SIGMA FASTENERS

2010 Bolting Catalog

DIMENSIONAL BOLTING CATALOG

DIMENSIONAL CATALOG
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Locknuts

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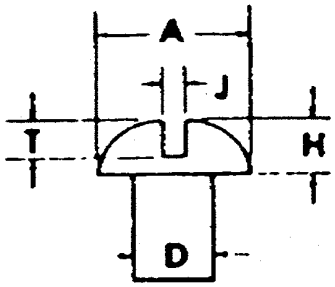
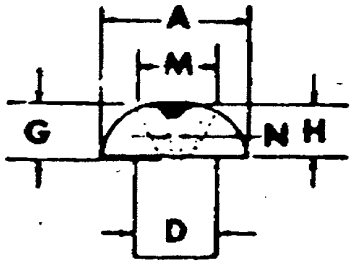
ROUND HEAD SCREWS

Nom Size (D)	A		H		J		T		M	G	N		Phillips Driver Sizes
	Head Diameter		Height of Head		Width of Slot		Depth of Slot		Dimensions of Recess				
									Diameter		Depth	Width	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
2	.162	.146	.069	.059	.031	.023	.048	.037	.097	.087	.071	.017	1
3	.187	.169	.078	.067	.035	.027	.053	.040	.106	.096	.080	.018	1
4	.211	.193	.086	.075	.039	.031	.058	.044	.115	.105	.090	.017	1
5	.236	.217	.095	.083	.043	.035	.063	.047	.151	.141	.104	.027	2
6	.260	.240	.103	.091	.048	.039	068	.051	.159	.149	.112	.027	2
8	.309	.287	.120	.107	.054	.045	.077	.058	.175	.165	.128	.030	2
10	.359	.334	.137	.123	.060	.050	.087	.065	.192	.182	.145	.031	2
12	.408	.382	.153	.139	.067	.056	.096	.072	.246	.236	.165	.036	3
1/4	.472	.443	.175	.160	.075	.064	.109	.082	.265	.255	.187	.037	3
5/16	.590	.557	.216	.198	.084	.072	.132	.099	.305	.295	.227	.043	3
3/8	.708	.670	.256	.237	.094	.081	.155	.117	.384	.374	.281	.064	4
1/2	.813	.766	.355	.332	.106	.091	.211	.159	.413	.403	.314	.068	4

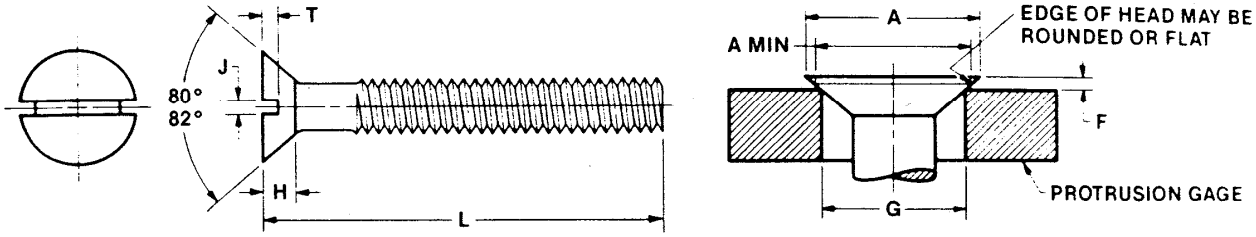
SLOTTED



PHILLIPS



SLOTTED FLAT COUNTERSUNK HEAD MACHINE SCREWS

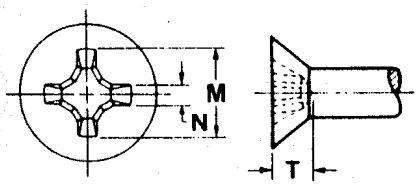


Dimensions of Slotted Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		L	A		H	J		T		F		G
		These Lengths or Shorter are Undercut	Head Diameter		Head Height	Slot Width		Slot Depth		Protrusion Above Gaging Diameter		Gaging Diameter
			Max Edge Sharp	Min Edge Rounded or Flat	Ref	Max	Min	Max	Min	Max	Min	
0000	0.0210	--	0.043	0.037	0.011	0.008	0.004	0.007	0.003	--	--	--
000	0.0340	--	0.064	0.058	0.016	0.011	0.007	0.009	0.005	--	--	--
00	0.0470	--	0.092	0.076	0.028	0.017	0.010	0.014	0.009	--	--	--
0	0.0600	1/8	0.119	0.099	0.035	0.023	0.016	0.015	0.010	0.026	0.016	0.078
1	0.0730	1/8	0.146	0.123	0.043	0.026	0.019	0.019	0.012	0.028	0.016	0.101
2	0.0860	1/8	0.172	0.147	0.051	0.031	0.023	0.023	0.015	0.029	0.017	0.124
3	0.0990	1/8	0.199	0.171	0.059	0.035	0.027	0.027	0.017	0.031	0.018	0.148
4	0.1120	3/16	0.225	0.195	0.067	0.039	0.031	0.030	0.020	0.032	0.019	0.172
5	0.1250	3/16	0.252	0.220	0.075	0.043	0.035	0.034	0.022	0.034	0.020	0.196
6	0.1380	3/16	0.279	0.244	0.083	0.048	0.039	0.038	0.024	0.036	0.021	0.220
8	0.1640	1/4	0.332	0.292	0.100	0.054	0.045	0.045	0.029	0.039	0.023	0.267
10	0.1900	5/16	0.385	0.340	0.116	0.060	0.050	0.053	0.034	0.042	0.025	0.313
12	0.2160	3/8	0.438	0.389	0.132	0.067	0.056	0.060	0.039	0.045	0.027	0.362
1/4	0.2500	7/16	0.507	0.452	0.153	0.075	0.064	0.070	0.046	0.050	0.029	0.424
5/16	0.3125	1/2	0.635	0.568	0.191	0.084	0.072	0.088	0.058	0.057	0.034	0.539
3/8	0.3750	9/16	0.762	0.685	0.230	0.094	0.081	0.106	0.070	0.065	0.039	0.653
7/16	0.4375	5/8	0.812	0.723	0.223	0.094	0.081	0.103	0.066	0.073	0.044	0.690
1/2	0.5000	3/4	0.875	0.775	0.223	0.106	0.091	0.103	0.065	0.081	0.049	0.739
9/16	0.5625	--	1.000	0.889	0.260	0.118	0.102	0.120	0.077	0.089	0.053	0.851
5/8	0.6250	--	1.125	1.002	0.298	0.133	0.116	0.137	0.088	0.097	0.058	0.962
3/4	0.7500	--	1.375	1.230	0.372	0.149	0.131	0.171	0.111	0.112	0.067	1.186

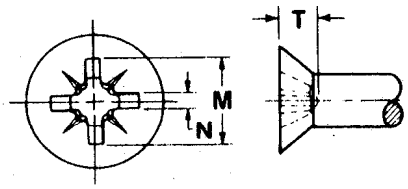
CROSS RECESSED FLAT COUNTERSUNK HEAD MACHINE SCREWS

TYPE 1



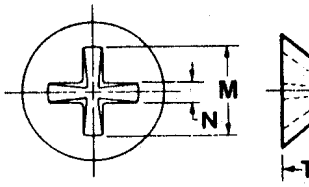
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consists of ting slots with parallel sides c a slightly truncated apex at bott

Dimensions of Cross Recessed Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A											
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.069	0.056	0.043	0.027	0.014	0	0.036	0.020	0.069	0.056	0.044	0.028	0.018	0	0.037	0.021	0.083	0.073	0.04
1	0.0730	0.077	0.064	0.051	0.035	0.015	0	0.044	0.028	0.077	0.064	0.052	0.036	0.018	0	0.045	0.029	0.097	0.086	0.05
2	0.0860	0.102	0.089	0.063	0.047	0.017	1	0.056	0.040	0.102	0.089	0.063	0.047	0.029	1	0.053	0.037	0.120	0.109	0.06
3	0.0990	0.107	0.094	0.068	0.052	0.018	1	0.061	0.045	0.107	0.094	0.068	0.052	0.029	1	0.058	0.042	0.139	0.127	0.07
4	0.1120	0.128	0.115	0.089	0.073	0.018	1	0.082	0.066	0.128	0.115	0.089	0.073	0.030	1	0.079	0.063	0.157	0.145	0.08
5	0.1250	0.154	0.141	0.086	0.063	0.027	2	0.075	0.052	0.154	0.141	0.086	0.068	0.041	2	0.071	0.053	0.176	0.162	0.10
6	0.1380	0.174	0.161	0.106	0.083	0.029	2	0.095	0.072	0.174	0.161	0.107	0.089	0.041	2	0.091	0.073	0.195	0.180	0.11
8	0.1640	0.189	0.176	0.121	0.098	0.030	2	0.110	0.087	0.189	0.176	0.121	0.103	0.041	2	0.107	0.089	0.232	0.216	0.13
10	0.1900	0.204	0.191	0.136	0.113	0.032	2	0.125	0.102	0.204	0.191	0.136	0.118	0.041	2	0.122	0.104	0.269	0.251	0.15
12	0.2160	0.268	0.255	0.156	0.133	0.035	3	0.139	0.116	0.268	0.255	0.158	0.140	0.056	3	0.136	0.118	0.307	0.287	0.18
1/4	0.2500	0.283	0.270	0.171	0.148	0.036	3	0.154	0.131	0.283	0.270	0.173	0.155	0.057	3	0.151	0.133	0.355	0.334	0.20
5/16	0.3125	0.365	0.352	0.216	0.194	0.061	4	0.196	0.174	0.365	0.352	0.220	0.202	0.086	4	0.193	0.175	0.444	0.420	0.26
3/8	0.3750	0.393	0.380	0.245	0.223	0.065	4	0.225	0.203	0.393	0.380	0.248	0.230	0.086	4	0.222	0.204	0.523	0.495	0.31
7/16	0.4375	0.409	0.396	0.261	0.239	0.068	4	0.241	0.219	0.409	0.396	0.265	0.247	0.086	4	0.238	0.220	0.568	0.540	0.34
1/2	0.5000	0.424	0.411	0.276	0.254	0.069	4	0.256	0.234	0.424	0.411	0.280	0.262	0.086	4	0.253	0.235	0.608	0.578	0.37
9/16	0.5625	0.454	0.431	0.300	0.278	0.073	4	0.280	0.258	0.452	0.429	0.303	0.285	0.087	4	0.276	0.258	0.656	0.623	0.40
5/8	0.6250	0.576	0.553	0.342	0.316	0.079	5	0.309	0.283	0.577	0.554	0.345	0.324	0.098	5	0.307	0.286	0.656	0.623	0.40
3/4	0.7500	0.640	0.617	0.406	0.380	0.087	5	0.373	0.347	0.641	0.618	0.410	0.389	0.099	5	0.372	0.351	0.656	0.623	0.40

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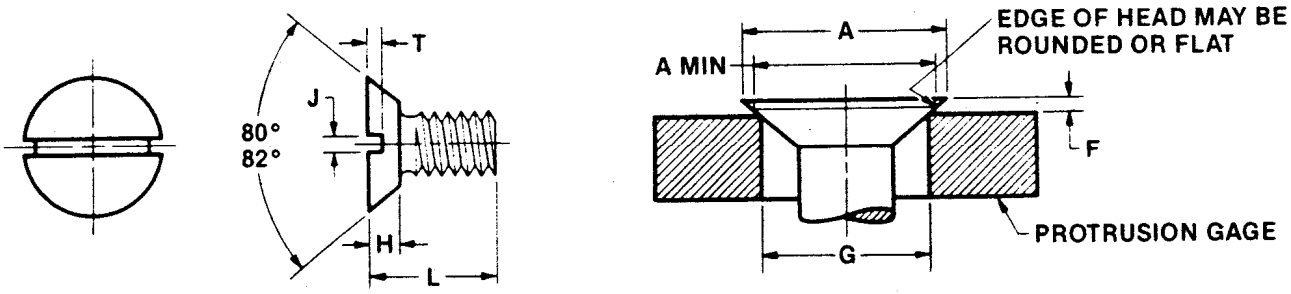
SLOTTED UNDERCUT FLAT
COUNTERSUNK HEAD MACHINE SCREWS

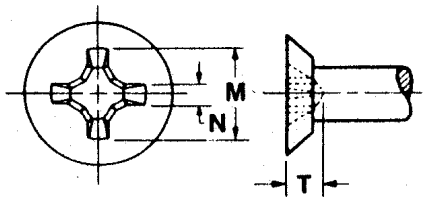


Dimensions of Slotted Undercut Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		L	A		H		J		T		F		G
		These Lengths or Shorter are Undercut	Head Diameter		Head Height		Slot Width		Slot Depth		Protrusion Above Gaging Diameter		Gaging Diameter
			Max Edge Sharp	Min Edge Rounded or Flat	Max	Min	Max	Min	Max	Min	Max	Min	
0	0.0600	1/8	0.119	0.099	0.025	0.018	0.023	0.016	0.011	0.007	--	--	--
1	0.0730	1/8	0.146	0.123	0.031	0.023	0.026	0.019	0.014	0.009	--	--	--
2	0.0860	1/8	0.172	0.147	0.036	0.028	0.031	0.023	0.016	0.011	0.029	0.017	0.124
3	0.0990	1/8	0.199	0.171	0.042	0.033	0.035	0.027	0.019	0.012	0.031	0.018	0.148
4	0.1120	3/16	0.225	0.195	0.047	0.038	0.039	0.031	0.022	0.014	0.032	0.019	0.172
5	0.1250	3/16	0.252	0.220	0.053	0.043	0.043	0.035	0.024	0.016	0.034	0.020	0.196
6	0.1380	3/16	0.279	0.244	0.059	0.048	0.048	0.039	0.027	0.017	0.036	0.021	0.220
8	0.1640	1/4	0.332	0.292	0.070	0.058	0.054	0.045	0.032	0.021	0.039	0.023	0.267
10	0.1900	5/16	0.385	0.340	0.081	0.068	0.060	0.050	0.037	0.024	0.042	0.025	0.313
12	0.2160	3/8	0.438	0.389	0.092	0.078	0.067	0.056	0.043	0.028	0.045	0.027	0.362
1/4	0.2500	7/16	0.507	0.452	0.107	0.092	0.075	0.064	0.050	0.032	0.050	0.029	0.424
5/16	0.3125	1/2	0.635	0.568	0.134	0.116	0.084	0.072	0.062	0.041	0.057	0.034	0.539
3/8	0.3750	9/16	0.762	0.685	0.161	0.140	0.094	0.081	0.075	0.049	0.065	0.039	0.653
7/16	0.4375	5/8	0.812	0.723	0.156	0.133	0.094	0.081	0.072	0.045	0.073	0.044	0.690
1/2	0.5000	3/4	0.875	0.775	0.156	0.130	0.106	0.091	0.072	0.046	0.081	0.049	0.739

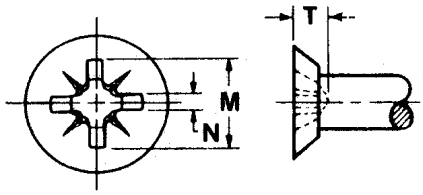
CROSS RECESSED UNDERCUT FLAT COUNTERSUNK HEAD MACHINE SCREWS

TYPE 1



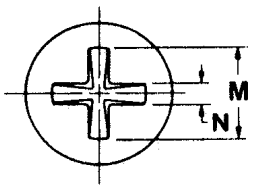
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consist
ting slots with parallel sid
a slightly truncated apex at

