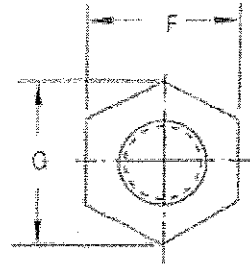
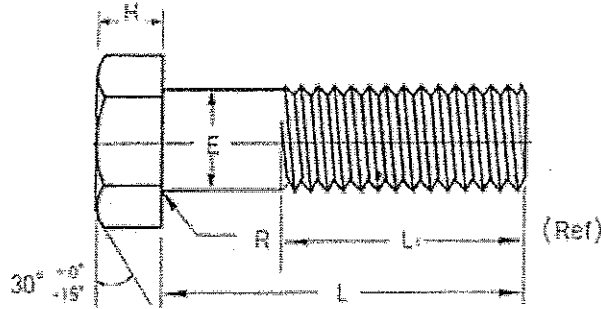


Heavy Hex Bolts

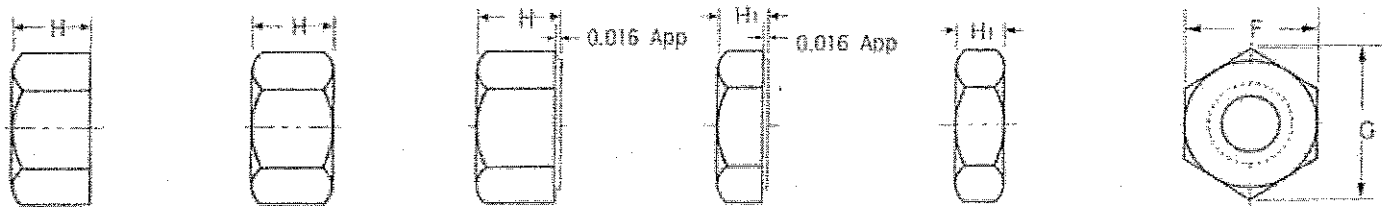


Unified ASME B18.2.1

Unit : inch

Nominal Size and Basic Product Diameter		E Body Dia	F Width Across Flats		G Width Across Corners		H Head Height			R Radius of Fillet		L _T Thread Length for Bolt Lengths			
			Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Basic
1/2	0.500	0.515	7/8	0.875	0.850	1.010	0.969	11/32	0.364	0.302	0.03	0.01	1.25	1.50	
5/8	0.625	0.642	1 1/16	1.062	1.031	1.227	1.175	27/64	0.444	0.378	0.06	0.02	1.50	1.75	
3/4	0.750	0.768	1 1/4	1.250	1.212	1.443	1.383	1/2	0.524	0.455	0.06	0.02	1.75	2.00	
1	7/8	0.875	1 7/16	1.438	1.394	1.660	1.589	37/64	0.604	0.531	0.06	0.02	2.00	2.25	
	1.000	1.022	1 5/8	1.625	1.575	1.876	1.796	43/64	0.700	0.591	0.09	0.03	2.25	2.50	
	1 1/8	1.125	1 13/16	1.812	1.756	2.093	2.002	3/4	0.780	0.658	0.09	0.03	2.50	2.75	
1 1/4	1.250	1.277	2	2.000	1.938	2.309	2.209	27/32	0.876	0.749	0.09	0.03	2.75	3.00	
	1 3/8	1.375	2 3/16	2.188	2.119	2.526	2.416	29/32	0.940	0.810	0.09	0.03	3.00	3.25	
1 1/2	1.500	1.531	2 3/8	2.375	2.300	2.742	2.622	1	1.036	0.902	0.09	0.03	3.25	3.50	
1 3/4	1.750	1.785	2 3/4	2.750	2.662	3.174	3.035	1 5/32	1.196	1.054	0.12	0.04	3.75	4.00	
	2.000	2.039	3 1/8	3.125	3.025	3.608	3.449	1 11/32	1.368	1.175	0.12	0.04	4.25	4.50	
2	2.250	2.305	3 1/2	3.500	3.388	4.041	3.862	1 1/2	1.548	1.327	0.19	0.06	4.75	5.00	
	2 1/2	2.500	3 7/8	3.875	3.750	4.474	4.275	1 21/32	1.708	1.479	0.19	0.06	5.25	5.50	
2 3/4	2.750	2.827	4 1/4	4.250	4.112	4.907	4.689	1 13/16	1.869	1.632	0.19	0.06	5.75	6.00	
	3.000	3.081	4 5/8	4.625	4.475	5.340	5.102	2	2.060	1.815	0.19	0.06	6.25	6.50	

Heavy Hex Nuts & Heavy Hex Jam Nuts



Unified ASME B18.2.2

Unit : inch

Nominal Size or Basic Major Dia of Thread		F Width Across Flats			G Width Across Corners		H Thickness Heavy Hex Nuts			H ₁ Thickness Heavy Hex Jam Nuts		
		Basic	Max	Min	Max	Min	Basic	Max	Min	Basic	Max	Min
1/2	0.500	7/8	0.875	0.850	1.010	0.969	31/64	0.504	0.464	19/64	0.317	0.277
5/8	0.625	1 1/16	1.062	1.031	1.227	1.175	39/64	0.631	0.587	23/64	0.391	0.337
3/4	0.750	1 1/4	1.250	1.212	1.443	1.383	47/64	0.758	0.710	27/64	0.445	0.392
1	7/8	1 7/16	1.438	1.394	1.660	1.589	55/64	0.885	0.833	31/64	0.510	0.458
	1.000	1 5/8	1.625	1.575	1.876	1.796	63/64	1.012	0.958	35/64	0.575	0.519
	1 1/8	1.125	1 13/16	1.812	1.756	2.093	2.002	1 7/64	1.139	1.072	39/64	0.639
1 1/4	1.250	2	2.000	1.938	2.309	2.209	1 7/32	1.251	1.187	23/32	0.701	0.667
	1 3/8	1.375	2 3/16	2.188	2.119	2.526	2.416	1 11/32	1.379	1.310	25/32	0.815
1 1/2	1.500	2 3/8	2.375	2.300	2.742	2.622	1 15/32	1.505	1.433	27/32	0.890	0.808
1 3/4	1.750	2 3/4	2.750	2.662	3.174	3.035	1 19/32	1.632	1.556	29/32	0.944	0.866
	2.000	3 1/8	3.125	3.025	3.608	3.449	1 23/32	1.759	1.679	31/32	1.009	0.929
2	2.250	3 1/2	3.500	3.388	4.041	3.862	1 27/32	1.886	1.802	1 1/32	1.073	0.989
	2 1/2	3 7/8	3.875	3.750	4.474	4.275	1 31/32	2.013	1.925	1 5/32	1.135	1.050
2 3/4	2.750	4 1/4	4.250	4.112	4.907	4.689	2 13/64	2.251	2.155	1 13/64	1.251	1.165
	3.000	4 5/8	4.625	4.475	5.340	5.102	2 29/64	2.505	2.401	1 29/64	1.505	1.401
3	3.250	5	5.000	4.828	5.774	5.515	2 45/64	2.759	2.647	1 37/64	1.634	1.522
	3 1/4	3.250	5	5.000	4.828	5.774	2 61/64	3.013	2.893	1 45/64	1.753	1.643
3 1/2	3.500	5 3/8	5.375	5.200	6.207	5.928	3 7/16	3.506	3.370	1 15/16	2.005	1.870
	3 3/4	3.750	5 3/4	5.625	5.443	6.341	3 11/16	3.760	3.616	2 1/16	2.134	1.990
4	4.000	6 1/8	6.125	5.925	7.073	6.755	3 15/16	4.014	3.852	2 3/16	2.264	2.112

Plain Washers

Metric KS B1326, JIS B1256, DIN126

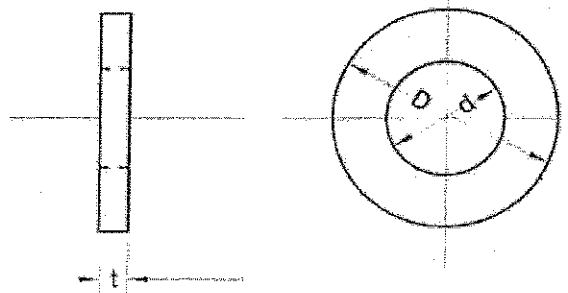
Unit : mm

ASTM F436M

Unit : mm

Nominal Size	Narrow Type		Regular Type						
	D	t	d		D		t		
	Basic	Basic	Basic	Tolerance	Basic	Tolerance	Basic	Tolerance	
6	11.5	1.6	6.6	+0.6	12.5	0	1.6	±0.2	
8	15.5	1.6	9	0	17	-0.7	1.6	±0.2	
10	18	2	11	+0.7	21	0	2	±0.25	
12	21	2.5	14		24		2.3	±0.3	
(14)	24	2.5	16		28		3.2	±0.4	
16	28	3	18	30	3.2				
(18)	30	3	20	34	3.2				
20	34	3	22	+0.8	37	0	3.2	±0.5	
(22)	37	3	24		39		3.2		
24	39	4	26		44		4.5		
(27)	44	4	30	0	50	-1	4.5	±0.5	
30	50	4	33		56		4.5		
(33)	56	5	36		60		6		
(36)	60	5	39	+1	66	0	6	±0.7	
(39)	66	6	42		72		-1.2		6
42			45		78		7		
(45)			48	0	85	-1.4	7	±0.7	
48			52		92		8		
(52)			56		98		8		
56			62	+1.2	105	0	9	±1	
(60)			66		110		-1.4		9
64			70		115		9		
(68)			74	0	120	-1.5	10	±1	
72			78		125		10		
(76)			82		135		10		
80			86	+1.4	140	0	12	±1.4	
(85)			91		145		12		
90			96		160		12		
(95)			101	0	165	-1.5	12	±1.4	
100			107		175		14		

Nominal Size	Hardened Circular Washers					
	(d) Inside Diameter		(D) Outside Diameter		Thickness (t)	
	Max	Min	Max	Min	Max	Min
12	14.4	14.0	27.0	25.7	4.6	3.1
14	16.4	16.0	30.0	28.7		
16	18.4	18.0	34.0	32.4		
20	22.5	22.0	42.0	40.4		
22	24.5	24.0	44.0	42.4	3.4	4.6
24	26.5	26.0	50.0	48.4		
27	30.5	30.0	56.0	54.1		
30	33.6	33.0	60.0	58.1		
36	39.6	39.0	72.0	70.1	7.2	4.6
42	45.6	45.0	84.0	81.8		
48	52.7	52.0	95.0	92.8		
56	62.7	62.0	107.0	104.8		
64	70.7	70.0	118.0	115.8	8.7	6.1
72	78.7	78.0	130.0	127.5		
80	86.9	86.0	142.0	139.5		
90	96.9	96.0	159.0	156.5		
100	107.9	107.0	176.0	173.5		



