49.7
For each 100 plain round washers add	3.8	5.3	7.9	11.5	14.4	17.2	20.8	27.1	31.8

#### ● NUT

Nominal Size Type Nut	1/2	5/8	3/4	7/8	1"	1 - 1/8	1 - 1/4	1 - 3/8	1 - 1/2
Heavy Hex.	6.5	11.9	19.3	29.7	42.5	59.2	78.6	102.0	131.0