Dimensions of Cross Recessed Undercut Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A											
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		R
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		D
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.069	0.056	0.043	0.027	0.014	0	0.036	0.020	0.069	0.056	0.044	0.028	0.018	0	0.037	0.021	0.072	0.062	0.035
1	0.0730	0.077	0.064	0.051	0.035	0.015	0	0.044	0.028	0.077	0.064	0.052	0.036	0.018	0	0.045	0.029	0.087	0.077	0.045
2	0.0860	0.095	0.082	0.056	0.040	0.017	1	0.049	0.033	0.095	0.082	0.056	0.040	0.028	1	0.046	0.030	0.105	0.095	0.056
3	0.0990	0.102	0.089	0.063	0.047	0.018	1	0.056	0.040	0.102	0.089	0.063	0.047	0.029	1	0.053	0.037	0.116	0.106	0.064
4	0.1120	0.117	0.104	0.078	0.062	0.018	1	0.071	0.055	0.117	0.104	0.078	0.062	0.029	1	0.068	0.052	0.135	0.123	0.076
5	0.1250	0.128	0.115	0.089	0.073	0.018	1	0.082	0.066	0.128	0.115	0.089	0.073	0.030	1	0.079	0.063	0.153	0.141	0.086
6	0.1380	0.146	0.133	0.078	0.055	0.025	2	0.067	0.044	0.146	0.133	0.078	0.060	0.040	2	0.063	0.045	0.167	0.155	0.095
8	0.1640	0.174	0.161	0.106	0.083	0.029	2	0.095	0.072	0.174	0.161	0.107	0.089	0.041	2	0.091	0.073	0.204	0.190	0.119
10	0.1900	0.189	0.176	0.121	0.098	0.030	2	0.110	0.087	0.189	0.176	0.121	0.103	0.041	2	0.107	0.089	0.244	0.228	0.140
12	0.2160	0.233	0.220	0.121	0.098	0.030	3	0.104	0.081	0.233	0.220	0.121	0.103	0.055	3	0.100	0.082	0.269	0.251	0.156
1/4	0.2500	0.250	0.237	0.136	0.113	0.032	3	0.119	0.096	0.248	0.235	0.137	0.119	0.056	3	0.115	0.097	0.314	0.294	0.178
5/16	0.3125	0.317	0.304	0.168	0.146	0.053	4	0.148	0.126	0.317	0.304	0.172	0.154	0.085	4	0.145	0.127	0.393	0.369	0.229
3/8	0.3750	0.365	0.352	0.216	0.194	0.061	4	0.196	0.174	0.365	0.352	0.220	0.202	0.086	4	0.193	0.175	0.467	0.439	0.277
7/16	0.4375	0.393	0.380	0.245	0.223	0.065	4	0.225	0.203	0.393	0.380	0.248	0.230	0.086	4	0.222	0.204	0.513	0.483	0.307
1/2	0.5000	0.409	0.396	0.261	0.242	0.068	4	0.241	0.219	0.409	0.396	0.265	0.247	0.086	4	0.238	0.220	0.563	0.533	0.340

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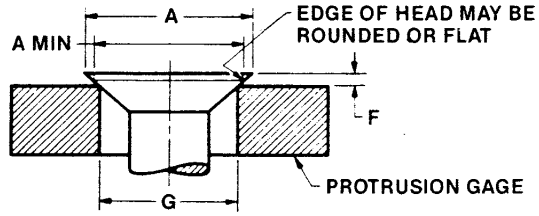
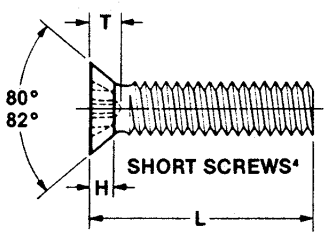
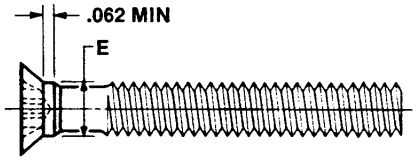
CROSS RECESSED FLAT COUNTERSUNK
TRIM HEAD MACHINE SCREWS

NOTE: FLAT COUNTERSUNK TRIM HEAD MACHINE SCREWS ARE FURNISHED IN CROSS RECESS HEADS ONLY.







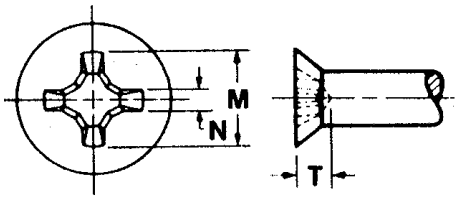
LONG SCREWS WITH REDUCED BODY AND SHOULDER

Dimensions of Flat Countersunk Trim Head Machine Screws

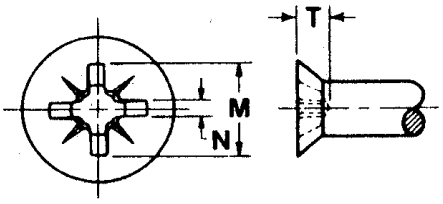
Nominal Size or Basic Screw Diameter		Head Size	E		A		H	F		G
			Shoulder Diameter		Head Diameter		Head Height	Protrusion Above Gaging Diameter		Gaging Diameter
			Max	Min	Max, Edge Sharp	Min, Edge Rounded or Flat	Ref	Max	Min	
4	0.1120	3	0.112	0.106	0.199	0.171	0.052	0.031	0.018	0.148
5	0.1250	4	0.125	0.119	0.225	0.195	0.060	0.032	0.019	0.172
6	0.1380	4	0.138	0.131	0.225	0.195	0.052	0.032	0.019	0.172
6	0.1380	5	0.138	0.131	0.252	0.220	0.068	0.034	0.020	0.196
8	0.1640	5	0.164	0.157	0.252	0.220	0.052	0.034	0.020	0.196
8	0.1640	6	0.164	0.157	0.279	0.244	0.069	0.036	0.021	0.220
10	0.1900	8	0.190	0.181	0.332	0.292	0.085	0.039	0.023	0.220
12	0.2160	8	0.216	0.207	0.332	0.292	0.069	0.039	0.023	0.267
12	0.2160	10	0.216	0.207	0.385	0.340	0.101	0.042	0.025	0.313
1/4	0.2500	10	0.250	0.240	0.385	0.340	0.080	0.042	0.025	0.313
1/4	0.2500	12	0.250	0.240	0.438	0.389	0.112	0.045	0.027	0.362
5/16	0.3125	12	0.312	0.302	0.438	0.389	0.075	0.045	0.027	0.362
5/16	0.3125	1/4	0.312	0.302	0.507	0.452	0.116	0.049	0.029	0.424
3/8	0.3750	5/16	0.375	0.364	0.635	0.568	0.155	0.057	0.034	0.539

CROSS RECESSED FLAT COUNTERSUNK TRIM HEAD MACHINE SCREWS

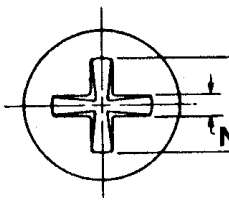
TYPE 1



TYPE 1A



TY



Dimensions of Cross Recessed Flat Countersunk Trim Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A												
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
4	0.1120	0.107	0.094	0.068	0.052	0.018	1	0.061	0.045	0.107	0.094	0.068	0.052	0.029	1	0.058	0.042	0.139	0.127	0.07
5	0.1250	0.128	0.115	0.089	0.073	0.018	1	0.082	0.066	0.128	0.115	0.089	0.073	0.030	1	0.079	0.063	0.157	0.145	0.08
6	0.1380	0.128	0.115	0.089	0.073	0.018	1	0.082	0.066	0.128	0.115	0.089	0.073	0.030	1	0.079	0.063	0.157	0.145	0.08
6	0.1380	0.154	0.141	0.086	0.063	0.027	2	0.075	0.052	0.154	0.141	0.086	0.068	0.041	2	0.071	0.053	0.176	0.162	0.10
8	0.1640	0.164	0.151	0.096	0.073	0.029	2	0.085	0.062	0.164	0.151	0.097	0.079	0.041	2	0.081	0.063	0.176	0.162	0.10
8	0.1640	0.182	0.169	0.114	0.091	0.030	2	0.103	0.080	0.182	0.169	0.114	0.096	0.041	2	0.099	0.081	0.195	0.180	0.11
10	0.1900	0.189	0.176	0.121	0.098	0.030	2	0.110	0.087	0.189	0.176	0.121	0.103	0.041	2	0.107	0.089	0.232	0.216	0.13
12	0.2160	0.198	0.185	0.131	0.108	0.032	2	0.120	0.097	0.198	0.185	0.131	0.113	0.041	2	0.117	0.099	0.232	0.216	0.13
12	0.2160	0.204	0.191	0.136	0.113	0.032	2	0.125	0.102	0.204	0.191	0.136	0.118	0.041	2	0.122	0.104	0.269	0.251	0.15
1/4	0.2500	0.204	0.191	0.136	0.113	0.032	2	0.125	0.102	0.204	0.191	0.136	0.118	0.041	2	0.122	0.104	0.269	0.251	0.15
1/4	0.2500	0.268	0.255	0.156	0.133	0.035	3	0.139	0.116	0.268	0.255	0.158	0.140	0.056	3	0.136	0.118	0.307	0.287	0.18
5/16	0.3125	0.268	0.255	0.156	0.133	0.035	3	0.139	0.116	0.268	0.255	0.158	0.140	0.056	3	0.136	0.118	0.307	0.287	0.18
5/16	0.3125	0.283	0.270	0.171	0.148	0.036	3	0.154	0.131	0.283	0.270	0.173	0.155	0.057	3	0.151	0.133	0.355	0.334	0.20
3/8	0.3750	0.365	0.352	0.216	0.194	0.061	4	0.196	0.174	0.365	0.352	0.220	0.202	0.086	4	0.193	0.175	0.444	0.420	0.26

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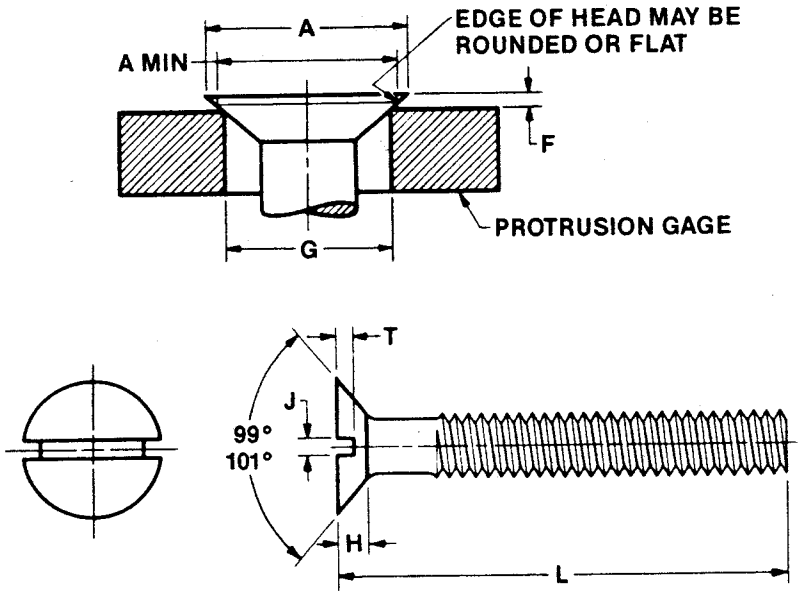
SLOTTED 100 DEGREE FLAT COUNTERSUNK HEAD MACHINE SCREWS

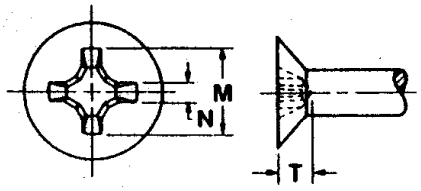


Dimensions of Slotted 100 Degree Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		A		H	J		T		F		G
		Head Diameter		Head Height	Slot Width		Slot Depth		Protrusion Above Gaging Diameter		Gaging Diameter
		Max Edge Sharp	Min Edge Rounded or Flat	Ref	Max	Min	Max	Min	Max	Min	
0000	0.0210	0.043	0.037	0.009	0.008	0.005	0.008	0.004	--	--	--
000	0.0340	0.064	0.058	0.014	0.012	0.008	0.011	0.007	--	--	--
00	0.0470	0.093	0.085	0.020	0.017	0.010	0.013	0.008	--	--	--
0	0.0600	0.119	0.096	0.026	0.023	0.016	0.013	0.008	0.020	0.012	0.074
1	0.0730	0.146	0.120	0.031	0.026	0.019	0.016	0.010	0.021	0.013	0.098
2	0.0860	0.172	0.143	0.037	0.031	0.023	0.019	0.012	0.022	0.014	0.121
3	0.0990	0.199	0.167	0.043	0.035	0.027	0.022	0.014	0.024	0.015	0.144
4	0.1120	0.225	0.191	0.049	0.039	0.031	0.024	0.017	0.025	0.016	0.167
6	0.1380	0.279	0.238	0.060	0.048	0.039	0.030	0.022	0.028	0.017	0.214
8	0.1640	0.332	0.285	0.072	0.054	0.045	0.036	0.027	0.031	0.019	0.261
10	0.1900	0.385	0.333	0.083	0.060	0.050	0.042	0.031	0.034	0.021	0.307
1/4	0.2500	0.507	0.442	0.110	0.075	0.064	0.055	0.042	0.040	0.025	0.415
5/16	0.3125	0.635	0.556	0.138	0.084	0.072	0.069	0.053	0.047	0.030	0.526
3/8	0.3750	0.762	0.670	0.165	0.094	0.081	0.083	0.065	0.053	0.034	0.638

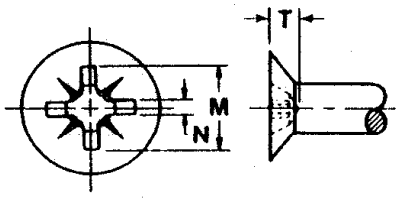
CROSS RECESSED 100 DEGREE FLAT COUNTERSUNK HEAD MACHINE SCREWS

TYPE 1



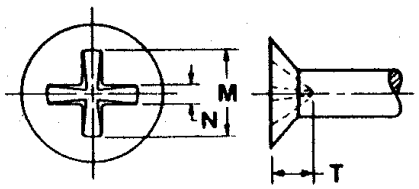
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consists of two intersecting slots with parallel sides converging to a slightly truncated apex at bottom of recess.