Type B ASME B18.22.1

Unit : inch

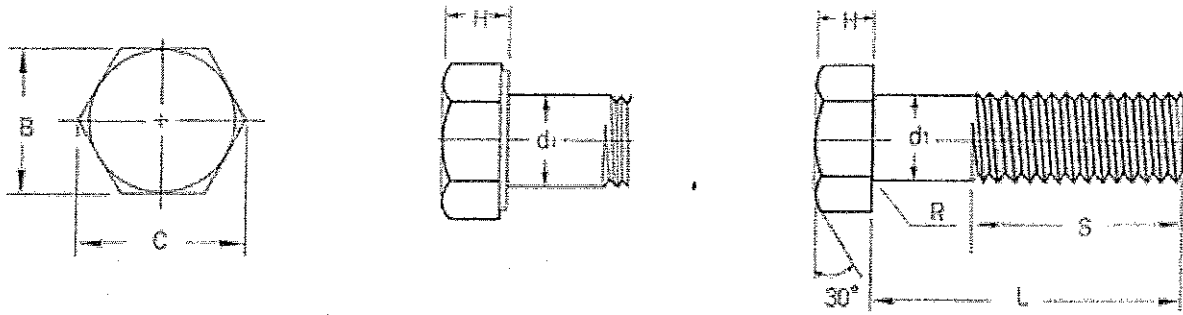
ASTM F436

Unit : inch

Nominal Size	Narrow Type		(D) Outside Dia		(t) Thickness		
	(d) Inside Diameter	Basic	Tolerance		Basic	Tolerance	
			Plus	Minus		Max	Min
# 10	0.023	0.406	0.008	0.005	0.040	0.045	0.036
# 12	0.234	0.438					
1/4	0.281	0.500					
5/16	0.344	0.625					
3/8	0.406	0.734	0.015	0.005	0.063	0.071	0.056
7/16	0.469	0.875					
1/2	0.531	1.000					
5/8	0.656	1.250					
3/4	0.812	1.375	0.030	0.007	0.100	0.112	0.090
7/8	0.938	1.469					
1	1.062	1.750					
1 - 1/8	1.188	2.000					
1 - 1/4	1.312	2.250	0.045	0.010	0.160	0.174	0.145
1 - 3/8	1.438	2.500					
1 - 1/2	1.562	2.750					
1 - 5/8	1.750	3.000					
1 - 3/4	1.875	3.250	0.045	0.010	0.250	0.266	0.234
1 - 7/8	2.000	3.500					
2	2.125	3.750					

Bolt Size	Hardened Circular Washers					
	Outside (D) Diameter		Inside (d) Diameter		Thickness (t)	
	Basic	Tol	Basic	Tol	Min	Max
1/4	5/8		9/32		0.061	0.080
5/16	11/16		11/32			
3/8	13/16		13/32			
7/16	59/64		15/32			
1/2	1 - 1/16		17/32		0.097	0.122
5/8	1 - 5/16		11/16			
3/4	1 - 15/32		13/16			
7/8	1 - 3/4	±1/32	15/16	+1/32		
1	2		1 - 1/8	0	0.136	0.177
1 - 1/8	2 - 1/4		1 - 1/4			
1 - 1/4	2 - 1/2		1 - 3/8			
1 - 3/8	2 - 3/4		1 - 1/2			
1 - 1/2	3		1 - 5/8		0.175	0.28
1 - 3/4	3 - 3/8		1 - 7/8			
2	3 - 3/4		2 - 1/8			
2 - 1/4	4		2 - 3/8			
2 - 1/2	4 - 1/2	±1/16	2 - 5/8	+1/16	0.24	0.34
2 - 3/4	5		2 - 7/8	0		
3	5 - 1/2		3 - 1/8			

Hex Bolts & Hex Cap Screws



Metric KS B1002, JIS B1180

Unit : mm

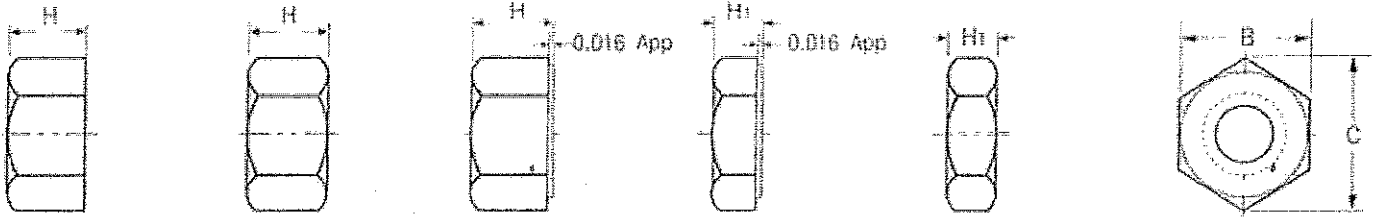
Bolt Diameter and Pitch		d1				H				B			C	R	S			
Coarse	Fine	Basic	Tolerance			Basic	Tolerance			Basic	Tolerance			App	Min	L ≤ 125	125 < L ≤ 200	L > 200
			Fin	Semi Fin	Regu		Fin	Semi Fin	Regu		Fin	Semi Fin	Regu					
M6x1	-	6	0	0	4	±0.15	±0.25	±0.6	10	3/4	3/4	3/4	11.5	0.25	18	-	-	
M8x1.25	M8x1	8	0	+0.2	5.5	±0.15	±0.25	±0.6	13	0	0	0	15	0.4	22	-	-	
M10x1.5	M10x1.25	10	-0.15	-0.2	7				17	-0.25	-0.7	-0.7	19.6	0.4	26	-	-	
M12x1.75	M12x1.25	12	0	+0.9	8				19	0	0	0	21.9	0.6	30	36	-	
M14x2	(M14x1.5)	14	0	-0.25	-0.2	9	±0.2	±0.8	22	0	0	0	25.4	0.6	34	40	-	
M16x2	M16x1.5	16	0	-0.25	-0.2	10			24	-0.35	-0.2	-0.8	27.7	0.6	38	44	-	
(M18x2.5)	(M18x1.5)	18	0	-0.2	12	27			31.2	0.6	42	48	-					
M20x2.5	M20x1.5	20	-0.2	-0.2	13	±0.2	±0.8	±0.9	30	0	0	0	34.6	0.8	45	52	-	
(M22x2.5)	(M22x1.5)	22	0	+0.95	14	±0.35	±0.9	±1.0	32	0	0	0	37	0.8	50	55	-	
M24x3	M24x2	24	-0.35	-0.35	15				36	41.6	0.8	54	60	-				
(M27x3)	(M27x2)	27	0	0	17				41	-0.4	-1.0	-1.0	47.3	1	60	65	79	
M30x3.5	M30x2	30	0	0	19	±0.25	±0.4	±1.0	46	0	0	0	53.1	1	65	72	85	
(M33x3.5)	(M33x2)	33	0	0	21	±0.25	±0.4	±1.0	50	0	0	0	57.7	1	72	78	91	
M36x4	M36x3	36	0	0	23				55	63.5	1	78	84	97				
(M39x4)	(M39x3)	39	0	0	25				60	69.3	1	84	90	103				
M42x4.5	-	42	-0.25	-0.4	-0.4	28	±0.25	±0.4	±1.0	65	0	0	0	75	1.2	90	95	109
(M45x4.5)	-	45	0	0	28	70	-0.45	-1.2	-1.2	70	-0.45	-1.2	-1.2	80.8	1.2	96	102	115
M48x5	-	48	0	0	30	±0.25	±0.4	±1.0	75	0	0	0	85.5	1.6	102	108	121	
(M52x5)	-	52	0	0	33	±0.25	±0.4	±1.0	80	0	0	0	92.4	1.6	-	116	129	
M56x5.5	-	56	0	0	35				85	98.1	2	-	124	137				
(M50x5.5)	-	60	0	0	38				90	104	2	-	132	145				
M64x6	-	64	0	0	40	±0.3	±0.5	-	95	0	0	0	110	2	-	140	153	
(M68x6)	-	68	-0.3	-1.45	43	±0.3	±0.5	-	100	-0.55	-1.4	-	115	2	-	148	161	
-	M72x6	72	0	0	45	±0.3	±0.5	-	105	0	0	0	121	2	-	155	169	
-	(M76x6)	76	0	0	48	±0.3	±0.5	-	110	0	0	0	127	2	-	164	177	
-	M80x6	80	0	0	50	±0.3	±0.5	-	115	0	0	0	133	2	-	172	185	

Unified ASME B18.2.1

Unit : inch

Nominal Size of Basic Bolt Dia		d1	B				C		H			R		S	
Basic Bolt Dia	Body Dia	Max	Width Across Flats		Width Across Corners		Head Height			Radius of Fillet		Thread Length for Bolt Lengths			
			Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Basic	
1/4	0.2500	0.260	7/16	0.438	0.425	0.505	0.484	11/64	0.168	0.150	0.03	0.01	0.750	1.000	
5/16	0.3125	0.324	1/2	0.500	0.484	0.577	0.552	7/32	0.235	0.195	0.03	0.01	0.875	1.125	
3/8	0.3750	0.388	9/16	0.562	0.544	0.650	0.620	1/4	0.269	0.226	0.03	0.01	1.000	1.250	
7/16	0.4375	0.452	5/8	0.625	0.603	0.722	0.687	19/64	0.316	0.272	0.03	0.01	1.125	1.375	
1/2	0.5000	0.515	3/4	0.750	0.725	0.866	0.826	11/32	0.364	0.302	0.03	0.01	1.250	1.500	
5/8	0.6250	0.642	15/16	0.938	0.906	1.083	1.033	27/64	0.444	0.378	0.05	0.02	1.500	1.750	
3/4	0.7500	0.768	1	1.125	1.088	1.299	1.240	1/2	0.524	0.455	0.05	0.02	1.750	2.000	
7/8	0.8750	0.895	1	1.312	1.269	1.516	1.447	27/64	0.604	0.531	0.05	0.02	2.000	2.250	
1	1.0000	1.022	1	1.500	1.450	1.732	1.653	43/64	0.700	0.591	0.09	0.03	2.250	2.500	
1	1.1250	1.149	1	1.688	1.631	1.949	1.859	3/4	0.790	0.658	0.09	0.03	2.500	2.750	
1	1.2500	1.277	1	1.875	1.812	2.165	2.056	27/32	0.876	0.749	0.09	0.03	2.750	3.000	
1	1.3750	1.404	2	1.1/16	2.062	1.994	2.382	2.273	29/32	0.940	0.810	0.09	0.03	3.000	3.250
1	1.5000	1.531	2	1/4	2.250	2.175	2.598	2.480	1	1.036	0.902	0.09	0.03	3.250	3.500
1	1.7500	1.785	2	5/8	2.625	2.538	3.031	2.893	1	1.196	1.054	0.12	0.04	3.750	4.000
2	2.0000	2.039	3	3.000	2.900	3.464	3.305	1	1.369	1.175	0.12	0.04	4.250	4.500	
2	1/4	2.2500	3	3/8	3.375	3.262	3.897	3.719	1	1.548	1.327	0.19	0.06	4.750	5.000
2	1/2	2.5000	3	3/4	3.750	3.625	4.330	4.133	1	1.708	1.479	0.19	0.06	5.250	5.500
2	3/4	2.7500	4	1/8	4.125	3.998	4.763	4.546	1	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	3.081	4	1/2	4.500	4.330	5.196	4.959	2	2.060	1.815	0.19	0.06	6.250	6.500
3	1/4	3.2500	4	7/8	4.875	4.712	5.629	5.372	2	2.251	1.936	0.19	0.06	6.750	7.000
3	1/2	3.5000	5	1/4	5.250	5.075	6.062	5.785	2	2.380	2.057	0.19	0.06	7.250	7.500
3	3/4	3.7500	5	5/8	5.625	5.437	6.495	6.198	2	2.572	2.241	0.19	0.06	7.750	8.000
4	4.0000	4.111	6	6.000	5.800	6.928	6.612	2	11/16	2.764	2.424	0.19	0.06	8.250	8.500