Dimensions of Cross Recessed 100 Degree Flat Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A											
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.061	0.048	0.035	0.019	0.012	0	0.028	0.012	0.061	0.048	0.036	0.020	0.018	0	0.029	0.013	0.062	0.052	0.04
1	0.0730	0.069	0.056	0.043	0.027	0.014	0	0.036	0.020	0.069	0.056	0.044	0.028	0.018	0	0.037	0.021	0.083	0.073	0.05
2	0.0860	0.095	0.082	0.056	0.040	0.012	1	0.049	0.033	0.095	0.082	0.056	0.040	0.028	1	0.046	0.030	0.097	0.087	0.06
3	0.0990	0.102	0.089	0.063	0.047	0.014	1	0.056	0.040	0.102	0.089	0.063	0.047	0.029	1	0.053	0.037	0.118	0.108	0.07
4	0.1120	0.117	0.104	0.078	0.062	0.018	1	0.071	0.055	0.117	0.104	0.078	0.062	0.029	1	0.068	0.052	0.136	0.126	0.08
6	0.1380	0.154	0.141	0.086	0.063	0.027	2	0.075	0.052	0.154	0.141	0.086	0.068	0.041	2	0.071	0.053	0.162	0.152	0.10
8	0.1640	0.169	0.156	0.101	0.078	0.028	2	0.090	0.067	0.169	0.156	0.101	0.083	0.041	2	0.086	0.068	0.191	0.179	0.12
10	0.1900	0.184	0.171	0.116	0.093	0.030	2	0.105	0.082	0.184	0.171	0.116	0.098	0.041	2	0.101	0.083	0.225	0.213	0.14
1/4	0.2500	0.247	0.234	0.135	0.112	0.033	3	0.118	0.095	0.247	0.234	0.135	0.117	0.056	3	0.114	0.096	0.294	0.282	0.19
5/16	0.3125	0.317	0.304	0.168	0.146	0.053	4	0.148	0.126	0.317	0.304	0.172	0.154	0.085	4	0.145	0.127	0.361	0.349	0.23
3/8	0.3750	0.342	0.329	0.193	0.171	0.056	4	0.173	0.151	0.342	0.329	0.196	0.178	0.085	4	0.170	0.152	0.440	0.426	0.28

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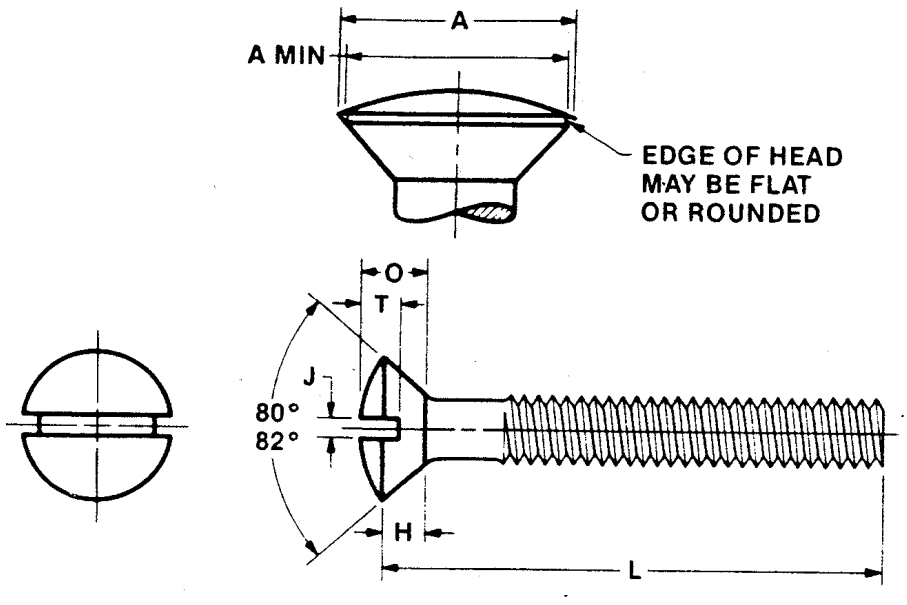
SLOTTED OVAL COUNTERSUNK HEAD MACHINE SCREWS

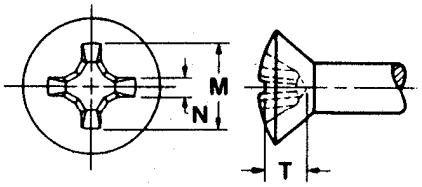


Dimensions of Slotted Oval Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		L	A		H	O		J		T	
		These Lengths or Shorter are Undercut	Head Diameter		Head Side Height	Total Head Height		Slot Width		Slot Depth	
			Max, Edge Sharp	Min, Edge Rounded or Flat	Ref	Max	Min	Max	Min	Max	Min
00	0.0470	--	0.093	0.083	0.028	0.042	0.034	0.017	0.010	0.023	0.016
0	0.0600	1/8	0.119	0.099	0.035	0.056	0.041	0.023	0.016	0.030	0.025
1	0.0730	1/8	0.146	0.123	0.043	0.068	0.052	0.026	0.019	0.038	0.031
2	0.0860	1/8	0.172	0.147	0.051	0.080	0.063	0.031	0.023	0.045	0.037
3	0.0990	1/8	0.199	0.171	0.059	0.092	0.073	0.035	0.027	0.052	0.043
4	0.1120	3/16	0.225	0.195	0.067	0.104	0.084	0.039	0.031	0.059	0.049
5	0.1250	3/16	0.252	0.220	0.075	0.116	0.095	0.043	0.035	0.067	0.055
6	0.1380	3/16	0.279	0.244	0.083	0.128	0.105	0.048	0.039	0.074	0.060
8	0.1640	1/4	0.332	0.292	0.100	0.152	0.126	0.054	0.045	0.088	0.072
10	0.1900	5/16	0.385	0.340	0.116	0.176	0.148	0.060	0.050	0.103	0.084
12	0.2160	3/8	0.438	0.389	0.132	0.200	0.169	0.067	0.056	0.117	0.096
1/4	0.2500	7/16	0.507	0.452	0.153	0.232	0.197	0.075	0.064	0.136	0.112
5/16	0.3125	1/2	0.635	0.568	0.191	0.290	0.249	0.084	0.072	0.171	0.141
3/8	0.3750	9/16	0.762	0.685	0.230	0.347	0.300	0.094	0.081	0.206	0.170
7/16	0.4375	5/8	0.812	0.723	0.223	0.345	0.295	0.094	0.081	0.210	0.174
1/2	0.5000	3/4	0.875	0.775	0.223	0.354	0.299	0.106	0.091	0.216	0.176
9/16	0.5625	--	1.000	0.889	0.260	0.410	0.350	0118	0.102	0.250	0.207
5/8	0.6250	--	1.125	1.002	0.298	0.467	0.399	0.133	0.116	0.285	0.235
3/4	0.7500	--	1.375	1.230	0.372	0.578	0.497	0.149	0.131	0.353	0.293

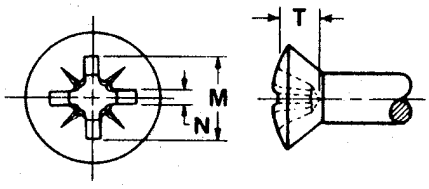
CROSS RECESSED OVAL COUNTERSUNK HEAD MACHINE SCREWS

TYPE 1



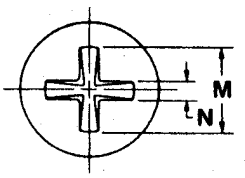
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE



This type of recess consi
ting slots with parallel si
a slightly truncated apex a

Dimensions of Cross Recessed Oval Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A											
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.074	0.061	0.045	0.027	0.014	0	0.038	0.020	0.074	0.061	0.048	0.032	0.018	0	0.042	0.024	0.083	0.073	0.04
1	0.0730	0.077	0.064	0.048	0.030	0.015	0	0.041	0.023	0.077	0.064	0.051	0.035	0.018	0	0.043	0.027	0.097	0.086	0.05
2	0.0860	0.112	0.099	0.069	0.052	0.018	1	0.062	0.045	0.112	0.099	0.073	0.057	0.029	1	0.062	0.046	0.120	0.109	0.06
3	0.0990	0.124	0.111	0.081	0.064	0.019	1	0.074	0.057	0.124	0.111	0.085	0.069	0.030	1	0.074	0.058	0.139	0.127	0.07
4	0.1120	0.136	0.123	0.094	0.077	0.019	1	0.087	0.070	0.136	0.123	0.097	0.081	0.030	1	0.086	0.070	0.157	0.145	0.08
5	0.1250	0.158	0.145	0.085	0.061	0.028	2	0.074	0.050	0.158	0.145	0.089	0.071	0.041	2	0.074	0.056	0.176	0.162	0.10
6	0.1380	0.178	0.165	0.105	0.080	0.030	2	0.094	0.069	0.178	0.165	0.109	0.091	0.041	2	0.093	0.075	0.195	0.180	0.11
8	0.1640	0.192	0.179	0.119	0.095	0.031	2	0.108	0.084	0.192	0.179	0.124	0.106	0.041	2	0.108	0.090	0.232	0.216	0.13
10	0.1900	0.209	0.196	0.137	0.113	0.033	2	0.126	0.102	0.209	0.196	0.141	0.123	0.041	2	0.125	0.107	0.269	0.251	0.15
12	0.2160	0.270	0.257	0.152	0.128	0.038	3	0.135	0.111	0.270	0.257	0.157	0.139	0.056	3	0.135	0.117	0.307	0.287	0.18
1/4	0.2500	0.290	0.277	0.173	0.148	0.040	3	0.156	0.131	0.290	0.277	0.177	0.159	0.057	3	0.155	0.137	0.355	0.334	0.20
5/16	0.3125	0.390	0.377	0.238	0.214	0.065	4	0.218	0.194	0.390	0.377	0.241	0.223	0.086	4	0.215	0.197	0.444	0.420	0.26
3/8	0.3750	0.410	0.397	0.257	0.233	0.068	4	0.237	0.213	0.410	0.397	0.262	0.244	0.086	4	0.235	0.217	0.523	0.495	0.31
7/16	0.4375	0.422	0.409	0.269	0.245	0.070	4	0.249	0.225	0.422	0.409	0.274	0.256	0.086	4	0.247	0.229	0.568	0.540	0.34
1/2	0.5000	0.437	0.424	0.283	0.259	0.071	4	0.263	0.239	0.437	0.424	0.289	0.271	0.086	4	0.262	0.244	0.608	0.578	0.37
9/16	0.5625	0.473	0.450	0.316	0.292	0.075	4	0.296	0.272	0.462	0.439	0.311	0.293	0.087	4	0.285	0.267	0.656	0.623	0.40
5/8	0.6250	0.591	0.568	0.356	0.324	0.081	5	0.323	0.291	0.574	0.551	0.338	0.317	0.098	5	0.300	0.279	0.656	0.623	0.40
3/4	0.7500	0.653	0.630	0.421	0.390	0.088	5	0.388	0.357	0.635	0.612	0.400	0.379	0.099	5	0.362	0.341	0.656	0.623	0.40

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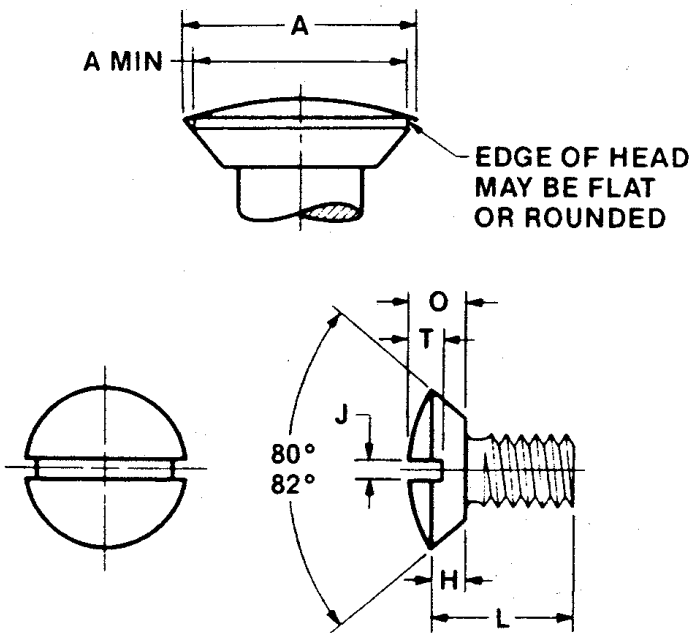
SLOTTED UNDERCUT OVAL COUNTERSUNK HEAD MACHINE SCREWS

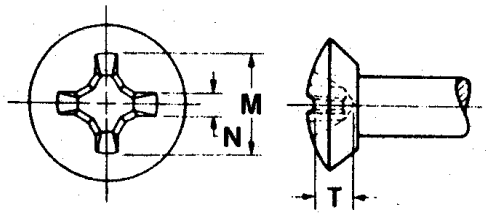


Dimensions of Slotted Undercut Oval Countersunk Head Machine Screws

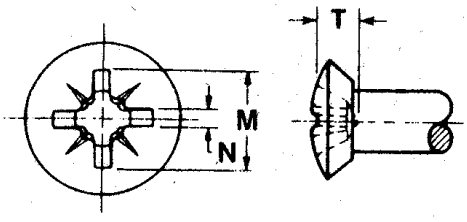
Nominal Size or Basic Screw Diameter		L	A		H	O		J		T	
		These Lengths or Shorter are Undercut	Head Diameter		Head Side Height	Total Head Height		Slot Width		Slot Depth	
			Max, Edge Sharp	Min, Edge Rounded or Flat	Ref	Max	Min	Max	Min	Max	Min
0	0.0600	1/8	0.119	0.099	0.025	0.046	0.033	0.023	0.016	0.028	0.022
1	0.0730	1/8	0.146	0.123	0.031	0.056	0.042	0.026	0.019	0.034	0.027
2	0.0860	1/8	0.172	0.147	0.036	0.065	0.050	0.031	0.023	0.040	0.033
3	0.0990	1/8	0.199	0.171	0.042	0.075	0.059	0.035	0.027	0.047	0.038
4	0.1120	3/16	0.225	0.195	0.047	0.084	0.067	0.039	0.031	0.053	0.043
5	0.1250	3/16	0.252	0.220	0.053	0.094	0.076	0.043	0.035	0.059	0.048
6	0.1380	3/16	0.279	0.244	0.059	0.104	0.084	0.048	0.039	0.065	0.053
8	0.1640	1/4	0.332	0.292	0.070	0.123	0.101	0.054	0.045	0.078	0.064
10	0.1900	5/16	0.385	0.340	0.081	0.142	0.118	0.060	0.050	0.090	0.074
12	0.2160	3/8	0.438	0.389	0.092	0.161	0.135	0.067	0.056	0.103	0.085
1/4	0.2500	7/16	0.507	0.452	0.107	0.186	0.158	0.075	0.064	0.119	0.098
5/16	0.3125	1/2	0.635	0.568	0.134	0.232	0.198	0.084	0.072	0.149	0.124
3/8	0.3750	9/16	0.762	0.685	0.161	0.278	0.239	0.094	0.081	0.179	0.149
7/16	0.4375	5/8	0.812	0.723	0.156	0.279	0.239	0.094	0.081	0.184	0.154
1/2	0.5000	3/4	0.875	0.775	0.156	0.288	0.244	0.106	0.091	0.204	0.169

CROSS RECESSED UNDERCUT OVAL COUNTERSUNK HEAD MACHINE SCREWS

TYPE 1



TYPE 1A



Dimensions of Cross Recessed Undercut Oval Countersunk Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A												
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.074	0.061	0.045	0.027	0.014	0	0.038	0.020	0.074	0.061	0.048	0.032	0.018	0	0.040	0.024	0.072	0.062	0.03
1	0.0730	0.077	0.064	0.048	0.030	0.015	0	0.041	0.023	0.077	0.064	0.051	0.035	0.018	0	0.043	0.027	0.087	0.077	0.04
2	0.0860	0.112	0.099	0.069	0.052	0.018	1	0.062	0.045	0.112	0.099	0.073	0.057	0.029	1	0.062	0.046	0.105	0.095	0.05
3	0.0990	0.124	0.111	0.081	0.064	0.019	1	0.074	0.057	0.124	0.111	0.085	0.069	0.030	1	0.074	0.058	0.116	0.106	0.06
4	0.1120	0.136	0.123	0.094	0.077	0.019	1	0.087	0.070	0.136	0.123	0.097	0.081	0.030	1	0.086	0.070	0.135	0.123	0.07
5	0.1250	0.158	0.145	0.085	0.061	0.028	2	0.074	0.050	0.158	0.145	0.089	0.071	0.041	2	0.074	0.056	0.153	0.141	0.08
6	0.1380	0.178	0.165	0.105	0.080	0.030	2	0.094	0.069	0.178	0.165	0.109	0.091	0.041	2	0.093	0.075	0.167	0.155	0.09
8	0.1640	0.192	0.179	0.119	0.095	0.031	2	0.108	0.084	0.192	0.179	0.124	0.106	0.041	2	0.108	0.090	0.204	0.190	0.11
10	0.1900	0.209	0.196	0.137	0.113	0.033	2	0.126	0.102	0.209	0.196	0.141	0.123	0.041	2	0.125	0.107	0.244	0.228	0.14
12	0.2160	0.270	0.257	0.152	0.128	0.038	3	0.135	0.111	0.270	0.257	0.157	0.139	0.056	3	0.135	0.117	0.269	0.251	0.15
1/4	0.2500	0.290	0.277	0.173	0.148	0.040	3	0.156	0.131	0.290	0.277	0.177	0.159	0.057	3	0.155	0.137	0.314	0.294	0.17
5/16	0.3125	0.381	0.368	0.226	0.202	0.064	4	0.206	0.182	0.381	0.368	0.232	0.214	0.086	4	0.205	0.187	0.393	0.369	0.22
3/8	0.3750	0.400	0.387	0.245	0.221	0.066	4	0.225	0.201	0.400	0.387	0.252	0.234	0.086	4	0.225	0.207	0.467	0.439	0.27
7/16	0.4375	0.410	0.397	0.257	0.233	0.068	4	0.237	0.213	0.410	0.397	0.262	0.244	0.086	4	0.235	0.217	0.513	0.483	0.30
1/2	0.5000	0.422	0.409	0.269	0.245	0.070	4	0.249	0.225	0.422	0.409	0.274	0.256	0.086	4	0.247	0.229	0.563	0.533	0.34