Hex Nuts & Hex Jam Nuts



Metric KS B1012, JIS B1181

Unit : mm

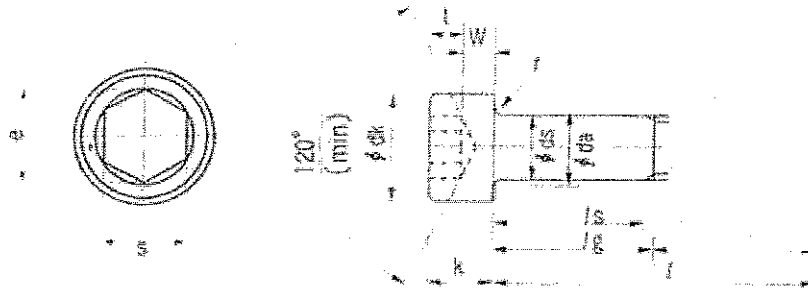
Nominal Size and Pitch		H				Hi				B				C
Coarse	Fine	Basic	Tolerance			Basic	Tolerance			Basic	Tolerance			App
			Finish	Semi Finish	Regu		Finish	Semi Finish	Regu		Finish	Semi Finish	Regu	
M6 x 1	-	5	0	0	±0.8	3.0	0	0	±0.6	10	0	0	0	11.5
M8 x 1.25	M8 x 1	6.5	0	0	±0.8	5	-0.3	-0.46	±0.6	13	0	0	0	15
M10 x 1.5	M10 x 1.25	8	-0.36	-0.58	±0.8	6				17	-0.25	-0.7	-0.7	19.6
M12 x 1.75	M12 x 1.25	10				7				19				21.9
(M14 x 2)	(M14 x 1.5)	11				8	0	0	±0.8	22	0	0	0	25.4
M16 x 2	M16 x 1.5	13				10	-0.36	-0.58		24	0	0	0	27.7
(M18 x 2.5)	(M18 x 1.5)	15	-0.43	-0.70	±0.8	11				27	-0.35	-0.8	-0.8	31.2
M20 x 2.5	M20 x 1.5	16				12				30				34.6
(M22 x 2.5)	(M22 x 1.5)	18				13	0	0	±0.8	32				37
M24 x 3	M24 x 2	19				14	-0.43	-0.70		36				41.6
(M27 x 3)	(M27 x 2)	22	0	0	±1.0	16				41	-0.4	0	0	47.3
M30 x 3.5	M30 x 2	24	-0.52	-0.84	±1.0	18				46				52.1
(M33 x 3.5)	(M33 x 2)	26				20				50				57.7
M36 x 4	M36 x 3	29				21	0	0	±1.0	55				63.5
(M39 x 4)	(M39 x 3)	31				23	-0.52	-0.84		60				69.3
M42 x 4.5	-	34				25				65				75
(M45 x 4.5)	-	36				27				70	0	0	0	80.5
M48 x 5	-	38	-0.62	-1.0	±1.2	29				75	-0.45	-1.2	-1.2	86.5
(M52 x 5)	-	42				31				80				92.4
M56 x 5.5	-	45				34				85				98.1
(M60 x 5.5)	-	48				36				90				104
M64 x 6	-	51				38	0	0	±1.2	95				110
(M68 x 6)	-	54				40	-0.62	-1.0		100	0	0	0	115
-	M72 x 6	58				42				105	-0.55	-1.4	-1.4	121
-	(M76 x 6)	61	0	0	±1.5	46				110				127
-	M80 x 6	64	-0.74	-1.2	±1.5	48				115				133
-	(M85 x 6)	68				50				120				139
-	M90 x 6	72				54				130				150
-	(M95 x 6)	76				57	0	0	±1.5	135	0	0	0	156
-	M100 x 6	80				60	-0.74	-1.2		145	-0.55	-1.6	-1.6	167
-	M110 x 6	88	0	0	±1.8	65				155				179
-	(M120 x 6)	98	-0.97	-1.4		72				170				196

Unified ASME B18.2.2

Unit : inch

Nominal Size or Basic Major Dia of Thread		B			C		H			Hi		
		Width Across Flats			Width Across Corners		Thickness Hex Nuts			Thickness Hex Jam Nuts		
		Basic	Max	Min	Max	Min	Basic	Max	Min	Basic	Max	Min
1/4	0.2500	7/16	0.438	0.428	0.505	0.488	7/32	0.226	0.212	5/32	0.163	0.150
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	17/64	0.273	0.259	3/16	0.195	0.180
3/8	0.3750	9/16	0.562	0.551	0.590	0.528	21/64	0.337	0.320	7/32	0.227	0.210
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	3/8	0.385	0.365	1/4	0.269	0.240
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	7/16	0.448	0.427	5/16	0.323	0.302
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	31/64	0.496	0.473	5/16	0.324	0.301
5/8	0.6250	15/16	0.938	0.922	1.083	1.051	35/64	0.559	0.535	3/8	0.387	0.363
3/4	0.7500	1 1/8	1.125	1.088	1.299	1.240	41/64	0.665	0.617	27/64	0.446	0.398
7/8	0.8750	1 5/16	1.312	1.269	1.516	1.447	3/4	0.776	0.724	31/64	0.510	0.459
1	1.0000	1 1/2	1.500	1.450	1.732	1.653	55/64	0.887	0.831	35/64	0.575	0.519
1 1/8	1.1250	1 11/16	1.688	1.631	1.949	1.859	31/32	0.989	0.939	39/64	0.639	0.579
1 1/4	1.2500	1 7/8	1.875	1.812	2.166	2.056	1 1/16	1.094	1.030	23/32	0.751	0.687
1 3/8	1.3750	2 1/16	2.062	1.994	2.382	2.273	1 11/64	1.208	1.138	25/32	0.815	0.747
1 1/2	1.5000	2 1/4	2.250	2.175	2.588	2.480	1 9/32	1.317	1.245	27/32	0.880	0.808

Hexagon Socket Head Cap Screws

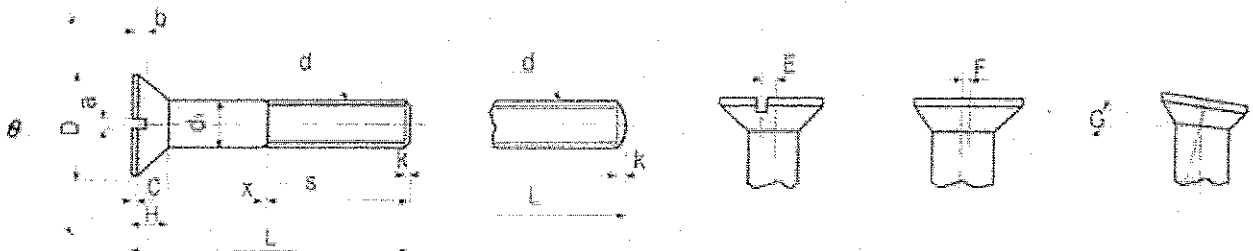


Metric KS B1003, JIS B1176

Unit : mm

(d) Nominal Size and Pitch	dk			da	ds		e	k		f	s			t	b	
	Basic	Max	Min	Max	Basic	Min	Min	Basic	Min	Min	Basic	Min	Max	Min	Reference	
M 3	0.5	5.5	5.69	5.32	3.6	3	2.86	2.87	3	2.96	0.1	2.5	2.52	2.56	1.3	18
M 4	0.7	7	7.22	6.78	4.7	4	3.82	3.44	4	3.82	0.2	3	3.02	3.060	2	20
M 5	0.8	8.5	8.72	8.28	5.7	5	4.82	4.58	5	4.82	0.2	4	4.02	4.095	2.5	22
M 6	1	10	10.22	9.78	6.8	6	5.82	5.72	6	5.70	0.25	5	5.02	5.095	3	24
M 8	1.25	13	13.27	12.73	9.2	8	7.78	6.85	8	7.64	0.4	6	6.02	6.095	4	28
M 10	1.5	16	16.27	15.73	11.2	10	9.78	9.15	10	9.64	0.4	8	8.025	8.115	5	32
M 12	1.75	18	18.27	17.73	13.7	12	11.73	11.43	12	11.57	0.6	10	10.025	10.115	6	36
(M 14)	2	21	21.33	20.67	15.7	14	13.73	13.72	14	13.57	0.6	12	12.032	12.142	7	40
M 16	2	24	24.33	23.67	17.7	16	15.73	16.00	16	15.57	0.6	14	14.032	14.142	8	44
(M 18)	2.5	27	27.33	26.67	20.2	18	17.73	18.00	18	17.57	0.6	14	14.032	14.142	9	48
M 20	2.5	30	30.33	29.67	22.4	20	19.67	19.44	20	19.48	0.8	17	17.050	17.230	10	52
(M 22)	2.5	33	33.39	32.61	24.4	22	21.67	19.44	22	21.48	0.8	17	17.050	17.230	11	56
M 24	3	36	36.39	35.61	26.4	24	23.67	21.72	24	23.48	0.8	19	19.065	19.275	12	60
(M 27)	3	40	40.39	39.61	30.4	27	26.67	21.72	27	26.48	1	19	19.065	19.275	13.5	66
M 30	3.5	45	45.39	44.61	33.4	30	29.67	25.15	30	29.48	1	22	22.065	22.275	15.5	72
(M 33)	3.5	50	50.39	49.61	36.4	33	32.61	27.43	33	32.38	1	24	24.065	24.275	16.5	78
M 36	4	54	54.46	53.54	39.4	36	35.61	30.85	36	35.38	1	27	27.065	27.275	19	84
(M 39)	4	58	58.46	57.54	42.4	39	38.61	30.85	39	38.38	1	27	27.065	27.275	20	90
M 42	4.5	63	63.46	62.54	45.6	42	41.61	36.57	42	41.38	1.2	32	32.080	32.330	21	96
(M 45)	4.5	68	68.46	67.54	48.6	45	44.61	36.57	45	44.38	1.2	32	32.080	32.330	23	102
M 48	5	72	72.46	71.54	52.6	48	47.61	41.13	48	47.38	1.6	36	36.080	36.330	24	108
(M 52)	5	78	78.46	77.54	56.6	52	51.54	41.13	52	51.26	1.6	36	36.080	36.330	26	116

Flat Head Bolts



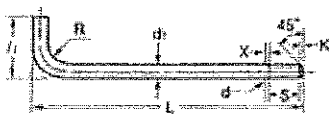
KS B1017, JIS B1179

Unit : mm

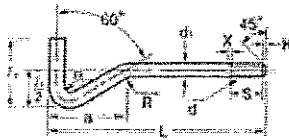
(d) Size	dk			D		H(Max)		C	θ	a		D		E & F			
	Basic	Tolerance		Basic	Tolerance		App	Basic		Tolerance		Basic	Tolerance		GradeA	GradeB	
		GradeA	GradeB		GradeA	GradeB				GradeA	GradeB						
M 10	10	0	0	20	0	0	5.5	5.7	0.5	30°	0	0	2.5	±0.3	±0.4	0.35	0.5
M 12	12	0	0	24	0	0	5.5	6.7	0.5	30°	0	0	2.5	±0.3	±0.4	0.35	0.5
M 14	14	0	+0.09	27	-0.35	-1.3	7	7.2	0.5	30°	0	0	3.3	±0.3	±0.4	0.35	0.5
M 16	16	-0.25	-0.2	30	0	0	7.5	7.7	0.5	30°	0	0	3.3	±0.3	±0.4	0.35	0.5
M 18	18	0	0	33	0	0	8	8.2	0.5	30°	0	0	3.3	±0.3	±0.4	0.35	0.5
M 20	20	0	0	36	0	0	8.5	8.8	0.5	30°	0	0	4.5	±0.4	±0.5	0.4	0.6
M 22	22	0	+0.05	39	-0.4	-1.6	13.2	13.6	1	60°	0	0	4.5	±0.4	±0.5	0.4	0.6
M 24	24	-0.35	-0.35	39	0	0	14	14.4	1	60°	0	0	4.5	±0.4	±0.5	0.4	0.6
M 30	30	0	0	48	0	0	16.6	17	1	60°	0	0	5	±0.45	±0.6	0.45	0.6
M 36	36	0	0	57	0	0	19.2	19.7	1	60°	0	0	7	±0.45	±0.6	0.45	0.6

Foundation Bolts (Anchor Bolts)

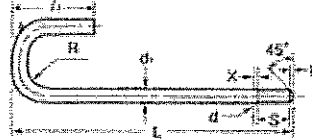
Type L



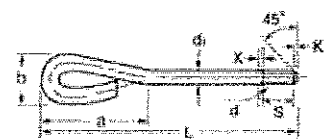
Type LA



Type J



Type JA



Metric/ KS B1016, JIS B1178

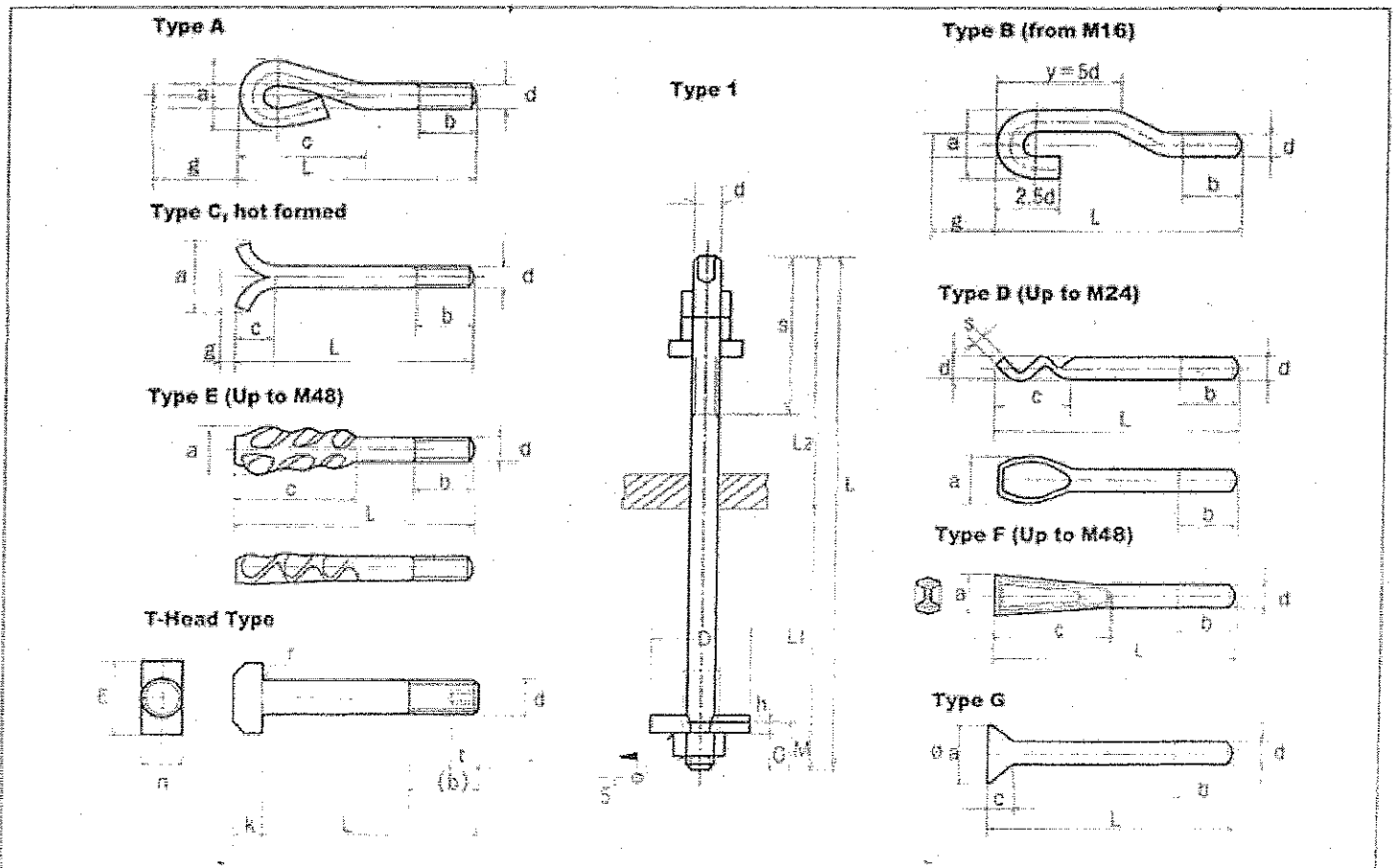
Unit : mm

d	d ₁		S		Tolerance	l _{App}		R _{App}		a _{App}		b _{App}	K _{App}
	Basic	Tolerance	LJ	LA, JA		L, LA	J	L, J	L, A	LA	JA	JA	
M8	8	±0.4		20	+6.3	32			8	41			1.2
M10	10		25	30	0	40	45	20	10	51	50	35	1.5
M12	12		32	35	+8	50	56	25	12	64	65	40	2
M16	16	±0.5	40	40	0	63	71	32	16	81	85	55	2
M20	20		50	50	+10	80	90	40	20	102	105	70	2.5
M24	24		63	80	0	100	112	50	24	127	125	80	3
M30	30	±0.6	80	90	+10	125	140	63	30	158	155	100	3.5
M36	36	±0.7	90	110	0	140	160	71	36	181	190	120	4
M42	42	±0.8	112	125		180	200	90	42	226	220	140	4.5
M48	48	±0.9	125	150	+12.5 H	200	244	100	48	252	250	160	5

Diameter of type "L" is M10-20

Shape of Foundation Bolts

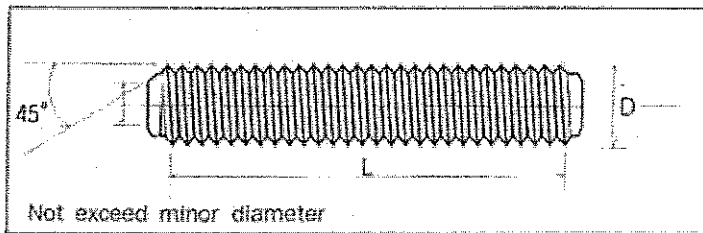
(DIN 186, 188, 261, 529, 7992)



Stud Bolts & Nuts

For Pressure-Temperature Piping (ASME B16.5)

Stud Bolts Size & Dimension Tolerance



Unit : inch

Diameter	Lengths	
	Tolerance On Stud Lengths	
	L ≤ 6	L > 6
Over 5/16 to 3/4	±1/16	±1/8
Over 3/4 to 1-1/4	±1/8	±3/16
Over 1-1/4	±1/4	±1/4

- Notes : 1. L is the length of first thread to first thread not including point of both ends.
2. Points shall be flat and chamfered.

Threads

Nominal Size or Diameter of Stud-bolt (D)		D=1" (25mm) & Smaller	D=1 1/2" (28mm) & Larger
Thread	INCH Series	Unified Coarse Thread Series Class 2A and 2B ASME B1.1	Unified 8-thread (3-pitch) Series Class 2A and 2B ASME B1.1
	METRIC Series	METRIC Coarse Thread Series Class 6G and 6H JIS B0209/ISO 261	METRIC 3-pitch Series Class 6G and 6H JIS B0209/ISO 261

Dimension of Nuts

Inch Series	Conform to Heavy Hex Nuts of ASME B 18. 2. 2. Double chamfered or Washer faced.
METRIC Series	Conform to Heavy Hex Nuts of ASME B 18. 2. 4.6M Double chamfered of Washer faced.