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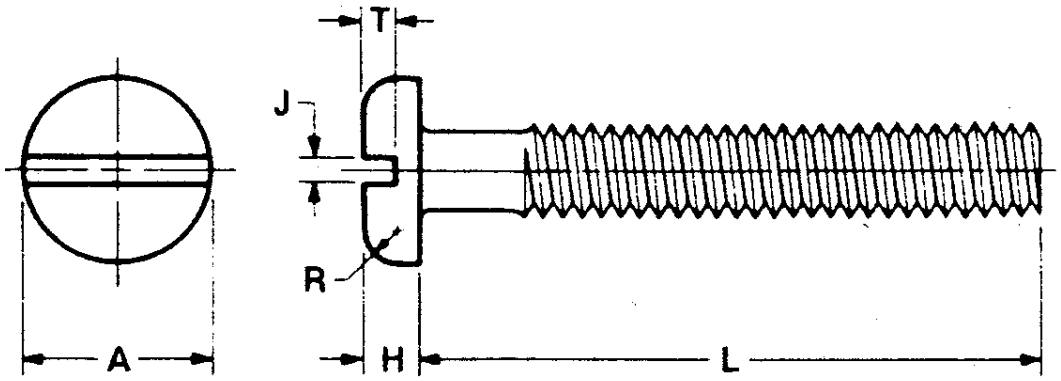
SLOTTED PAN HEAD MACHINE SCREWS

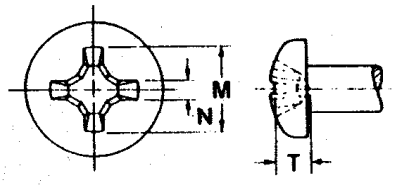


Dimensions of Slotted Pan Head Machine Screws

Nominal Size or Basic Screw Diameter		A Head Diameter		H Head Height		R Head Radius	J Slot Width		T Slot Depth	
		Max	Min	Max	Min	Max	Max	Min	Max	Min
0000	0.0210	0.042	0.036	0.016	0.010	0.007	0.008	0.004	0.008	0.004
000	0.0340	0.066	0.060	0.023	0.017	0.010	0.012	0.008	0.012	0.008
00	0.0470	0.090	0.082	0.025	0.032	0.015	0.017	0.010	0.016	0.010
0	0.0600	0.116	0.104	0.039	0.031	0.020	0.023	0.016	0.022	0.014
1	0.0730	0.142	0.130	0.046	0.038	0.025	0.026	0.019	0.027	0.018
2	0.0860	0.167	0.155	0.053	0.045	0.035	0.031	0.023	0.031	0.022
3	0.0990	0.193	0.180	0.060	0.051	0.037	0.035	0.027	0.036	0.026
4	0.1120	0.219	0.205	0.068	0.058	0.042	0.039	0.031	0.040	0.030
5	0.1250	0.245	0.231	0.075	0.065	0.044	0.043	0.035	0.045	0.034
6	0.1380	0.270	0.256	0.082	0.072	0.046	0.048	0.039	0.050	0.037
8	0.1640	0.322	0.306	0.096	0.085	0.052	0.054	0.045	0.058	0.045
10	0.1900	0.373	0.357	0.110	0.099	0.061	0.060	0.050	0.068	0.053
12	0.2160	0.425	0.407	0.125	0.112	0.078	0.067	0.056	0.077	0.061
1/4	0.2500	0.492	0.473	0.144	0.130	0.087	0.075	0.064	0.087	0.070
5/16	0.3125	0.615	0.594	0.178	0.162	0.099	0.084	0.072	0.106	0.085
3/8	0.3750	0.740	0.716	0.212	0.195	0.143	0.094	0.081	0.124	0.100
7/16	0.4375	0.863	0.837	0.247	0.228	0.153	0.094	0.081	0.142	0.116
1/2	0.5000	0.987	0.958	0.281	0.260	0.175	0.106	0.091	0.161	0.131
9/16	0.5625	1.041	1.000	0.315	0.293	0.197	0.118	0.102	0.179	0.146
5/8	0.6250	1.172	1.125	0.350	0.325	0.219	0.133	0.116	0.197	0.162
3/4	0.7500	1.435	1.375	0.419	0.390	0.263	0.149	0.131	0.234	0.192

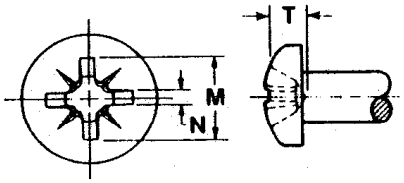
CROSS RECESSED PAN HEAD MACHINE SCREWS

TYPE 1



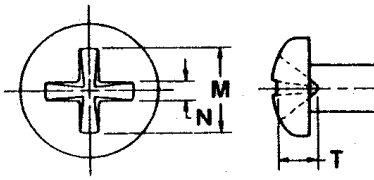
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consists of two tersecting slots with parallel sides c verging to a slightly truncated apex bottom of recess.

Dimensions of Cross Recessed Pan Head Machine Screws

Nominal Size or Basic Screw Diameter		H_1 Head Height		H_2 Head Radius	Type I								Type IA								Type II	
					M Recess Diameter		T Recess Depth		N Recess Width	Driver Size	Recess Penetration Gaging Depth		M Recess Diameter		T Recess Depth		N Recess Width	Driver Size	Recess Penetration Gaging Depth		M Recess Diameter	
		Max	Min	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min
0	0.0600	0.044	0.036	0.005	0.067	0.054	0.039	0.021	0.013	0	0.032	0.014	0.067	0.054	0.040	0.024	0.018	0	0.033	0.017	0.076	0.066
1	0.0730	0.053	0.044	0.005	0.074	0.061	0.045	0.025	0.014	0	0.040	0.022	0.074	0.061	0.047	0.031	0.018	0	0.040	0.024	0.089	0.079
2	0.0860	0.062	0.053	0.010	0.104	0.091	0.059	0.041	0.017	1	0.052	0.034	0.104	0.091	0.064	0.048	0.028	1	0.053	0.037	0.109	0.097
3	0.0990	0.071	0.062	0.010	0.112	0.099	0.068	0.050	0.019	1	0.061	0.043	0.112	0.099	0.073	0.057	0.029	1	0.062	0.046	0.125	0.113
4	0.1120	0.080	0.070	0.010	0.122	0.109	0.078	0.060	0.019	1	0.071	0.053	0.122	0.109	0.083	0.067	0.029	1	0.072	0.056	0.143	0.130
5	0.1250	0.089	0.079	0.015	0.158	0.145	0.083	0.057	0.028	2	0.072	0.046	0.154	0.141	0.084	0.066	0.040	2	0.068	0.050	0.159	0.145
6	0.1380	0.097	0.087	0.015	0.166	0.153	0.091	0.066	0.028	2	0.080	0.055	0.162	0.149	0.092	0.074	0.040	2	0.076	0.058	0.176	0.162
8	0.1640	0.115	0.105	0.015	0.182	0.169	0.108	0.082	0.030	2	0.097	0.071	0.177	0.164	0.108	0.090	0.041	2	0.092	0.074	0.207	0.192
10	0.1900	0.133	0.122	0.020	0.199	0.186	0.124	0.100	0.031	2	0.113	0.089	0.193	0.180	0.124	0.106	0.041	2	0.108	0.090	0.240	0.224
12	0.2160	0.151	0.139	0.025	0.259	0.246	0.141	0.115	0.034	3	0.124	0.098	0.254	0.241	0.139	0.121	0.056	3	0.117	0.099	0.272	0.254
1/4	0.2500	0.175	0.162	0.035	0.281	0.268	0.161	0.135	0.036	3	0.144	0.118	0.273	0.260	0.159	0.141	0.057	3	0.137	0.119	0.318	0.300
5/16	0.3125	0.218	0.203	0.040	0.350	0.337	0.193	0.169	0.059	4	0.173	0.149	0.341	0.328	0.191	0.173	0.086	4	0.164	0.146	0.396	0.375
3/8	0.3750	0.261	0.244	0.040	0.389	0.376	0.233	0.210	0.065	4	0.213	0.190	0.377	0.364	0.228	0.210	0.086	4	0.201	0.183	0.480	0.457
7/16	0.4375	0.305	0.284	0.050	0.413	0.400	0.259	0.234	0.068	4	0.239	0.214	0.399	0.386	0.251	0.233	0.086	4	0.224	0.206	0.557	0.531
1/2	0.5000	0.348	0325	0.055	0.435	0.422	0.280	0.255	0.071	4	0.260	0.235	0.420	0.407	0.273	0.255	0.086	4	0.246	0.228	0.630	0.604
9/16	0.5625	0.391	0.366	0.065	0.470	0.447	0.312	0.288	0.076	4	0.292	0.268	0.456	0.433	0.304	0.286	0.087	4	0.277	0.259	0.638	0.612
5/8	0.6250	0.434	0.406	0.075	0.587	0.564	0.343	0.314	0.081	5	0.310	0.281	0.570	0.547	0.333	0.312	0.098	5	0.295	0.274	0.638	0.612
3/4	0.7500	0.521	0.488	0.085	0.633	0.610	0.382	0.355	0.086	5	0.349	0.322	0.614	0.591	0.379	0.358	0.098	5	0.341	0.320	0.638	0.612

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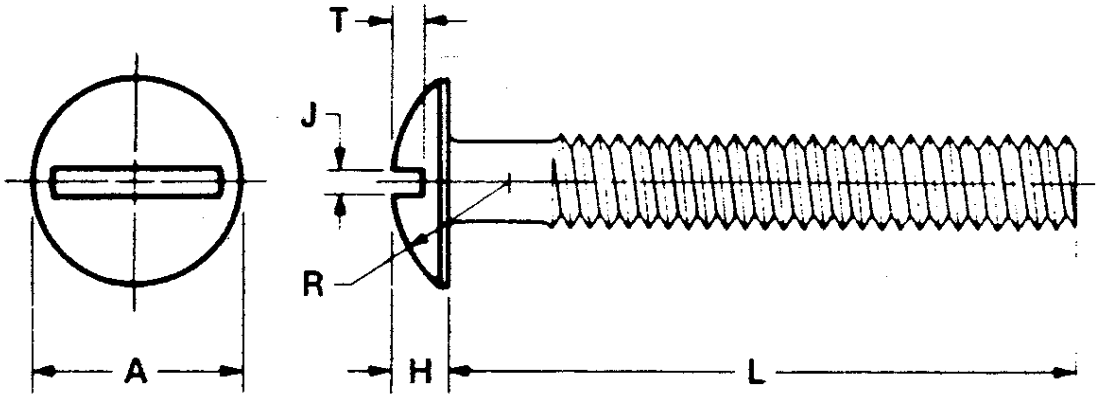
SLOTTED FILLISTER HEAD MACHINE SCREWS

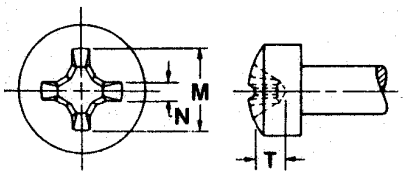


Dimensions of Slotted Fillister Head Machine Screws

Nominal Size or Basic Screw Diameter		A		H		O		J		T	
		Head Diameter		Head Side Height		Total Head Height		Slot Width		Slot Depth	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
0000	0.0210	0.038	0.032	0.019	0.011	0.025	0.015	0.008	0.004	0.012	0.006
000	0.0340	0.059	0.053	0.029	0.021	0.035	0.027	0.012	0.006	0.017	0.011
00	0.0470	0.082	0.072	0.039	0.028	0.047	0.039	0.017	0.010	0.022	0.015
0	0.0600	0.096	0.083	0.043	0.038	0.055	0.047	0.023	0.016	0.025	0.015
1	0.0730	0.118	0.104	0.053	0.045	0.066	0.058	0.026	0.019	0.031	0.020
2	0.0860	0.140	0.124	0.062	0.053	0.083	0.066	0.031	0.023	0.037	0.025
3	0.0990	0.161	0.145	0.070	0.061	0.095	0.077	0.035	0.027	0.043	0.030
4	0.1120	0.183	0.166	0.079	0.069	0.107	0.088	0.039	0.031	0.048	0.035
5	0.1250	0.205	0.187	0.088	0.078	0.120	0.100	0.043	0.035	0.054	0.040
6	0.1380	0.226	0.208	0.096	0.086	0.132	0.111	0.048	0.039	0.060	0.045
8	0.1640	0.270	0.250	0.113	0.102	0.156	0.133	0.054	0.045	0.071	0.054
10	0.1900	0.313	0.292	0.130	0.118	0.180	0.156	0.060	0.050	0.083	0.064
12	0.2160	0.357	0.334	0.148	0.134	0.205	0.178	0.067	0.056	0.094	0.074
1/4	0.2500	0.414	0.389	0.170	0.155	0.237	0.207	0.075	0.064	0.109	0.087
5/16	0.3125	0.518	0.490	0.211	0.194	0.295	0.262	0.084	0.072	0.137	0.110
3/8	0.3750	0.622	0.590	0.253	0.233	0.355	0.315	0.094	0.081	0.164	0.133
7/16	0.4375	0.625	0.589	0.265	0.242	0.368	0.321	0.094	0.081	0.170	0.135
1/2	0.5000	0.750	0.710	0.297	0.273	0.412	0.362	0.106	0.091	0.190	0.151
9/16	0.5625	0.812	0.768	0.336	0.308	0.466	0.410	0.118	0.102	0.214	0.172
5/8	0.6250	0.875	0.827	0.375	0.345	0.521	0.461	0.133	0.116	0.240	0.193
3/4	0.7500	1.000	0.945	0.441	0.406	0.612	0.542	0.149	0.131	0.281	0.226

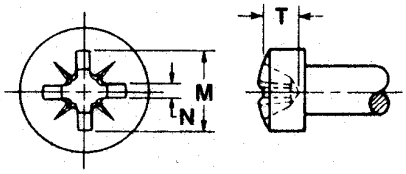
CROSS RECESSED FILLISTER HEAD MACHINE SCREWS

TYPE 1



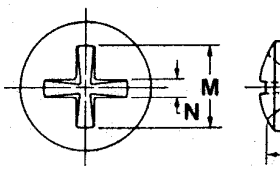
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consists o
ting slots with parallel sides
a slightly truncated apex at bo