Materials

Conform to ASTM, ASME, JIS Specification

Marking

Identification Grade Markings Shall conform to ASTM, ASME designation for steel fasteners

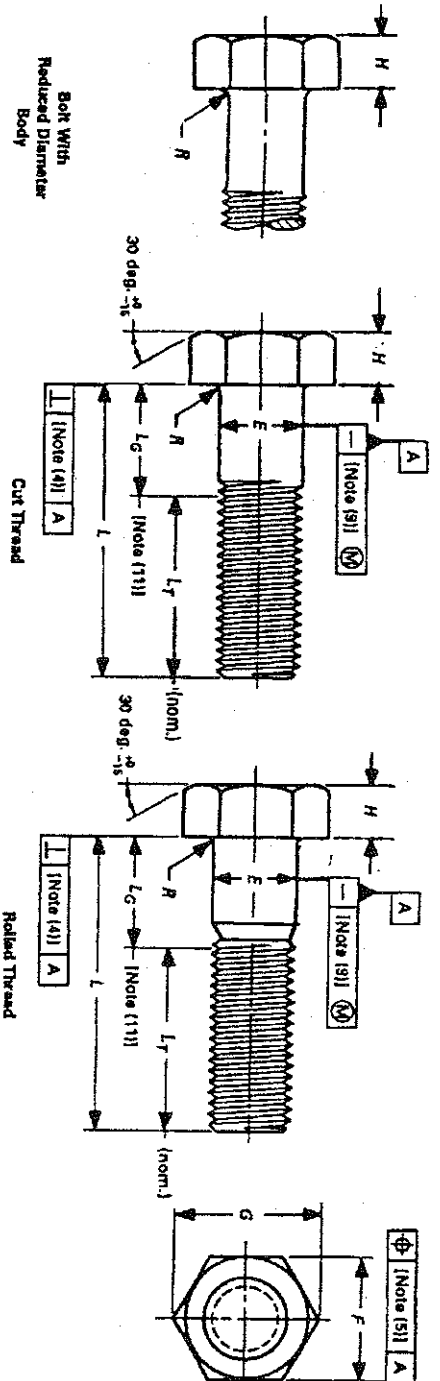


TABLE 2 DIMENSIONS OF HEX BOLTS

Nominal Size or Basic Product Diameter [Note (16)]	E		F		G		H		R		L _r	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Norm.	Norm.
1/4	0.2500	0.237	0.438	0.425	0.505	0.484	0.188	0.150	0.03	0.01	0.750	1.000
5/16	0.3125	0.298	0.500	0.484	0.577	0.552	0.235	0.195	0.03	0.01	0.875	1.125
3/8	0.3750	0.360	0.562	0.544	0.650	0.620	0.268	0.226	0.03	0.01	1.000	1.250
7/16	0.4375	0.421	0.625	0.603	0.722	0.687	0.316	0.272	0.03	0.01	1.125	1.375
1/2	0.5000	0.482	0.750	0.725	0.866	0.826	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.605	0.938	0.906	1.083	1.033	0.444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.729	1.125	1.088	1.299	1.240	0.524	0.455	0.06	0.02	1.750	2.000
7/8	0.8750	0.852	1.312	1.269	1.516	1.447	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	0.976	1.500	1.450	1.732	1.653	0.700	0.591	0.09	0.03	2.250	2.500
1 1/8	1.1250	1.098	1.688	1.631	1.949	1.859	0.780	0.658	0.09	0.03	2.500	2.750
1 1/4	1.2500	1.223	1.875	1.812	2.165	2.066	0.876	0.749	0.09	0.03	2.750	3.000
1 1/2	1.3750	1.345	2.062	1.994	2.382	2.273	0.940	0.810	0.09	0.03	3.000	3.250
1 3/4	1.5000	1.470	2.250	2.175	2.598	2.480	1.036	0.902	0.09	0.03	3.250	3.500
1 7/8	1.7500	1.716	2.625	2.538	3.031	2.893	1.196	1.054	0.12	0.04	3.750	4.000
2	2.0000	1.964	3.000	2.900	3.464	3.306	1.388	1.175	0.12	0.04	4.250	4.500
2 1/4	2.2500	2.214	3.375	3.262	3.897	3.719	1.548	1.327	0.19	0.06	4.750	5.000
2 1/2	2.5000	2.461	3.750	3.625	4.330	4.133	1.708	1.479	0.19	0.06	5.250	5.500
2 3/4	2.7500	2.711	4.125	3.988	4.763	4.546	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	2.961	4.500	4.350	5.196	4.959	2.060	1.815	0.19	0.06	6.250	6.500
3 1/4	3.2500	3.210	4.875	4.712	5.629	5.372	2.251	1.936	0.19	0.06	6.750	7.000
3 1/2	3.5000	3.461	5.250	5.075	6.062	5.786	2.380	2.057	0.19	0.06	7.250	7.500
3 3/4	3.7500	3.726	5.625	5.437	6.495	6.198	2.572	2.241	0.19	0.06	7.750	8.000
4	4.000	3.975	6.000	5.800	6.928	6.612	2.764	2.424	0.19	0.06	8.250	8.500

SQUARE AND HEX BOLTS AND SCREWS (INCH SERIES)

ASME B18.2.1-1996

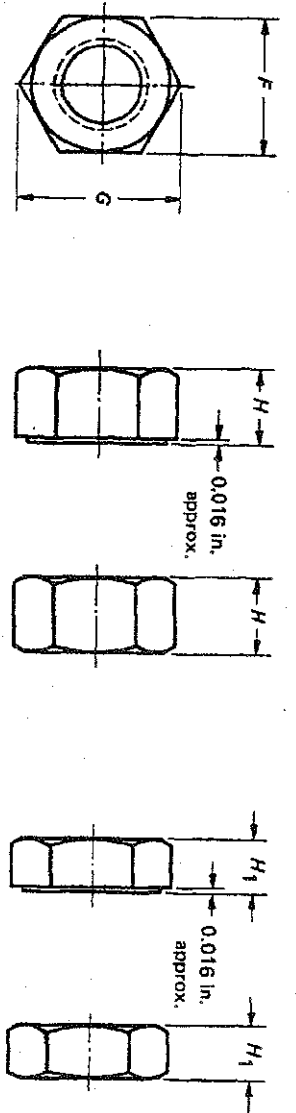


TABLE 3 DIMENSIONS OF HEX NUTS AND HEX JAM NUTS

Nominal Size or Basic Major Diam. of Thread	F		G		H		H ₁		Runout of Bearing Face FIM			
	Width Across Flats		Width Across Corners		Thickness Hex Nuts		Thickness Hex Jam Nuts		Hex Nuts Specified Proof Load	Hex Jam Nuts	All Strength Levels	
	Basic	Max.	Min.	Max.	Min.	Max.	Min.	Max.				Up to 150,000 psi
1/4	0.2500	0.438	0.428	0.505	0.488	0.226	0.212	0.163	0.150	0.015	0.010	0.015
5/16	0.3125	0.500	0.489	0.577	0.557	0.273	0.258	0.195	0.180	0.016	0.011	0.016
3/8	0.3750	0.562	0.551	0.650	0.628	0.337	0.320	0.227	0.210	0.017	0.012	0.017
7/16	0.4375	0.688	0.675	0.794	0.768	0.385	0.365	0.260	0.240	0.018	0.013	0.018
1/2	0.5000	0.750	0.736	0.866	0.840	0.448	0.427	0.323	0.302	0.019	0.014	0.019
9/16	0.5625	0.875	0.861	1.010	0.982	0.496	0.473	0.324	0.301	0.020	0.015	0.020
5/8	0.6250	0.938	0.922	1.083	1.051	0.559	0.535	0.387	0.363	0.021	0.016	0.021
3/4	0.7500	1.125	1.088	1.299	1.240	0.665	0.617	0.446	0.398	0.023	0.018	0.023
7/8	0.8750	1.312	1.269	1.516	1.447	0.776	0.724	0.510	0.458	0.025	0.020	0.025
1	1.0000	1.500	1.450	1.732	1.653	0.887	0.831	0.575	0.519	0.027	0.022	0.027
1 1/8	1.1250	1.688	1.631	1.949	1.859	0.999	0.939	0.639	0.579	0.030	0.025	0.030
1 1/4	1.2500	1.875	1.812	2.165	2.066	1.094	1.030	0.751	0.687	0.033	0.028	0.033
1 3/8	1.3750	2.062	1.994	2.362	2.273	1.206	1.138	0.815	0.747	0.036	0.031	0.036
1 1/2	1.5000	2.250	2.175	2.588	2.480	1.317	1.245	0.880	0.808	0.039	0.034	0.039
See Notes		1		2							3	

For additional requirements refer to Notes on p. 8 and General Data on pp. 1 and 2.

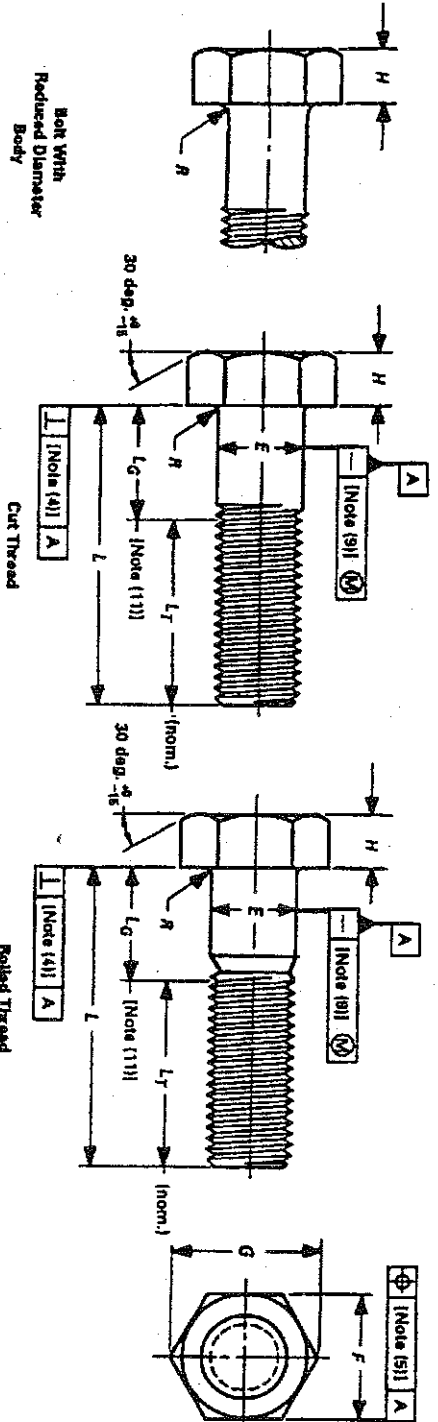


TABLE 3 DIMENSIONS OF HEAVY HEX BOLTS

Nominal Size or Basic Product Diameter [Note (16)]	E		F		G		H		R		L _T		
	Full Size Body Diameter [Notes (6), (7)]		Width Across Flats [Note (3)]		Width Across Corners [Note (3)]		Head Height		Radius of Fillet		Thread Length for Bolt Lengths [Notes (11)]		
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Nom.	Over 6 in.	
1/2	0.5000	0.515	0.875	0.850	1.010	0.969	1/2	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	1.062	1.031	1.227	1.175	3/8	0.444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1.250	1.212	1.443	1.383	1/2	0.524	0.455	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	1.438	1.394	1.660	1.589	3/4	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	1.022	1.625	1.575	1.876	1.796	4/8	0.700	0.591	0.09	0.03	2.250	2.500
1 1/8	1.1250	1.149	1.812	1.756	2.093	2.002	1/2	0.780	0.658	0.09	0.03	2.500	2.750
1 1/4	1.2500	1.277	2.000	1.938	2.309	2.209	3/4	0.876	0.749	0.09	0.03	2.750	3.000
1 1/2	1.3750	1.404	2.188	2.119	2.526	2.416	1 1/8	0.940	0.810	0.09	0.03	3.000	3.250
1 3/4	1.5000	1.531	2.375	2.300	2.742	2.622	1 1/4	1.036	0.902	0.09	0.03	3.250	3.500
2	1.7500	1.785	2.750	2.662	3.175	3.035	1 3/8	1.196	1.054	0.12	0.04	3.750	4.000
2 1/4	2.0000	2.039	3.125	3.025	3.608	3.449	1 1/2	1.388	1.175	0.12	0.04	4.250	4.500
2 1/2	2.2500	2.305	3.500	3.388	4.041	3.862	1 3/4	1.548	1.327	0.19	0.06	4.750	5.000
2 3/4	2.5000	2.559	3.875	3.750	4.474	4.275	1 7/8	1.708	1.479	0.19	0.06	5.250	5.500
3	2.7500	2.827	4.250	4.112	4.907	4.688	2	1.869	1.632	0.19	0.06	5.750	6.000
	3.0000	3.081	4.625	4.475	5.340	5.102		2.060	1.815	0.19	0.06	6.250	6.500