Dimensions of Cross Recessed Fillister Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A												
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.067	0.054	0.039	0.021	0.013	0	0.032	0.014	0.067	0.054	0.040	0.024	0.018	0	0.033	0.017	0.072	0.062	0.03
1	0.0730	0.074	0.061	0.045	0.025	0.014	0	0.040	0.022	0.074	0.061	0.047	0.031	0.018	0	0.040	0.024	0.088	0.078	0.04
2	0.0860	0.104	0.091	0.059	0.041	0.017	1	0.052	0.034	0.104	0.091	0.064	0.048	0.028	1	0.053	0.037	0.105	0.093	0.05
3	0.0990	0.112	0.099	0.068	0.050	0.019	1	0.061	0.043	0.112	0.099	0.073	0.057	0.029	1	0.062	0.046	0.121	0.109	0.06
4	0.1120	0.122	0.109	0.078	0.060	0.019	1	0.071	0.053	0.122	0.109	0.083	0.067	0.029	1	0.072	0.056	0.137	0.124	0.07
5	0.1250	0.143	0.130	0.067	0.042	0.027	2	0.056	0.031	0.140	0.127	0.070	0.052	0.040	2	0.054	0.036	0.154	0.140	0.08
6	0.1380	0.166	0.153	0.091	0.066	0.028	2	0.080	0.055	0.162	0.149	0.092	0.074	0.040	2	0.076	0.058	0.170	0.156	0.09
8	0.1640	0.182	0.169	0.108	0.082	0.030	2	0.097	0.071	0.177	0.164	0.108	0.090	0.041	2	0.092	0.074	0.202	0.187	0.11
10	0.1900	0.199	0.186	0.124	0.100	0.031	2	0.113	0.089	0.193	0.180	0.124	0.106	0.041	2	0.108	0.090	0.235	0.219	0.13
12	0.2160	0.259	0.246	0.141	0.115	0.034	3	0.124	0.098	0.254	0.241	0.139	0.121	0.056	3	0.117	0.099	0.268	0.250	0.15
1/4	0.2500	0.281	0.268	0.161	0.135	0.036	3	0.144	0.118	0.273	0.260	0.159	0.141	0.057	3	0.137	0.119	0.308	0.290	0.18
5/16	0.3125	0.322	0.309	0.203	0.177	0.042	3	0.186	0.160	0.315	0.302	0.202	0.184	0.057	3	0.181	0.163	0.388	0.367	0.22
3/8	0.3750	0.389	0.376	0.233	0.210	0.065	4	0.213	0.190	0.377	0.364	0.228	0.210	0.086	4	0.201	0.183	0.466	0.442	0.27
7/16	0.4375	0.413	0.400	0.259	0.234	0.068	4	0.239	0.214	0.399	0.386	0.251	0.233	0.086	4	0.224	0.206	0.466	0.442	0.27
1/2	0.5000	0.435	0.422	0.280	0.255	0.071	4	0.260	0.235	0.420	0.407	0.273	0.255	0.086	4	0.246	0.228	0.562	0.532	0.33
9/16	0.5625	0.470	0.442	0.312	0.288	0.076	4	0.292	0.268	0.456	0.433	0.304	0.286	0.087	4	0.277	0.259	0.609	0.576	0.37
5/8	0.6250	0.587	0.564	0.343	0.314	0.081	5	0.310	0.281	0.570	0.547	0.333	0.312	0.098	5	0.295	0.274	0.609	0.576	0.37
3/4	0.7500	0.633	0.610	0.382	0.355	0.086	5	0.349	0.322	0.614	0.591	0.379	0.358	0.098	5	0.341	0.320	0.609	0.576	0.37

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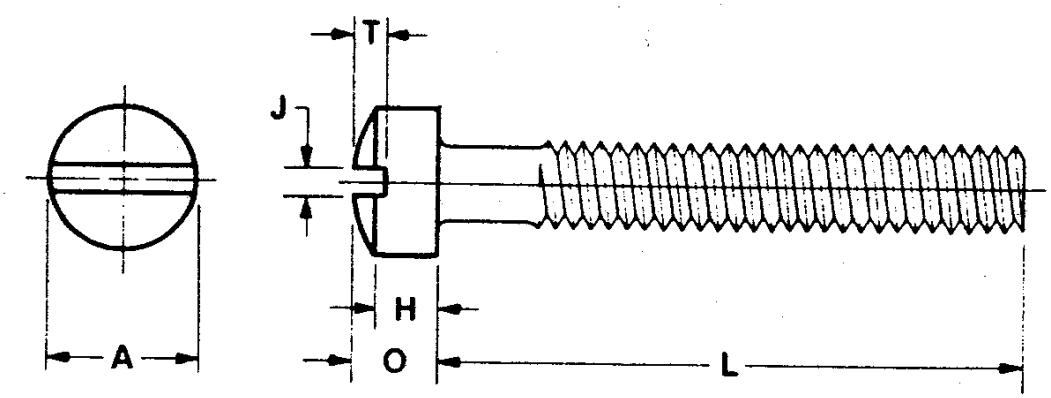
SLOTTED TRUSS HEAD MACHINE SCREWS

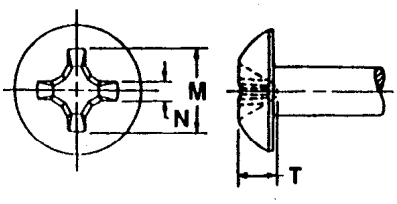


Dimensions of Slotted Truss Head Machine Screws

Nominal Size or Basic Screw Diameter		A		H		R	J		T	
		Head Diameter		Head Side Height		Head Radius	Slot Width		Slot Depth	
		Max	Min	Max	Min	Max	Max	Min	Max	Min
0000	0.0210	0.049	0.043	0.014	0.010	0.032	0.009	0.005	0.009	0.005
000	0.0340	0.077	0.071	0.022	0.018	0.051	0.013	0.009	0.013	0.009
00	0.0470	0.106	0.098	0.030	0.024	0.070	0.017	0.010	0.018	0.012
0	0.0600	0.131	0.119	0.037	0.029	0.087	0.023	0.016	0.022	0.014
1	0.0730	0.164	0.149	0.045	0.037	0.107	0.026	0.019	0.027	0.018
2	0.0860	0.194	0.180	0.053	0.044	0.129	0.031	0.023	0.031	0.022
3	0.0990	0.226	0.211	0.061	0.051	0.151	0.035	0.027	0.036	0.026
4	0.1120	0.257	0.241	0.069	0.059	0.169	0.039	0.031	0.040	0.030
5	0.1250	0.289	0.272	0.078	0.066	0.191	0.043	0.035	0.045	0.034
6	0.1380	0.321	0.303	0.086	0.074	0.211	0.048	0.039	0.050	0.037
8	0.1640	0.384	0.364	0.102	0.088	0.254	0.054	0.045	0.058	0.045
10	0.1900	0.448	0.425	0.118	0.103	0.283	0.060	0.050	0.068	0.053
12	0.2160	0.511	0.487	0.134	0.118	0.336	0.067	0.056	0.077	0.061
1/4	0.2500	0.573	0.546	0.150	0.133	0.375	0.075	0.064	0.087	0.070
5/16	0.3125	0.698	0.666	0.183	0.162	0.457	0.084	0.072	0.106	0.085
3/8	0.3750	0.823	0.787	0.215	0.191	0.538	0.094	0.081	0.124	0.100
7/16	0.4375	0.948	0.907	0.248	0.221	0.619	0.094	0.081	0.142	0.116
1/2	0.5000	1.073	1.028	0.280	0.250	0.701	0.106	0.091	0.161	0.131
9/16	0.5625	1.198	1.149	0.312	0.279	0.783	0.118	0.102	0.179	0.146
5/8	0.6250	1.198	0.269	0.345	0.309	0.863	0.133	0.116	0.196	0.162
3/4	0.7500	1.573	1.511	0.410	0.368	1.024	0.149	0.131	0.234	0.182

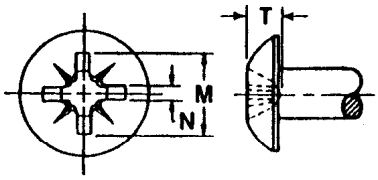
CROSS RECESSED TRUSS HEAD MACHINE SCREWS

TYPE 1



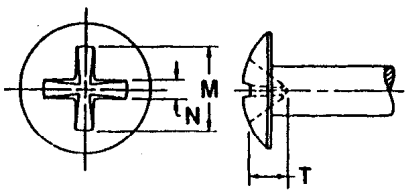
This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.

TYPE II



This type of recess consists of two intersecting slots with parallel sides converging to a slightly truncated apex at bottom of recess.

OPTION
LONG REC
WITH

Dimensions of Cross Recessed Truss Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A								M		
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		Recess Diameter		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width						
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.063	0.050	0.037	0.019	0.013	0	0.030	0.012	0.062	0.049	0.037	0.021	0.018	0	0.030	0.014	0.073	0.067	0.03
1	0.0730	0.071	0.058	0.045	0.027	0.014	0	0.038	0.020	0.070	0.057	0.045	0.029	0.018	0	0.038	0.022	0.091	0.083	0.04
2	0.0860	0.104	0.091	0.059	0.041	0.018	1	0.052	0.034	0.098	0.085	0.059	0.043	0.029	1	0.049	0.033	0.109	0.101	0.05
3	0.0990	0.110	0.097	0.066	0.049	0.018	1	0.059	0.042	0.105	0.092	0.066	0.050	0.029	1	0.056	0.040	0.127	0.118	0.07
4	0.1120	0.112	0.099	0.069	0.051	0.018	1	0.062	0.044	0.108	0.095	0.069	0.053	0.029	1	0.059	0.043	0.144	0.135	0.08
5	0.1250	0.128	0.115	0.085	0.067	0.019	1	0.078	0.060	0.124	0.111	0.085	0.069	0.030	1	0.075	0.059	0.162	0.152	0.09
6	0.1380	0.158	0.145	0.084	0.059	0.027	2	0.073	0.048	0.148	0.135	0.080	0.062	0.041	2	0.065	0.047	0.180	0.170	0.10
8	0.1640	0.173	0.160	0.099	0.074	0.029	2	0.088	0.063	0.162	0.149	0.094	0.076	0.041	2	0.079	0.061	0.215	0.204	0.12
10	0.1900	0.188	0.175	0.115	0.090	0.030	2	0.104	0.079	0.178	0.165	0.110	0.092	0.042	2	0.095	0.077	0.251	0.238	0.14
12	0.2160	0.248	0.235	0.128	0.103	0.032	3	0.111	0.086	0.234	0.221	0.122	0.104	0.055	3	0.101	0.083	0.286	0.273	0.16
1/4	0.2500	0.263	0.250	0.143	0.118	0.033	3	0.126	0.101	0.248	0.235	0.136	0.118	0.056	3	0.115	0.097	0.321	0.306	0.18
5/16	0.3125	0.352	0.339	0.193	0.168	0.059	4	0.173	0.148	0.333	0.320	0.187	0.169	0.086	4	0.161	0.143	0.391	0.373	0.22
3/8	0.3750	0.383	0.370	0.226	0.202	0.063	4	0.206	0.182	0.364	0.351	0.219	0.201	0.086	4	0.192	0.174	0.456	0.436	0.27
7/16	0.4375	0.414	0.401	0.257	0.232	0.068	4	0.237	0.212	0.394	0.381	0.249	0.231	0.086	4	0.223	0.205	0.523	0.500	0.31
1/2	0.5000	0.444	0.431	0.288	0.263	0.072	4	0.268	0.243	0.422	0.409	0.278	0.260	0.086	4	0.251	0.233	0.601	0.576	0.36
9/16	0.5625	0.451	0.428	0.302	0.278	0.074	4	0.282	0.258	0.432	0.409	0.283	0.265	0.086	4	0.256	0.238	0.601	0.576	0.36
5/8	0.6250	0.559	0.536	0.322	0.289	0.077	5	0.289	0.256	0.536	0.513	0.304	0.283	0.097	5	0.266	0.245	0.601	0.275	0.36
3/4	0.7500	0.620	0.597	0.384	0.352	0.085	5	0.351	0.319	0.593	0.570	0.362	0.341	0.098	5	0.323	0.302	0.601	0.576	0.36

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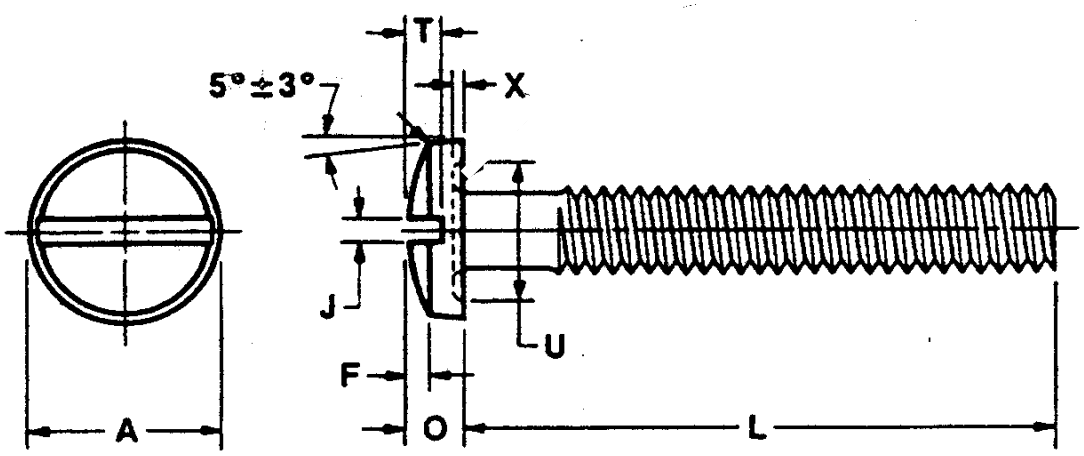
SLOTTED BINDING HEAD MACHINE SCREWS

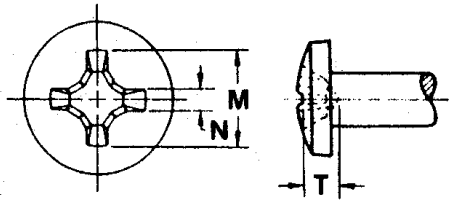


Dimensions of Slotted Binding Head Machine Screws

Nominal Size or Basic Screw Diameter		A		O		F		J		T		U		X	
		Head Diameter		Head Side Height		Total Head Height		Slot Width		Slot Depth		Undercut Diameter		Undercut Depth	
		Max	Min	Max	Min	Max	Max	Min	Max	Min	Min	Max	Min	Max	Min
0000	0.0210	0.046	0.040	0.014	0.009	0.006	0.003	0.008	0.004	0.009	0.005	--	--	--	--
000	0.0340	0.073	0.067	0.021	0.015	0.008	0.005	0.012	0.006	0.013	0.009	--	--	--	--
00	0.0470	0.098	0.090	0.028	0.023	0.011	0.007	0.017	0.010	0.018	0.012	--	--	--	--
0	0.0600	0.126	0.119	0.032	0.026	0.012	0.008	0.023	0.016	0.018	0.009	0.098	0.086	0.007	0.002
1	0.0730	0.153	0.145	0.041	0.035	0.015	0.011	0.026	0.019	0.024	0.014	0.120	0.105	0.008	0.003
2	0.0860	0.181	0.171	0.050	0.043	0.018	0.013	0.031	0.023	0.030	0.020	0.141	0.124	0.010	0.005
3	0.0990	0.208	0.197	0.059	0.052	0.022	0.016	0.035	0.027	0.036	0.025	0.162	0.143	0.011	0.006
4	0.1120	0.235	0.223	0.068	0.061	0.025	0.018	0.039	0.031	0.042	0.030	0.184	0.161	0.012	0.007
5	0.1250	0.263	0.249	0.078	0.069	0.029	0.021	0.043	0.035	0.048	0.035	0.205	0.180	0.014	0.009
6	0.1380	0.290	0.275	0.087	0.078	0.032	0.024	0.048	0.039	0.053	0.040	0.226	0.199	0.015	0.010
8	0.1640	0.344	0.326	0.105	0.095	0.039	0.029	0.054	0.045	0.065	0.050	0.269	0.236	0.017	0.012
10	0.1900	0.399	0.378	0.123	0.112	0.045	0.034	0.060	0.050	0.077	0.060	0.312	0.274	0.020	0.015
12	0.2160	0.454	0.430	0.141	0.130	0.052	0.039	0.067	0.056	0.089	0.070	0.354	0.311	0.023	0.018
1/4	0.2500	0.525	0.498	0.165	0.152	0.061	0.046	0.075	0.064	0.105	0.084	0.410	0.360	0.026	0.021
5/16	0.3125	0.656	0.622	0.209	0.194	0.077	0.059	0.084	0.072	0.134	0.108	0.513	0.450	0.032	0.027
3/8	0.3750	0.788	0.746	0.253	0.235	0.094	0.071	0.094	0.081	0.163	0.132	0.615	0.540	0.039	0.034

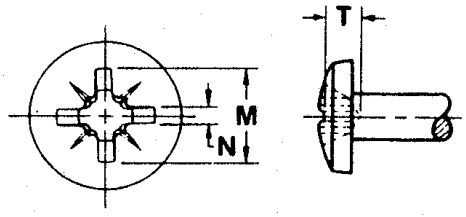
CROSS RECESSED BINDING HEAD MACHINE SCREWS

TYPE 1

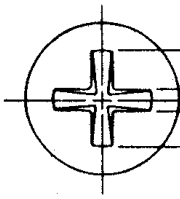


This type of recess has a large center opening, tapered wings, and blunt bottom, with all edges relieved or rounded.

TYPE 1A



This type of recess has a large center opening, wide straight wings, and blunt bottom, with all edges relieved or rounded.



This type of rece
ting slots with p
a slightly trunca

Dimensions of Cross Recessed Binding Head Machine Screws

Nominal Size or Basic Screw Diameter		Type 1								Type 1A											
		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		T		N	Driver Size	Recess Penetration Gaging Depth		M		
		Recess Diameter		Recess Depth		Recess Width				Recess Diameter		Recess Depth		Recess Width				Recess Diameter		
		Max	Min	Max	Min	Min		Max	Min	Max	Min	Max	Min	Min		Max	Min	Max	Min	Max
0	0.0600	0.067	0.054	0.040	0.023	0.013	0	0.033	0.016	0.067	0.054	0.042	0.026	0.018	0	0.034	0.018	0.083	0.073	0.04
1	0.0730	0.074	0.061	0.047	0.030	0.014	0	0.040	0.023	0.074	0.061	0.049	0.033	0.018	0	0.043	0.027	0.097	0.087	0.05
2	0.0860	0.100	0.087	0.058	0.041	0.017	1	0.051	0.034	0.104	0.091	0.065	0.049	0.029	1	0.054	0.038	0.118	0.106	0.06
3	0.0990	0.110	0.097	0.068	0.051	0.017	1	0.061	0.044	0.109	0.096	0.070	0.054	0.029	1	0.059	0.043	0.136	0.124	0.07
4	0.1120	0.118	0.105	0.077	0.059	0.017	1	0.070	0.052	0.117	0.104	0.078	0.062	0.029	1	0.068	0.052	0.154	0.141	0.08
5	0.1250	0.148	0.135	0.075	0.051	0.018	2	0.064	0.040	0.144	0.131	0.075	0.057	0.040	2	0.059	0.041	0.172	0.158	0.09
6	0.1380	0.160	0.147	0.088	0.064	0.026	2	0.077	0.053	0.156	0.143	0.087	0.069	0.040	2	0.072	0.054	0.190	0.176	0.11
8	0.1640	0.186	0.173	0.114	0.090	0.028	2	0.103	0.079	0.181	0.168	0.113	0.095	0.041	2	0.097	0.079	0.224	0.209	0.12
10	0.1900	0.205	0.192	0.134	0.109	0.029	2	0.123	0.098	0.199	0.186	0.131	0.113	0.041	2	0.115	0.097	0.247	0.231	0.14
12	0.2160	0.267	0.254	0.151	0.126	0.032	3	0.134	0.109	0.260	0.247	0.147	0.129	0.056	3	0.125	0.107	0.293	0.275	0.17
1/4	0.2500	0.281	0.268	0.164	0.140	0.046	3	0.147	0.123	0.274	0.261	0.161	0.143	0.057	3	0.139	0.121	0.329	0.311	0.18
5/16	0.3125	0.350	0.337	0.195	0.172	0.068	4	0.175	0.152	0.339	0.326	0.190	0.172	0.086	4	0.163	0.145	0.414	0.393	0.24
3/8	0.3750	0.400	0.387	0.247	0.223	0.076	4	0.227	0.203	0.387	0.374	0.240	0.222	0.086	4	0.213	0.195	0.480	0.456	0.28

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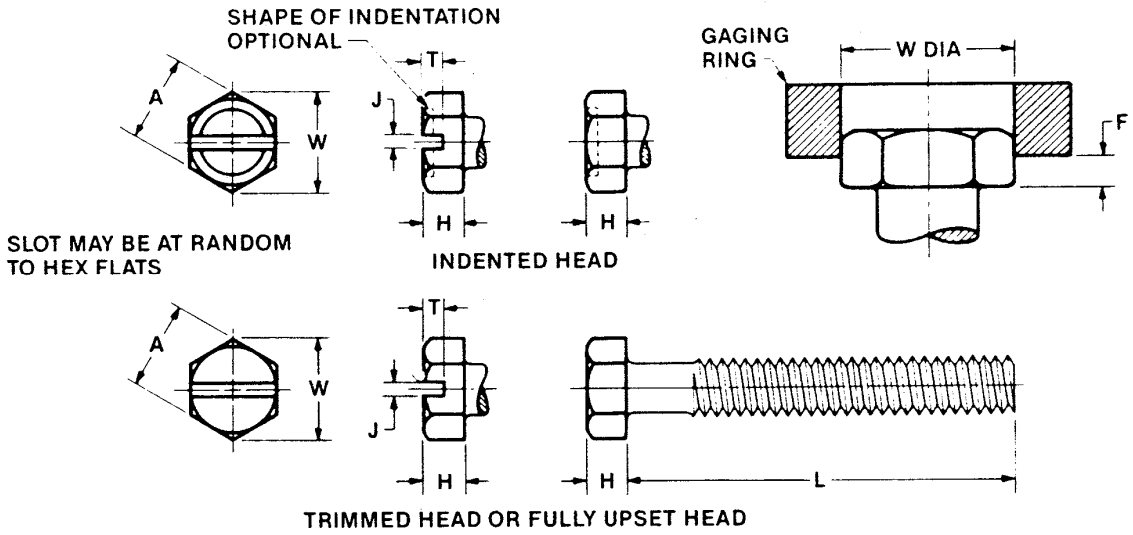
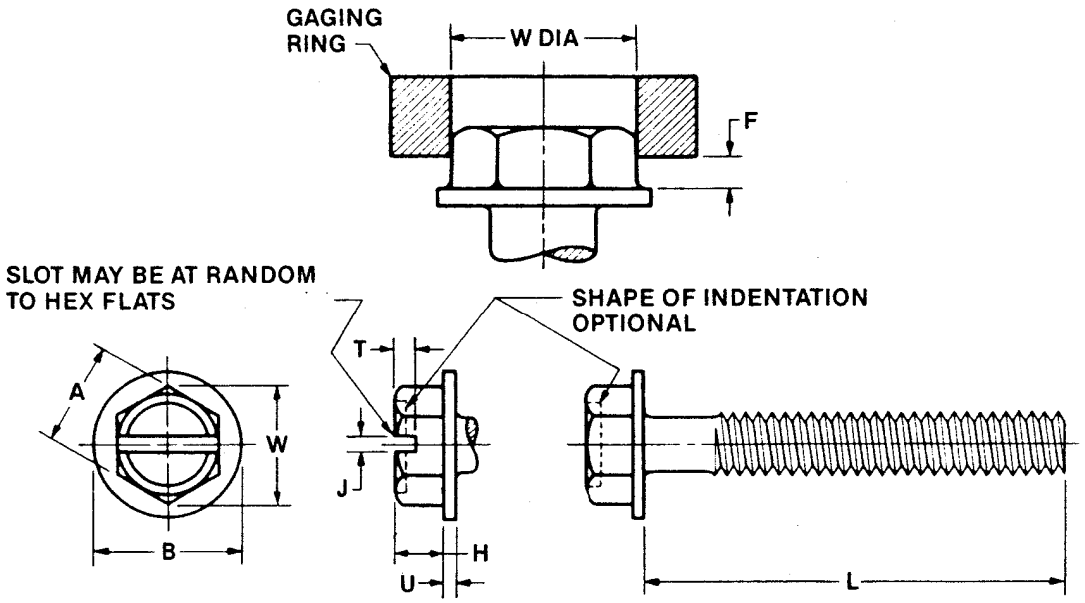
HEX HEAD MACHINE SCREWS



Dimensions of Plain and Slotted Regular and Large Hex Head Machine Screws

Nominal Size or Basic Screw Diameter		A Regular Head Width Across Flats Max	A Regular Head Width Across Flats Min	W Regular Head Across Corners Min	A Large Head Width Across Flats Max	A Large Head Width Across Flats Min	W Large Head Across Corners Min	H Head Height Max	H Head Height Min	J Slot Width Max	J Slot Width Min	T Slot Depth Max	T Slot Depth Min	F Protrusion Beyond Gaging Ring Min
1	0.0730	0.125	0.120	0.134	--	--	--	0.044	0.036	--	--	--	--	0.022
2	0.0860	0.125	0.120	0.134	--	--	--	0.050	0.040	--	--	--	--	0.024
3	0.0990	0.188	0.181	0.202	--	--	--	0.055	0.044	--	--	--	--	0.026
4	0.1120	0.188	0.181	0.202	0.219	0.213	0.238	0.060	0.049	0.039	0.031	0.036	0.025	0.029
5	0.1250	0.188	0.181	0.202	0.250	0.244	0.272	0.070	0.058	0.043	0.035	0.042	0.030	0.035
6	0.1380	0.250	0.244	0.272	--	--	--	0.093	0.080	0.048	0.039	0.046	0.033	0.048
8	0.1640	0.250	0.244	0.272	0.312	0.305	0.340	0.110	0.096	0.054	0.045	0.066	0.052	0.058
10	0.1900	0.312	0.305	0.340	--	--	--	0.120	0.105	0.060	0.050	0.072	0.057	0.063
12	0.2160	0.312	0.305	0.340	0.375	0.367	0.409	0.155	0.139	0.067	0.056	0.093	0.077	0.083
1/4	0.2500	0.375	0.367	0.409	0.438	0.428	0.477	0.190	0.172	0.075	0.064	0.101	0.083	0.103
5/16	0.3125	0.500	0.489	0.545	--	--	--	0.230	0.208	0.084	0.072	0.122	0.100	0.125
3/8	0.3750	0.562	0.551	0.614	--	--	--	0.295	0.270	0.094	0.081	0.156	0.131	0.162

HEX WASHER HEAD MACHINE SCREWS

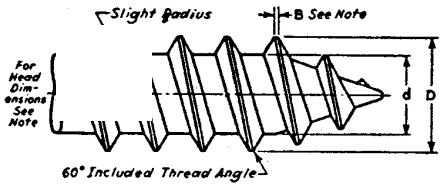


Dimensions of Plain and Slotted Hex Washer Head Machine Screws

Nominal Size or Basic Screw Diameter		A		W	H		B		U		J		T		F
		Width Across Flats		Width Across Corners	Head Height		Washer Diameter		Washer Thickness		Slot Width		Slot Depth		Protrusion Beyond Gaging Ring
		Max	Min	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Min
2	0.0860	0.125	0.120	0.134	0.050	0.040	0.166	0.154	0.016	0.010	--	--	--	--	0.024
3	0.0990	0.125	0.120	0.134	0.055	0.044	0.177	0.163	0.016	0.010	--	--	--	--	0.026
4	0.1120	0.188	0.181	0.202	0.060	0.049	0.243	0.225	0.019	0.011	0.039	0.031	0.042	0.025	0.029
5	0.1250	0.188	0.181	0.202	0.070	0.058	0.260	0.240	0.025	0.015	0.043	0.035	0.049	0.030	0.035
6	0.1380	0.250	0.244	0.272	0.093	0.080	0.328	0.302	0.025	0.015	0.048	0.039	0.083	0.033	0.048
8	0.1640	0.250	0.244	0.272	0.110	0.096	0.348	0.322	0.031	0.019	0.054	0.045	0.074	0.052	0.058
10	0.1900	0.312	0.305	0.340	0.120	0.105	0.414	0.384	0.031	0.019	0.060	0.050	0.080	0.057	0.063
12	0.2160	0.312	0.305	0.340	0.155	0.139	0.432	0.398	0.039	0.022	0.067	0.056	0.103	0.077	0.083
1/4	0.2500	0.375	0.367	0.409	0.190	0.172	0.520	0.480	0.050	0.030	0.075	0.064	0.111	0.083	0.103
5/16	0.3125	0.500	0.489	0.545	0.230	0.208	0.676	0.624	0.055	0.035	0.084	0.072	0.134	0.100	0.125
3/8	0.3750	0.562	0.551	0.614	0.295	0.270	0.780	0.720	0.063	0.037	0.094	0.081	0.168	0.131	0.162

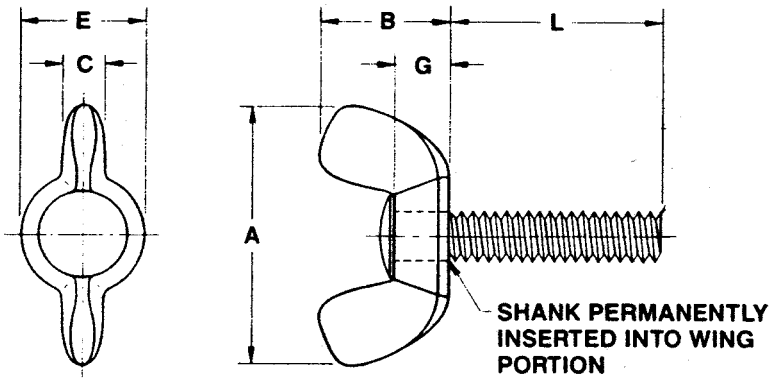
TAPPING SCREW SPECIFICATIONS

Type A
Tapping Screws



Nominal Size	Threads per Inch	D		d	
		Major Diameter		Minor Diameter	
		Max	Min	Max	Min
2	32	.088	.084	.061	.056
3	28	.101	.097	.076	.071
4	24	.114	.110	.083	.078
5	20	.130	.126	.095	.090
6	18	.141	.136	.102	.096
7	16	.153	.152	.114	.108
8	15	.168	.162	.123	.116
10	12	.194	.188	.133	.126
12	11	.221	.215	.162	.155
14	10	.254	.248	.185	.178