SQUARE AND HEX BOLTS AND SCREWS (INCH SERIES)

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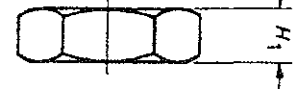
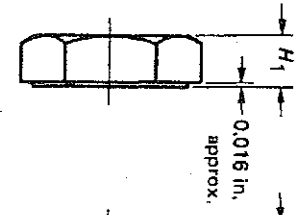
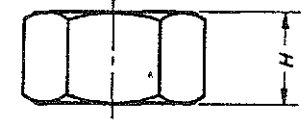
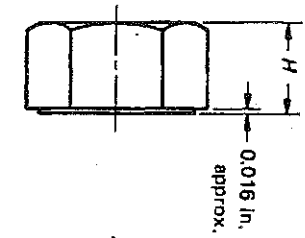
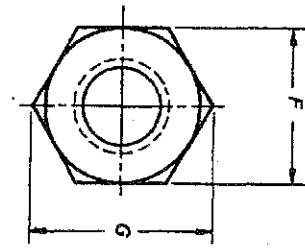


TABLE 9

TABLE 9 DIMENSIONS OF HEAVY HEX NUTS AND HEAVY HEX JAM NUTS

Nominal Size or Basic Major Diam. of Thread	F		G		H		H ₁		Runout of Bearing Face Flm		
	Width Across Flats		Width Across Corners		Thickness Heavy Hex Nuts		Thickness Heavy Hex Jam Nuts		Heavy Hex Nuts	Heavy Hex Jam Nuts	All Strength Levels
	Basic	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Up to 150,000 psi	150,000 psi and Greater	
1/4	0.2500	0.500	0.488	0.577	0.250	0.218	0.188	0.156	0.017	0.011	0.017
5/16	0.3125	0.582	0.546	0.650	0.314	0.280	0.220	0.186	0.020	0.012	0.020
3/8	0.3750	0.688	0.669	0.794	0.377	0.341	0.252	0.216	0.021	0.014	0.021
7/16	0.4375	0.750	0.728	0.866	0.441	0.403	0.285	0.247	0.022	0.015	0.022
1/2	0.5000	0.875	0.850	1.010	0.504	0.464	0.317	0.277	0.023	0.016	0.023
9/16	0.5625	0.938	0.909	1.083	0.568	0.526	0.349	0.307	0.024	0.017	0.024
5/8	0.6250	1.062	1.031	1.227	0.631	0.587	0.381	0.337	0.025	0.018	0.025
3/4	0.7500	1.250	1.212	1.443	0.758	0.710	0.446	0.398	0.027	0.020	0.027
7/8	0.8750	1.438	1.394	1.660	0.885	0.833	0.510	0.458	0.029	0.022	0.029
1	1.0000	1.625	1.575	1.876	1.012	0.956	0.575	0.519	0.031	0.024	0.031
1 1/8	1.1250	1.812	1.756	2.093	1.139	1.079	0.639	0.579	0.033	0.027	0.033
1 1/4	1.2500	2.000	1.938	2.309	1.261	1.187	0.751	0.687	0.035	0.030	0.035
1 3/8	1.3750	2.188	2.119	2.526	1.378	1.310	0.815	0.747	0.038	0.033	0.038
1 1/2	1.5000	2.375	2.300	2.742	1.505	1.433	0.880	0.808	0.041	0.036	0.041
1 5/8	1.6250	2.562	2.481	2.959	1.632	1.556	0.944	0.868	0.044	0.038	0.044
1 3/4	1.7500	2.750	2.662	3.175	1.759	1.679	1.009	0.929	0.048	0.041	0.048
1 7/8	1.8750	2.938	2.844	3.392	1.886	1.802	1.073	0.989	0.051	0.044	0.051
2	2.0000	3.125	3.026	3.608	2.013	1.925	1.138	1.050	0.055	0.047	0.055
2 1/4	2.2500	3.500	3.388	4.041	2.251	2.155	1.251	1.155	0.061	0.052	0.061
2 1/2	2.5000	3.875	3.750	4.474	2.505	2.401	1.505	1.401	0.068	0.058	0.068
2 3/4	2.7500	4.250	4.112	4.907	2.759	2.647	1.634	1.522	0.071	0.064	0.074
3	3.0000	4.625	4.476	5.340	3.013	2.893	1.783	1.643	0.081	0.070	0.081
3 1/4	3.2500	5.000	4.838	5.774	3.252	3.124	1.878	1.748	0.087	0.075	0.087
3 1/2	3.5000	5.375	5.200	6.207	3.506	3.370	2.006	1.870	0.084	0.081	0.094
3 3/4	3.7500	5.750	5.562	6.640	3.760	3.616	2.134	1.990	0.100	0.087	0.100
4	4.0000	6.125	5.925	7.073	4.014	3.862	2.264	2.112	0.107	0.093	0.107

For additional requirements refer to Notes on p. 22 and General Data on pp. 1 and 2.)

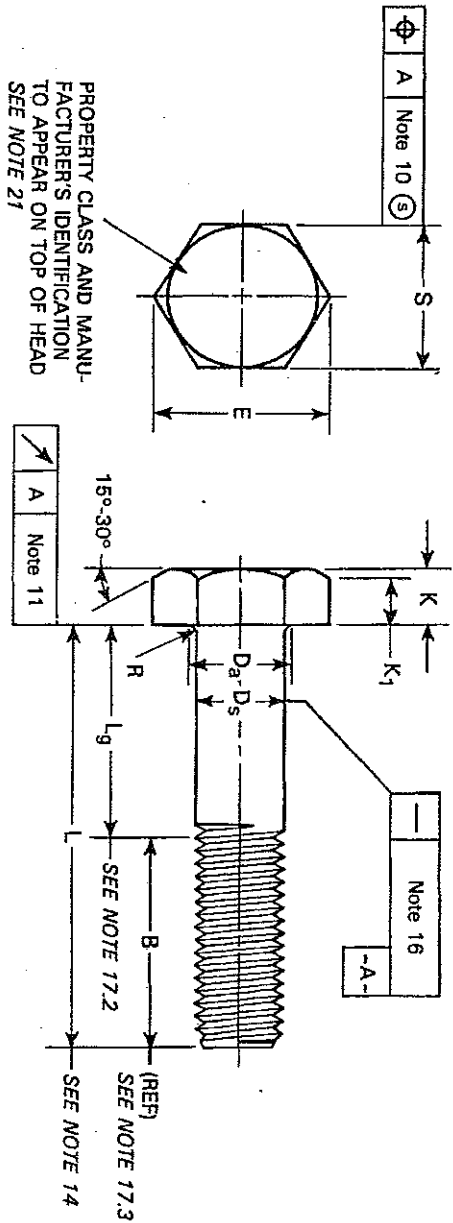


Table 1 Dimensions of Heavy Hex Bolts

D Nominal Bolt Size & Thread Pitch	Ds Body Diameter		S Width Across Flats		E Width Across Corners		K Head Height		K ₁ Wrenching Height	Da Filllet Transition Dia	R Radius of Filllet	B (Ref) Thread Length (Basic)		
	Max	Min	Max	Min	Max	Min	Max	Min				Bolt Lengths ≤ 125	Bolt Lengths > 125 and ≤ 200	Bolt Lengths > 200
M12 x 1.75	12.70	11.30	21.00	20.16	24.25	22.78	7.95	7.24	5.2	13.7	0.6	30	35	49
M14 x 2	14.70	13.30	24.00	23.16	27.71	26.17	9.25	8.51	6.2	15.7	0.6	34	40	53
M16 x 2	16.70	15.30	27.00	26.16	31.18	29.56	10.75	9.68	7.0	17.7	0.6	38	44	57
M20 x 2.5	20.84	19.16	34.00	33.00	39.26	37.29	13.40	12.12	8.8	22.4	0.8	46	52	65
M24 x 3	24.84	23.16	41.00	40.00	47.34	45.20	15.90	14.56	10.5	26.4	0.8	54	60	73
M30 x 3.5	30.84	29.16	50.00	49.00	57.74	55.37	19.75	17.92	13.1	33.4	1.0	66	72	85
M36 x 4	37.00	35.00	60.00	58.80	69.28	66.44	23.55	21.72	15.8	39.4	1.0	78	84	97
See Notes	12				8.9		7		8	13		17.3		

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AMERICAN NATIONAL STANDARD
METRIC HEX BOLTS

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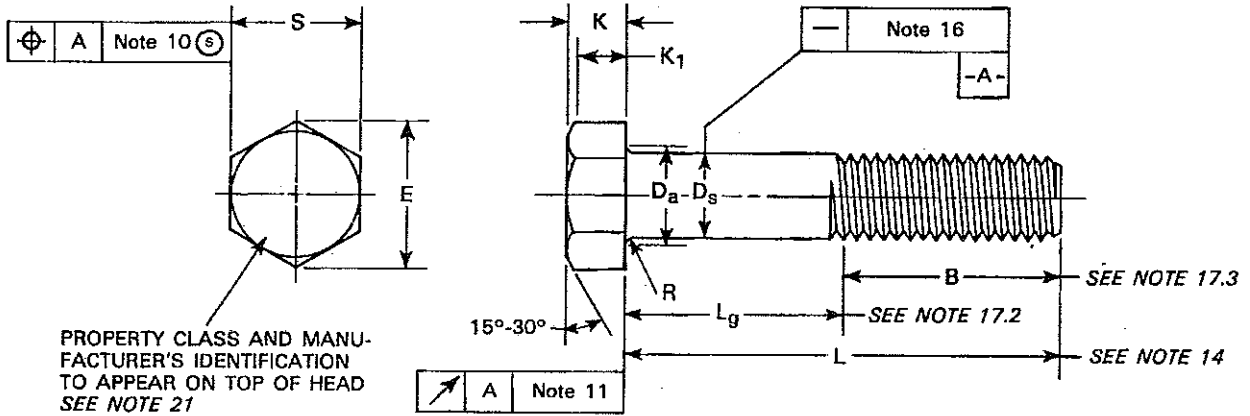