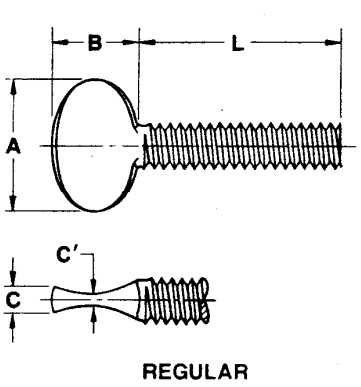
TYPE A THUMB AND WING SCREWS



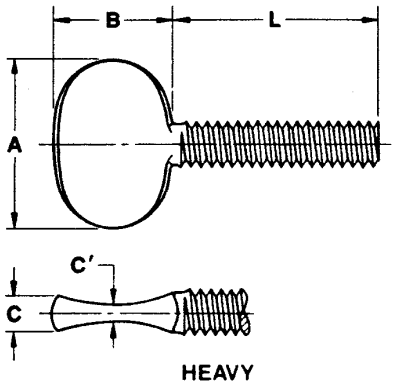
Dimensions of Type A, Wing Screws

Nominal Size or Basic Screw Diameter		Threads per Inch	Series	Head Blank Size (Ref)	A		B		C		E		G		L	
					Wing Spread		Wing Height		Wing Thickness		Boss Diameter		Boss Height		Practical Screw Lengths	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	(0.1120)	40	Heavy	AA	0.72	0.59	0.41	0.28	0.11	0.07	0.33	0.29	0.14	0.10	0.75	0.25
6	(0.1380)	32	Light **Heavy**	AA **A**	0.72 **0.91**	0.59 **0.78**	0.41 **0.47**	0.28 **0.34**	0.11 **0.14**	0.07 **0.10**	0.33 **0.43**	0.29 **0.39**	0.14 **0.18**	0.10 **0.14**	0.75	0.25
8	(0.1640)	32	**Light** Heavy	**A** B	**0.91** 1.10	**0.78** 0.97	**0.47** 0.57	**0.34** 0.43	**0.14** 0.18	**0.10** 0.14	**0.43** 0.50	**0.37** 0.45	**0.18** 0.22	**0.14** 0.17	0.75	0.38
10	(0.1900)	24 & 32	**Light** Heavy	**A** B	**0.91** 1.10	**0.78** 0.97	**0.47** 0.57	**0.34** 0.43	**0.14** 0.18	**0.10** 0.14	**0.43** 0.50	**0.37** 0.45	**0.18** 0.22	**0.14** 0.17	1.00	0.38
12	(0.2160)	24	**Light** Heavy	**B** C	**1.10** 1.25	**0.97** 1.12	**0.57** 0.66	**0.43** 0.53	**0.18** 0.21	**0.14** 0.17	**0.50** 0.58	**0.45** 0.51	**0.22** 0.25	**0.17** 0.20	1.00	0.38
1/4	(0.2500)	20	**Light** Regular Heavy	**B** C D	**1.10** 1.25 1.44	**0.97** 1.12 1.31	**0.57** 0.66 0.79	**0.43** 0.53 0.65	**0.18** 0.21 0.24	**0.14** 0.17 0.20	**0.50** 0.58 0.70	**0.45** 0.51 0.64	**0.22** 0.25 0.30	**0.17** 0.20 0.26	1.50	0.50
5/16	(0.3125)	18	**Light** Regular Heavy	**C** D E	**1.25** 1.44 1.94	**1.12** 1.31 1.81	**0.66** 0.79 1.00	**0.53** 0.65 0.87	**0.21** 0.24 0.33	**0.17** 0.20 0.26	**0.58** 0.70 0.93	**0.51** 0.64 0.86	**0.25** 0.30 0.39	**0.20** 0.26 0.35	1.50	0.50
3/8	(0.3750)	16	**Light** Regular Heavy	**D** E F	**1.44** 1.94 2.76	**1.31** 1.81 2.62	**0.79** 1.00 1.44	**0.65** 0.87 1.31	**0.24** 0.33 0.40	**0.20** 0.26 0.34	**0.70** 0.93 1.19	**0.64** 0.86 1.13	**0.30** 0.39 0.55	**0.26** 0.35 0.51	2.00	0.75
7/16	(0.4375)	14	**Light** Heavy	**E** F	**1.94** 2.76	**1.81** 2.62	**1.00** 1.44	**0.87** 1.31	**0.33** 0.40	**0.26** 0.34	**0.93** 1.19	**0.86** 1.13	**0.39** 0.55	**0.35** 0.51	4.00	1.00
1/2	(0.5000)	13	**Light** Heavy	**E** F	**1.94** 2.76	**1.81** 2.62	**1.00** 1.44	**0.87** 1.31	**0.33** 0.40	**0.26** 0.34	**0.93** 1.19	**0.86** 1.13	**0.39** 0.55	**0.35** 0.51	4.00	1.00
5/8	(0.6250)	11	Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	1.19	1.13	0.55	0.51	4.00	1.25

TYPE B THUMB SCREWS



REGULAR



HEAVY

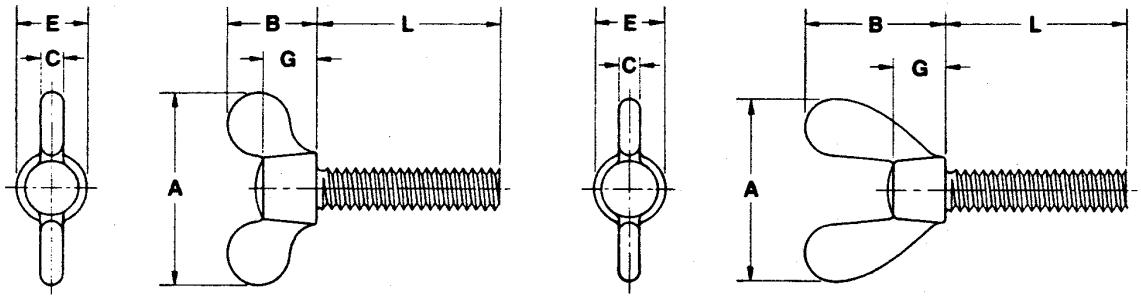
Dimensions of Type B, Regular Thumb Screws

Nominal Size or Basic Screw Diameter		Threads per Inch	A Head Width		B Head Height		C Head Thickness		C[1] Head Thickness		L Practical Screw Lengths	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
6	(0.1380)	32	0.45	0.43	0.28	0.26	0.08	0.06	0.03	0.02	1.00	0.25
8	(0.1640)	32	0.51	0.49	0.32	0.30	0.09	0.07	0.04	0.02	1.00	0.38
10	(0.1900)	24 & 32	0.58	0.54	0.39	0.36	0.10	0.08	0.05	0.03	2.00	0.38
12	(0.2160)	24	0.71	0.67	0.45	0.43	0.11	0.09	0.05	0.03	2.00	0.38
1/4	(0.2500)	20	0.83	0.80	0.52	0.48	0.16	0.14	0.06	0.03	2.50	0.50
5/16	(0.3125)	18	0.96	0.91	0.64	0.60	0.17	0.14	0.09	0.06	3.00	0.50
3/8	(0.3750)	16	1.09	1.03	0.71	0.67	0.22	0.18	0.11	0.08	3.00	0.75
7/16	(0.4375)	14	1.40	1.35	0.96	0.91	0.27	0.24	0.14	0.11	4.00	1.00
1/2	(0.5000)	13	1.54	1.46	1.09	1.03	0.33	0.29	0.15	0.11	4.00	1.00

Dimensions of Type B, Heavy Thumb Screws

Nominal Size or Basic Screw Diameter		Threads per Inch	A Head Width		B Head Height		C Head Thickness		C[1] Head Thickness		L Practical Screw Lengths	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
10	(0.1900)	24	0.89	0.83	0.78	0.66	0.18	0.16	0.08	0.06	2.00	0.50
1/4	(0.2500)	20	1.05	0.99	0.81	0.72	0.24	0.22	0.11	0.09	3.00	0.50
5/16	(0.3125)	18	1.21	1.15	0.88	0.78	0.27	0.25	0.11	0.09	4.00	0.50
3/8	(0.3750)	16	1.41	1.34	0.94	0.84	0.30	0.28	0.14	0.12	4.00	0.50
7/16	(0.4375)	14	1.59	1.53	1.00	0.91	0.36	0.34	0.14	0.12	3.00	1.00
1/2	(0.5000)	13	1.81	1.72	1.09	0.97	0.40	0.38	0.18	0.16	3.00	1.00

TYPE B WING SCREWS



Dimensions of Type B, Style 1 Wing Screws

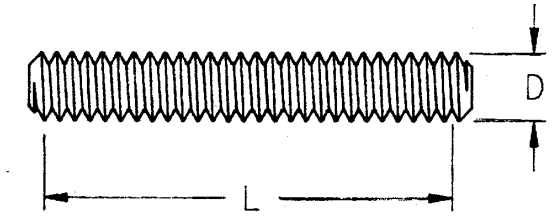
Nominal Size or Basic Screw Diameter		Threads per Inch	A		B		C		E		G		L	
			Wing Spread		Wing Height		Wing Thickness		Boss Diameter		Boss Height		Practical Screw Lengths	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
10	(0.1900)	24	0.97	0.91	0.45	0.39	0.15	0.12	0.39	0.36	0.28	0.22	2.00	0.50
1/4	(0.2500)	20	1.16	1.09	0.56	0.50	0.17	0.14	0.47	0.44	0.34	0.28	3.00	0.50
5/16	(0.3125)	18	1.44	1.38	0.67	0.61	0.18	0.15	0.55	0.52	0.41	0.34	3.00	0.50
3/8	(0.3750)	16	1.72	1.66	0.80	0.73	0.20	0.17	0.63	0.60	0.47	0.41	4.00	0.50
7/16	(0.4375)	14	2.00	1.94	0.91	0.84	0.21	0.18	0.71	0.68	0.53	0.47	3.00	1.00
1/2	(0.5000)	13	2.31	2.22	1.06	0.94	0.23	0.20	0.79	0.76	0.62	0.50	3.00	1.00
5/8	(0.6250)	11	2.84	2.72	1.31	1.19	0.27	0.23	0.96	0.92	0.75	0.62	2.50	1.00

Dimensions of Type B, Style 2 Wing Screws

Nominal Size or Basic Screw Diameter		Threads per Inch	A		B		C		E		G		L	
			Wing Spread		Wing Height		Wing Thickness		Boss Diameter		Boss Height		Practical Screw Lengths	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
10	(0.1900)	24	1.01	0.95	0.78	0.72	0.14	0.11	0.39	0.36	0.28	0.22	1.25	0.50
1/4	(0.2500)	20	1.22	1.16	0.94	0.88	0.16	0.13	0.47	0.44	0.34	0.28	2.00	0.50
5/16	(0.3125)	18	1.43	1.37	1.09	1.03	0.17	0.14	0.55	0.52	0.41	0.34	2.00	0.50
3/8	(0.3750)	16	1.63	1.57	1.25	1.19	0.18	0.15	0.63	0.60	0.47	0.41	2.00	0.50

DESCRIPTION	PAGE
B7 Studs and Nuts	
Stud Bolts for Pressure-Temperature Piping	2-1
General Purpose End-to-End Studs	2-2
Tap End Stud Bolts	2-3
Double End Stud Bolts	2-4

STUD BOLTS FOR PRESSURE-TEMPERATURE PIPING



Stud bolts for Pressure-Temperature Piping

REFERENCE

Stud bolts for pressure-temperature applications conform to the requirements of ANSI/ASME B16.5, Steel Pipe Flanges and Flanged Fittings.

LENGTH-FIRST TO FIRST

The length of stud bolt, measured parallel to the axis, is the distance from first thread to first thread. First thread is defined as the intersection of the major diameter of the thread with the base of the point. Please see the drawing above-this is confusing to most users!! Stud bolts are normally available in 1/4 in. length increments. Length tolerances, all stud bolt sizes, shall be as tabulated below:

Length, in.	Length Tolerance, in.
to 12	+/-0.062
over 12 to 18	+/-0.125
over 18	+/-0.250

POINTS

Points shall be flat and chamfered, or sheared at option of the manufacturer. When points are flat and chamfered, the diameter of the flat shall not exceed the minor diameter of the thread, and shall be not less than one or more than two complete threads as measured from the extreme end parallel to the axis.

THREADS

Threads shall be Unified inch coarse thread series (UNC), Class 2A, for all stud bolt sizes 1 in. and smaller, and Unified inch 8 thread series (8 UN), Class 2A, for all stud bolts larger than 1 in., in accordance with ANSI/ASME B1.1. Acceptability of screw threads shall be determined based on ANSI/ASME B1.3.

MATERIAL

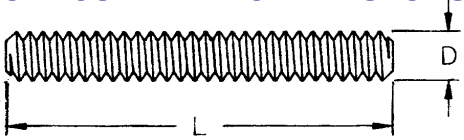
Chemical and mechanical requirements shall be specified by the purchaser and shall be in accordance with applicable ASME, ASTM, and ANSI codes and specifications current at the time of ordering.

DESIGNATION

It is recommended that stud bolts be designated in the following sequence: product name, nominal size, threads per inch, length, material, and protective finish, if required.

Example: ANSI/ASME B16.5 stud bolt,
5/8-11 x 3-1/2, ASTM A193, Grade B7, Zinc & Clear Chromate Plated

GENERAL PURPOSE END-TO-END STUDS



Continuous Thread Studs (General Purpose)

LENGTH

The length of stud, measured parallel to the axis, is the distance from extreme end to extreme end. The tolerance on length shall be tabulated below:

	Tolerance on Length, in.	
Nominal Stud Size in.	**For Lengths 6 in. and Shorter**	**For Lengths Over 6 in.**
To 5/16 over 5/16 to 3/4 over 3/4 to 1-1/4 over 1-1/4	+/-0.03 +/-0.06 +/-0.12 +/-0.25	+/-0.06 +/-0.12 +/-0.19 +/-0.25

POINTS

Both ends of stud bolt shall be pointed. At manufacturer's option, points may be rounded (oval), or sheared at option of the manufacturer, or flat and chamfered. When rounded, the stud shall have an oval point with a radius equal to approximately one times the basic stud diameter. When flat and chamfered, the end shall be chamfered from a diameter not exceeding the minor diameter of the thread to produce a length of chamfer or incomplete thread approximately equivalent to 2 times the thread pitch.

THREADS

Threads shall be Unified inch coarse or fine series (UNC or UNF series), Class 2A, in accordance with ANSI/ASME B1.1 for stud sizes 1 in. and smaller, and Unified coarse or 8 thread series (UNC or 8 UN series) for stud sizes larger than 1 in. Acceptability of screw threads shall be determined based on System 21 of ANSI/ASME B1.3.

MATERIAL

Chemical and mechanical requirements shall be agreed upon by the manufacturer and purchaser. Properties of carbon steel studs are covered in SAE J429, ASTM A307, ASTM A449, and ASTM A354. Properties of several grades of stainless steel are covered in ASTM 593, and of several nonferrous materials in ASTM F468.

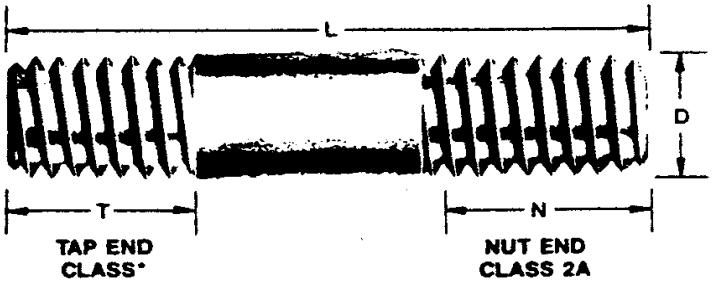
DESIGNATION

To avoid misunderstanding when specifying continuous thread studs, it is recommended that they be designated in the following sequence: product name, nominal size, threads per inch, stud length, material, and protective finish, if required.

Example: Continuous thread stud, 7/8-9 x 8, End-to-End,
ASTM A307, zinc plated

TAP END STUD BOLTS

Dimensions per AWHEM** Standards



D Diameter – Nominal Stud Sizes
L Length – Measured end to end
T For 6B & 6BX studded flange connections with R, RX & BX gaskets, thread length maximum on end = 1 diameter + 1.5 pitch + 1/16-0
N Nut end thread length for 6B & 6BX studded flange connections with R, RX & BX gaskets shall be 2-1/2 diameters of full thread minimum.

* Class of Threads – Tap end threads may be furnished in any class thread specified. Nut end threads shall be American Standard Coarse or Fine series, Class 2A or 8 UN.

When ordering, please specify:
Diameter (D); Length (L); End-to-end dimension. (If length is figured first thread to first thread, order must so specify.)

Tap end thread length (T) and thread series

Nut end thread length (N) and thread series

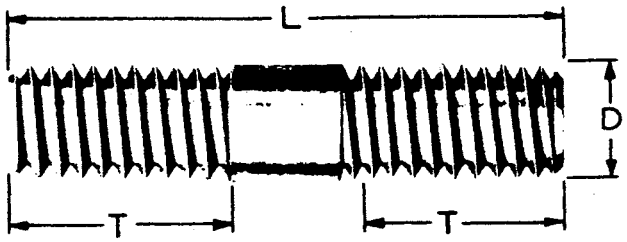
Double End or Tap End Studs are available in either rolled or cut threads. When the threads are rolled, the full thread dimensions will increase slightly, and the diameter of the bodies will be undersized to the pitch diameter of the thread.