Table 1 Dimensions of Hex Bolts

Nominal Bolt Dia and Thread Pitch	D _s		S		E		K		K ₁	D _a	R	B (Ref)		
	Body Diameter		Width Across Flats		Width Across Corners		Head Height		Wrenching Height	Fillet Transition Dia	Radius of Fillet	Thread Length (Basic)		
	Max	Min	Max	Min	Max	Min	Max	Min	Min	Max	Min	Bolt Lengths < 125	Bolt Lengths > 125 and < 200	Bolt Lengths > 200
M5 x 0.8	5.48	4.52	8.00	7.64	9.24	8.63	3.88	3.36	2.4	5.7	0.2	16	22	35
M6 x 1	6.19	5.52	10.00	9.64	11.55	10.89	4.38	3.85	2.8	6.8	0.3	18	24	37
M8 x 1.25	8.58	7.42	13.00	12.57	15.01	14.20	5.68	5.10	3.7	9.2	0.4	22	28	41
M10 x 1.5	10.58	9.42	16.00	15.57	18.48	17.59	6.85	6.17	4.5	11.2	0.4	26	32	45
M12 x 1.75	12.70	11.30	18.00	17.57	20.78	19.85	7.95	7.24	5.2	13.7	0.6	30	36	49
M14 x 2	14.70	13.30	21.00	20.16	24.25	22.78	9.25	8.51	6.2	15.7	0.6	34	40	53
M16 x 2	16.70	15.30	24.00	23.16	27.71	26.17	10.75	9.68	7.0	17.7	0.6	38	44	57
M20 x 2.5	20.84	19.16	30.00	29.16	34.64	32.95	13.40	12.12	8.8	22.4	0.8	46	52	65
M24 x 3	24.84	23.16	36.00	35.00	41.57	39.55	15.90	14.56	10.5	26.4	0.8	54	60	73
M30 x 3.5	30.84	29.16	46.00	45.00	53.12	50.55	19.75	17.92	13.1	33.4	1.0	66	72	85
M36 x 4	37.00	35.00	55.00	53.80	63.51	60.79	23.55	21.62	15.8	39.4	1.0	78	84	97
M42 x 4.5	43.00	41.00	65.00	62.90	75.06	71.71	27.05	25.03	18.2	45.4	1.2	90	96	109
M48 x 5	49.00	47.00	75.00	72.60	86.60	82.76	31.07	28.93	21.0	52.0	1.5	102	108	121
M56 x 5.5	57.20	54.80	85.00	82.20	98.15	93.71	36.20	33.80	24.5	62.0	2.0	—	124	137
M64 x 6	65.52	62.80	95.00	91.80	109.70	104.65	41.32	38.68	28.0	70.0	2.0	—	140	153
M72 x 6	73.84	70.80	105.00	101.40	121.24	115.60	46.45	43.55	31.5	78.0	2.0	—	156	169
M80 x 6	82.16	78.80	115.00	111.00	132.79	126.54	51.58	48.42	35.0	86.0	2.0	—	172	185
M90 x 6	92.48	88.60	130.00	125.50	150.11	143.07	57.74	54.26	39.2	96.0	2.0	—	192	205
M100 x 6	102.80	98.60	145.00	140.00	167.43	159.60	63.90	60.10	43.4	107.0	2.5	—	212	225
See Notes	12				6.9		7		8	13		17.3		
M10 x 1.5	10.58	9.42	15.00	14.57	17.32	16.46	6.85	6.17	4.5	11.2	0.4	26	32	45

*See Note 2.2 of General Data.

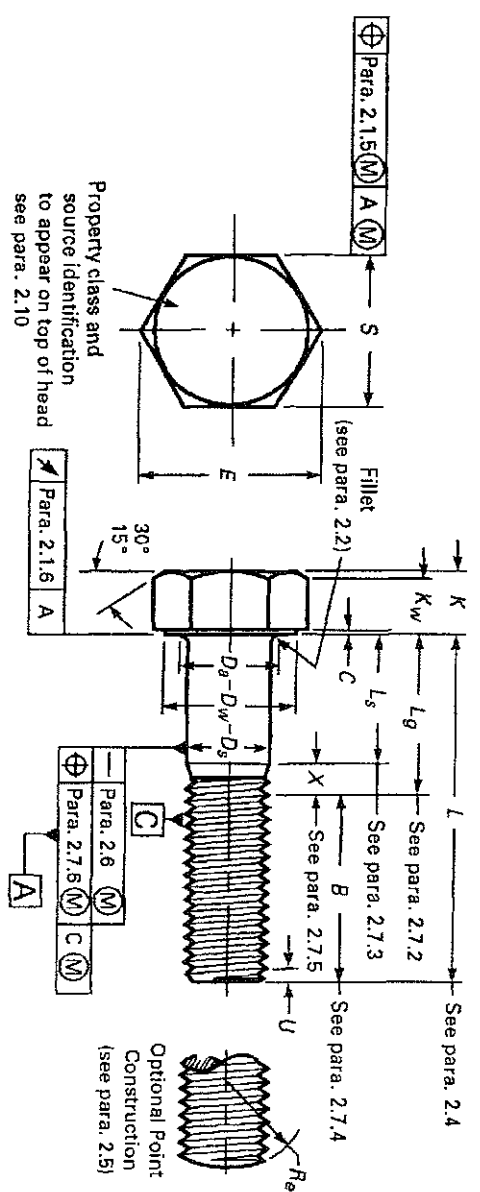


TABLE 3 DIMENSIONS OF HEX CAP SCREWS

Nominal Screw Diameter and Thread Pitch, <i>D</i>	Body Diameter, <i>D_b</i> [Note (1)]		Width Across Flats, <i>S</i>		Width Across Corners, <i>E</i> [Note (2)]		Head Height, <i>K</i> [Note (3)]		Wrenching Height, <i>K_w</i> Min. [Note (4)]	Washer Face Thickness, <i>C</i> [Note (5)]		Washer Face Diameter, <i>D_w</i> Min. [Note (6)]
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	
M5 × 0.8	4.82	5.00	7.78	8.00	8.79	9.24	3.35	3.65	2.4	0.2	0.5	7.0
M6 × 1	5.82	6.00	9.78	10.00	11.05	11.55	3.85	4.15	2.8	0.2	0.5	8.9
M8 × 1.125	7.78	8.00	12.73	13.00	14.38	15.01	5.10	5.50	3.7	0.3	0.6	11.6
M10 × 1.5 (7)	9.78	10.00	14.73	15.00	16.64	17.32	6.17	6.63	4.5	0.3	0.6	13.6
M10 × 1.5 (7)	9.78	10.00	15.73	16.00	17.77	18.48	6.17	6.63	4.5	0.3	0.6	14.6
M12 × 1.75	11.73	12.00	17.73	18.00	20.03	20.78	7.24	7.76	5.2	0.3	0.6	16.6
M14 × 2	13.73	14.00	20.67	21.00	23.35	24.25	8.51	9.09	6.2	0.3	0.6	19.6
M16 × 2	15.73	16.00	23.67	24.00	26.75	27.71	9.68	10.32	7.0	0.4	0.8	22.49
M20 × 2.5	19.67	20.00	29.16	30.00	32.95	34.64	12.12	12.88	8.8	0.4	0.8	27.7
M24 × 3	23.67	24.00	35.00	36.00	39.55	41.57	14.46	15.44	10.5	0.4	0.8	33.2
M30 × 3.5	29.67	30.00	45.00	46.00	50.85	53.12	17.92	19.48	13.1	0.4	0.8	42.7
M36 × 4	35.61	36.00	53.80	55.00	60.79	63.51	21.62	23.38	15.8	0.4	0.8	51.1
M42 × 4.5	41.38	42.00	62.90	65.00	71.71	75.06	25.03	26.97	18.2	0.5	1.0	59.8
M48 × 5	47.38	48.00	72.60	75.00	82.76	86.60	28.93	31.07	21.0	0.5	1.0	69.0
M56 × 5.5	55.26	56.00	82.20	85.00	93.71	98.15	33.80	36.20	24.5	0.5	1.0	78.1

(continued)

AMERICAN NATIONAL STANDARD
METRIC HEAVY HEX SCREWS

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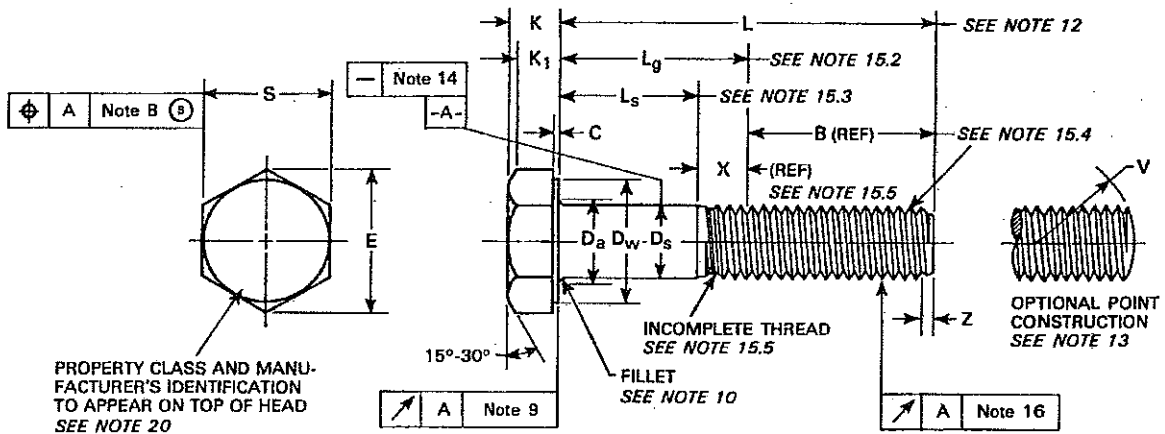


Table 1 Dimensions of Heavy Hex Screws

Nom Screw Dia and Thread Pitch	Ds		S		E		K		K ₁	C		D _w	Runout of Bearing Surface FIM
	Body Diameter		Width Across Flats		Width Across Corners		Head Height		Wrenching Height	Washer Face Thickness		Washer Face Dia	
	Max	Min	Max	Min	Max	Min	Max	Min	Min	Max	Min	Min	
M12 x 1.75	12.00	11.73	21.00	20.67	24.25	23.35	7.76	7.24	5.2	0.6	0.3	19.6	0.39
M14 x 2	14.00	13.73	24.00	23.67	27.71	26.75	9.09	8.51	6.2	0.6	0.3	22.5	0.43
M16 x 2	16.00	15.73	27.00	26.67	31.18	30.14	10.32	9.68	7.0	0.8	0.4	25.3	0.48
M20 x 2.5	20.00	19.67	34.00	33.00	39.26	37.29	12.88	12.12	8.8	0.8	0.4	31.4	0.59
M24 x 3	24.00	23.67	41.00	40.00	47.34	45.20	15.44	14.56	10.5	0.8	0.4	38.0	0.70
M30 x 3.5	30.00	29.67	50.00	49.00	57.74	55.37	19.48	17.92	13.1	0.8	0.4	46.6	0.85
M36 x 4	36.00	35.61	60.00	58.80	69.28	66.44	23.38	21.72	15.8	0.8	0.4	55.9	1.01
See Notes	11				6.7		5		6	9		9	9

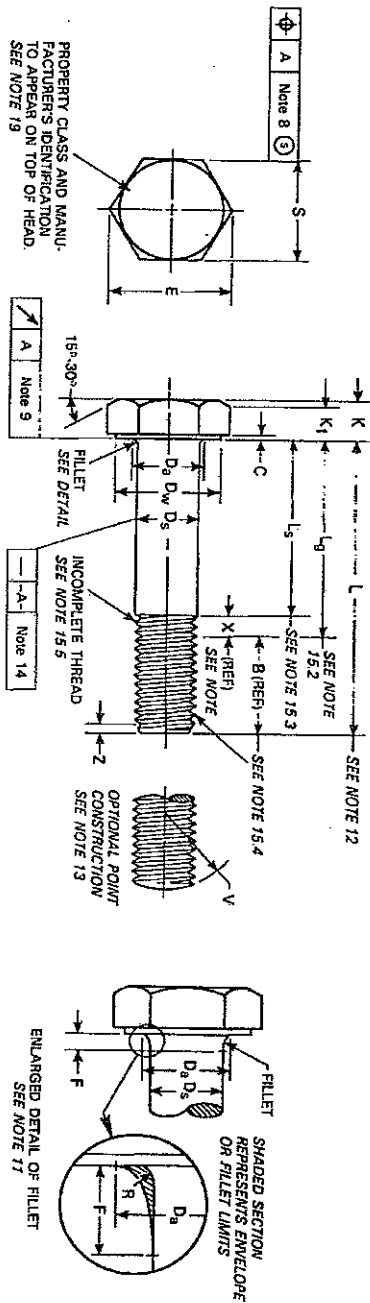


Table 1 Dimensions of Heavy Hex Structural Bolts

Nominal Bolt Dia and Thread Pitch	D _s		S		E		K		K ₁	D _w	Rounded Bearing Surface F ₁ M	C		D _a	F	R	B (Ref)		X (Ref)
	Max	Min	Max	Min	Max	Min	Max	Min				Max	Min				Max	Min	
M18 x 2	16.70	15.30	27.00	25.15	31.15	29.55	10.75	8.25	6.5	24.9	0.48	0.8	0.4	18.2	3.0	0.6	31	38	6.0
M20 x 2.5	20.84	19.15	34.00	33.00	39.25	37.25	13.40	11.60	8.1	31.4	0.59	0.8	0.4	22.4	4.0	0.8	36	43	7.5
M22 x 2.5	22.84	21.15	35.00	35.00	41.57	39.55	14.90	13.10	9.2	33.3	0.63	0.8	0.4	24.4	4.0	0.8	38	45	7.5
M24 x 3	24.84	23.15	41.00	40.00	47.34	45.20	15.90	14.10	9.9	38.0	0.70	0.8	0.4	25.4	4.0	1.0	41	48	9.0
M27 x 3	27.84	25.15	46.00	45.00	53.12	50.55	17.90	16.10	11.3	42.8	0.77	0.8	0.4	30.4	5.0	1.2	44	51	9.0
M30 x 3.5	30.84	29.15	50.00	49.00	57.24	55.37	19.75	17.55	12.4	46.5	0.85	0.8	0.4	33.4	6.0	1.2	49	56	10.5
M36 x 4	37.00	35.00	60.00	58.80	67.28	65.44	23.55	21.45	15.0	55.9	1.01	0.8	0.4	39.4	6.0	1.5	56	63	12.0

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 METRIC HEAVY HEX STRUCTURAL BOLTS

AMERICAN NATIONAL STANDARD
METRIC HEX NUTS, STYLE 2

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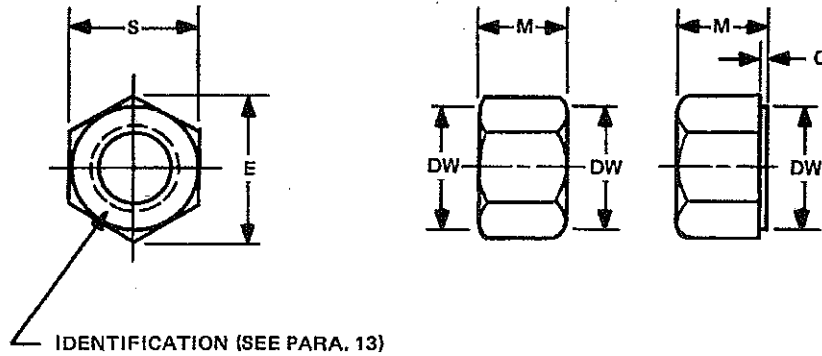


Table 1 Dimensions of Hex Nuts, Style 2

Nominal Nut Dia and Thread Pitch	S		E		M		Dw	C		Total Runout of Bearing Surface FIM
	Width Across Flats		Width Across Corners		Thickness		Bearing Face Dia	Washer Face Thickness		
	Max	Min	Max	Min	Max	Min	Min	Max	Min	
M3 x 0.5	5.50	5.32	6.35	6.01	2.90	2.65	4.6	—	—	—
M3.5 x 0.6	6.00	5.82	6.93	6.58	3.30	3.00	5.1	—	—	—
M4 x 0.7	7.00	6.78	8.08	7.66	3.80	3.50	5.9	—	—	—
M5 x 0.8	8.00	7.78	9.24	8.79	5.10	4.80	6.9	—	—	0.30
M6 x 1	10.00	9.78	11.55	11.05	5.70	5.40	8.9	—	—	0.33
M8 x 1.25	13.00	12.73	15.01	14.38	7.50	7.14	11.6	—	—	0.36
M10 x 1.5	16.00	15.73	18.48	17.77	9.30	8.94	14.6	—	—	0.39
M12 x 1.75	18.00	17.73	20.78	20.03	12.00	11.57	16.6	—	—	0.42
M14 x 2	21.00	20.67	24.25	23.35	14.10	13.40	19.6	—	—	0.45
M16 x 2	24.00	23.67	27.71	26.75	16.40	15.70	22.5	—	—	0.48
M20 x 2.5	30.00	29.16	34.64	32.95	20.30	19.00	27.7	0.8	0.4	0.56
M24 x 3	36.00	35.00	41.57	39.55	23.90	22.60	33.2	0.8	0.4	0.64
M30 x 3.5	46.00	45.00	53.12	50.85	28.60	27.30	42.7	0.8	0.4	0.76
M36 x 4	55.00	53.80	63.51	60.79	34.70	33.10	51.1	0.8	0.4	0.89
Refer to Para.	4		7		5		6	6		6
*M10 x 1.5	15.00	14.73	17.32	16.64	10.0	9.6	13.6	0.6	0.3	0.39

*See Para. 2.2 in General Data.

AMERICAN NATIONAL STANDARD
METRIC HEAVY HEX NUTS

ANSI B18.2.4.6M-1979

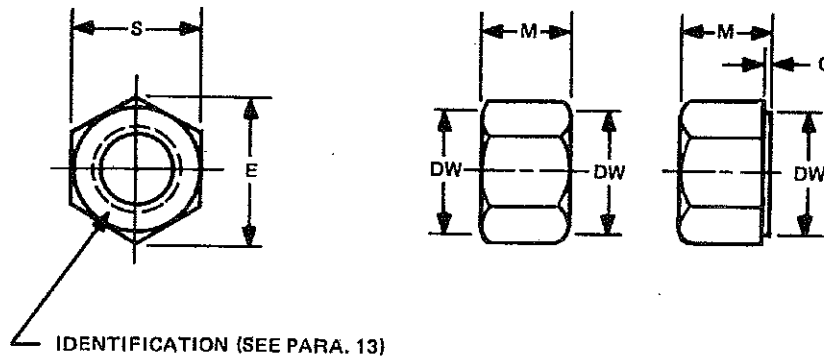


Table 1 Dimensions of Heavy Hex Nuts

Nominal Nut Dia and Thread Pitch	S		E		M		Dw	C		Total Runout of Bearing Surface FIM
	Width Across Flats		Width Across Corners		Thickness		Bearing Face Dia	Washer Face Thickness		
	Max	Min	Max	Min	Max	Min	Min	Max	Min	
M12 x 1.75	21.00	20.16	24.25	22.78	12.3	11.9	19.2	0.8	0.4	0.38
M14 x 2	24.00	23.16	27.71	26.17	14.3	13.6	22.0	0.8	0.4	0.42
M16 x 2	27.00	26.16	31.18	29.56	17.1	16.4	24.9	0.8	0.4	0.47
M20 x 2.5	34.00	33.00	39.26	37.29	20.7	19.4	31.4	0.8	0.4	0.58
M22 x 2.5	36.00	35.00	41.57	39.55	23.6	22.3	33.3	0.8	0.4	0.63
M24 x 3	41.00	40.00	47.34	45.20	24.2	22.9	38.0	0.8	0.4	0.72
M27 x 3	46.00	45.00	53.12	50.85	27.6	26.3	42.8	0.8	0.4	0.80
M30 x 3.5	50.00	49.00	57.74	55.37	30.7	29.1	46.6	0.8	0.4	0.87
M36 x 4	60.00	58.80	69.28	66.44	36.6	35.0	55.9	0.8	0.4	1.05
M42 x 4.5	70.00	67.90	80.83	77.41	42.0	40.4	64.5	1.0	0.5	1.22
M48 x 5	80.00	77.60	92.38	88.46	48.0	46.4	73.7	1.0	0.5	1.40
M56 x 5.5	90.00	87.20	103.92	99.41	56.0	54.1	82.8	1.0	0.5	1.57
M64 x 6	100.00	96.80	115.47	110.35	64.0	62.1	92.0	1.0	0.5	1.75
M72 x 6	110.00	106.40	127.02	121.30	72.0	70.1	101.1	1.2	0.6	1.92
M80 x 6	120.00	116.00	138.56	132.24	80.0	78.1	110.2	1.2	0.6	2.09
M90 x 6	135.00	130.50	155.88	148.77	90.0	87.8	124.0	1.2	0.6	2.36
M100 x 6	150.00	145.00	173.21	165.30	100.0	97.8	137.8	1.2	0.6	2.62
Refer to Para.	4		7		5		6	6		6