Tap End Studs are available in ASTM A193 Grades of material or special materials. Sigma stocks the most frequently used sizes of tap end studs in ASTM A193 Grade B7. Tap end studs can also be plated or coated if allowances are made for coating thickness and thread fit.

Prints should be furnished on Double end or Tap End studs whenever possible.

** American Association of Wellhead Manufacturers

DOUBLE END STUD BOLTS



D Diameter – Nominal Stud Sizes
L Length – Measured end to end
T Thread Lengths – 2 x **D** plus 1/4" thru 6" in length and 2 x **D** plus 1/2" for length over 6", full usable thread

Class of Threads – Threads shall be American Standard Class 2A tolerance for UNC, UNF, or 8 UN thread series.

When ordering, please specify:

Diameter (D); Length (L); End-to-end dimension. (If length is figured first thread to first thread, order must so specify.)

Thread length (T) and thread series

Double End studs are available in cut or rolled threads, and in any grade of material. They may be furnished plain, plated or coated at the customer's request.

Prints should be furnished on Double End or Tap End studs whenever possible.

DESCRIPTION	PAGE
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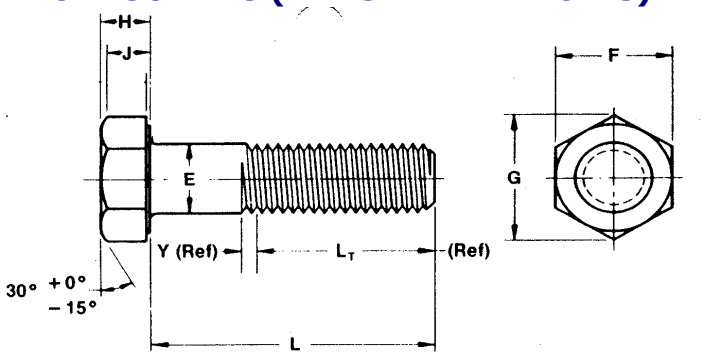
HEX CAP SCREWS (FINISHED HEX BOLTS)



Dimensions of Hex Head Screws

Nominal Size or Basic Product Diameter		E		F			G		H			J	L_T		Y	Runout of Bearing Surface FIM
		Body Diameter		Width Across Flats			Width Across Corners		Height			Wrenching Height	Thread Length for Screw Lengths		Transition Thread Length	
													6 in. & Shorter	Over 6 in.		
		Max	Min	Basic	Max	Min	Max	Min	Basic	Max	Min	Min	Basic	Basic	Max	Max
¼	0.2500	0.2500	0.2450	7/16	0.438	0.428	0.505	0.488	5/32	0.163	0.150	0.106	0.750	1.000	0.250	0.010
5/16	0.3125	0.3125	0.3065	1/2	0.500	0.489	0.577	0.557	13/64	0.211	0.195	0.140	0.875	1.125	0.278	0.011
3/8	0.3750	0.3750	0.3690	9/16	0.562	0.551	0.650	0.628	15/64	0.243	0.226	0.160	1.000	1.250	0.312	0.012
7/16	0.4375	0.4375	0.4305	5/8	0.625	0.612	0.722	0.698	9/32	0.291	0.272	0.195	1.125	1.375	0.357	0.013
½	0.5000	0.5000	0.4930	3/4	0.750	0.736	0.866	0.840	5/16	0.323	0.302	0.215	1.250	1.500	0.385	0.014
9/16	0.5625	0.5625	0.5545	13/16	0.812	0.798	0.938	0.910	23/64	0.371	0.348	0.250	1.375	1.625	0.417	0.015
5/8	0.6250	0.6250	0.6170	15/16	0.938	0.922	1.083	1.051	25/64	0.403	0.378	0.269	1.500	1.750	0.455	0.017
¾	0.7500	0.7500	0.7410	1-1/8	1.125	1.100	1.299	1.254	15/32	0.483	0.455	0.324	1.750	2.000	0.500	0.020
7/8	0.8750	0.8750	0.8660	1-5/16	1.312	1.285	1.516	1.465	35/64	0.563	0.531	0.378	2.000	2.250	0.556	0.023
1	1.0000	1.0000	0.9900	1-1/2	1.500	1.469	1.732	1.675	39/64	0.627	0.591	0.416	2.250	2.500	0.625	0.026
1-1/8	1.1250	1.1250	1.1140	1-11/16	1.688	1.631	1.949	1.859	11/16	0.718	0.658	0.461	2.500	2.750	0.714	0.029
1-1/4	1.2500	1.2500	1.2390	1-7/8	1.875	1.812	2.165	2.066	25/32	0.813	0.749	0.530	2.750	3.000	0.714	0.033
1-3/8	1.3750	1.3750	1.3630	2-1/16	2.062	1.994	2.382	2.273	27/32	0.878	0.810	0.569	3.000	3.250	0.833	0.036
1-1/2	1.5000	1.5000	1.4880	2-1/4	2.250	2.175	2.598	2.480	1-5/16	0.974	0.902	0.640	3.250	3.500	0.833	0.039
1-3/4	1.7500	1.7500	1.7380	2-5/8	2.625	2.538	3.031	2.890	1-3/32	1.134	1.054	0.748	3.750	4.000	1.000	0.046
2	2.0000	2.0000	1.9880	3	3.000	2.900	3.464	3.306	1-7/32	1.263	1.175	0.825	4.250	4.500	1.111	0.052
2-1/4	2.2500	2.2500	2.2380	3-3/8	3.375	3.262	3.897	3.719	1-3/8	1.423	1.327	0.933	4.750	5.000	1.111	0.059
2-1/2	2.5000	2.5000	2.4880	3-3/4	3.750	3.625	4.330	4.133	1-17/32	1.583	1.479	1.042	5.250	5.500	1.250	0.065
2-3/4	2.7500	2.7500	2.7380	4-1/8	4.125	3.988	4.763	4.546	1-11/16	1.744	1.632	1.151	5.750	6.000	1.250	0.072
3	3.00	3.0000	2.9880	4-1/2	4.500	4.350	5.196	4.959	1-7/8	1.935	1.815	1.290	6.250	6.500	1.250	0.079

WRENCH OPENINGS FOR SQUAREAND HEX BOLTS AND SCREWS

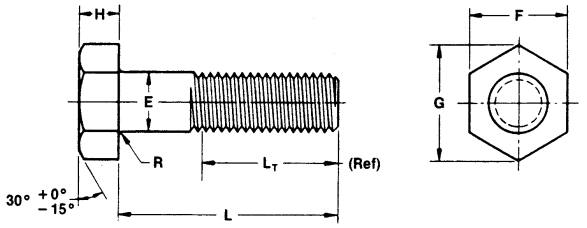
Nominal Size of Wrench (1) also Basic (Maximum) Width Across Flats of Bolt and Screw Heads		Allowance between Bolt or Screw Head and Jaws of Wrench (2)	Wrench Openings			Square Bolts Hex Bolts Hex Cap Screw (Finished Hex Bolt) Lag Screw	Heavy Hex Bolt Heavy Hex Screw Heavy Hex Structural Bolt
			Min	Tol (2)	Max	Nominal Product Sizes	
1/8	0.1250	0.002	0.127	0.005	0.132	...	...
5/32	0.1562	0.002	0.158	0.005	0.163	...	...
3/16	0.1875	0.002	0.190	0.005	0.195	...	...
7/32	0.2188	0.002	0.220	0.005	0.225	...	...
¼	0.2500	0.002	0.252	0.005	0.257	...	...
9/32	0.2812	0.002	0.283	0.005	0.288	No. 10	...
5/16	0.3125	0.003	0.316	0.006	0.322	...	...
11/32	0.3438	0.003	0.347	0.006	0.353	...	...
3/8	0.3750	0.003	0.378	0.006	0.384	1.4 (3)	...
7/16	0.4375	0.003	0.440	0.006	0.446	1/4	...
½	0.5000	0.004	0.504	0.006	0.510	5/16	...
9/16	0.5625	0.004	0.566	0.007	0.573	3/8	...
5/8	0.6250	0.004	0.629	0.007	0.636	7/16	...
11/16	0.6875	0.004	0.692	0.007	0.699	...	...
¾	0.7500	0.005	0.755	0.008	0.763	1/2	...
13/16	0.8125	0.005	0.818	0.008	0.826	9/16	...
7/8	0.8750	0.005	0.880	0.008	0.888	...	½
15/16	0.9375	0.006	0.944	0.009	0.953	5/8	...
1	1.0000	0.006	1.006	0.009	1.015	...	...
1-1/16	1.0625	0.006	1.068	0.009	1.077	...	5/8
1-1/8	1.1250	0.007	1.132	0.010	1.142	3/4	...
1-1/4	1.2500	0.007	1.257	0.010	1.267	...	¾
1-5/16	1.3125	0.008	1.320	0.011	1.331	7/8	...
1-3/8	1.3750	0.008	1.383	0.011	1.394	...	...
1-7/16	1.4375	0.008	1.446	0.011	1.457	...	7/8
1-1/2	1.5000	0.008	1.508	0.012	1.520	1	
1-5/8	1.6250	0.009	1.634	0.012	1.646	...	1
1-11/16	1.6875	0.009	1.696	0.012	1.708	1-1/8	
1-13/16	1.8125	0.010	1.822	0.013	1.835	...	1-1/8
1-7/8	1.8750	0.010	1.885	0.013	1.898	1-1/4	
2	2.0000	0.011	2.011	0.014	2.025	...	1-1/4
2-1/16	2.0625	0.011	2.074	0.014	2.088	1-3/8	
2-3/16	2.1875	0.012	2.200	0.015	2.215	...	1-3/8
2-1/4	2.2500	0.012	2.262	0.015	2.277	1-1/2	

WRENCH OPENINGS FOR SQUARE AND HEX BOLTS AND SCREWS

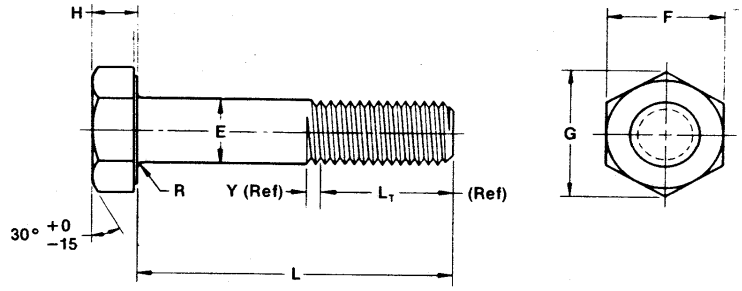
Nominal Size of Wrench (1) also Basic (Maximum) Width Across Flats of Bolt and Screw Heads		Allowance between Bolt or Screw Head and Jaws of Wrench (2)	Wrench Openings			Square Bolts	Heavy Hex Bolt
						Hex Bolts	Heavy Hex Screw
						Hex Cap Screw (Finished Hex Bolt)	Heavy Hex Structural Bolt
						Lag Screw	
			Min	Tol (2)	Max	Nominal Product Sizes	
2-3/8	2.3750	0.013	2.388	0.016	2.404	...	1-1/2
2-7/16	2.4375	0.013	2.450	0.016	2.466	1-5/8	...
2-9/16	2.5625	0.014	2.576	0.017	2.593	...	1-5/8
2-5/8	2.6250	0.014	2.639	0.017	2.656	1-3/4	...
2-3/4	2.7500	0.014	2.766	0.017	2.783	...	1-3/4
2-13/16	2.8125	0.015	2.827	0.018	2.845	1-7/8	...
2-15/16	2.9375	0.016	2.954	0.019	2.973	...	1-7/8
3	3.0000	0.016	3.016	0.019	3.035	2	...
3-1/8	3.1250	0.017	3.142	0.020	3.162	...	2
3-3/8	3.3750	0.018	3.393	0.021	3.414	2-1/4	...
3-1/2	3.5000	0.019	3.518	0.022	3.540	...	2-1/4
3-3/4	3.7500	0.020	3.770	0.023	3.793	2-1/2	...
3-7/8	3.8750	0.020	3.895	0.023	3.918	...	2-1/2
4-1/8	4.1250	0.022	4.147	0.025	4.172	2-3/4	...
4-1/4	4.2500	0.022	4.272	0.025	4.297	...	2-3/4
4-1/2	4.5000	0.024	4.524	0.026	4.550	3	...
4-5/8	4.6250	0.024	4.649	0.027	4.676	...	3
4-7/8	4.8750	0.025	4.900	0.028	4.928	3-1/4	...
5	5.0000	0.026	5.026	0.029	5.055	...	...
5-1/4	5.2500	0.027	5.277	0.030	5.307	3-1/2	...
5-3/8	5.3750	0.028	5.403	0.031	5.434	...	...
5-5/8	5.6250	0.029	5.654	0.032	5.686	3-3/4	...
5-3/4	5.7500	0.030	5.780	0.033	5.813	...	...
6	6.0000	0.031	6.031	0.034	6.065	4	...
6-1/8	6.1250	0.032	6.157	0.035	6.192	...	...

HEAVY HEX BOLTS

Dimensions of Heavy Hex Bolts



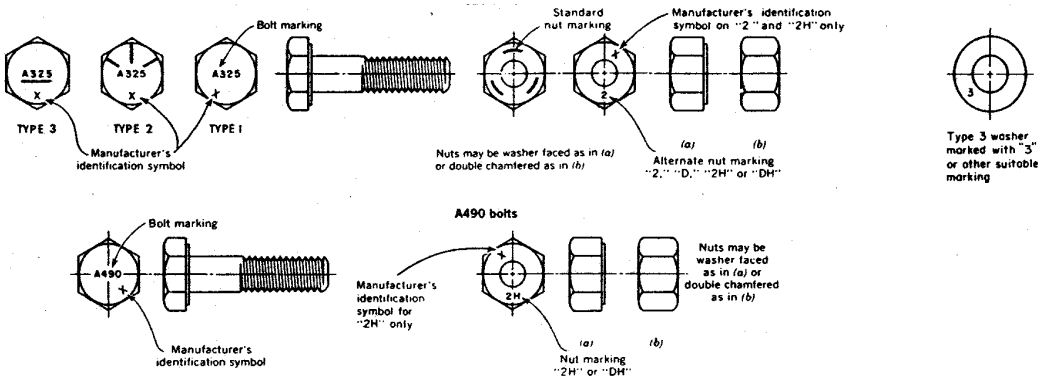
Nominal Size or Basic Product Diameter	E	F			G		H			R		L_T		
	Body Dia	Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length for Bolt Lengths		
												6 in. & Shorter		Over 6 in.
	Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic		Basic
1/2	0.5000	0.515	7/8	0.875	0.850	1.010	0.969	11/32	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	1-1/16	1.062	1.031	1.227	1.175	27/64	.0444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1-1/4	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	1-7/16	1.438	1.394	1.660	1.589	37/64	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	1.022	1-5/8	1.625	1.575	1.876	1.796	43/64	0.700	0.591	0.09	0.03	2.250	2.500
1-1/8	1.1250	1.149	1-13/16	1.812	1.756	2.093	2.002	3/4	0.780	0.658	0.09	0.03	2.500	2.750
1-1/4	1.2500	1.277	2	2.000	1.938	2.309	2.209	27/32	0.876	0.749	0.09	0.03	2.750	3.000
1-3/8	1.3750	1.404	2-3/16	2.188	2.119	2.526	2.416	29/32	0.940	0.810	0.09	0.03	3.000	3.250
1-1/2	1.5000	1.531	2-3/8	2.375	2.300	2.742	2.622	1	1.036	0.902	0.09	0.03	3.250	3.500
1-3/4	1.7500	1.785	2-3/4	2.750	2.662	3.175	3.035	1-5/32	1.196	1.054	0.12	0.04	3.750	4.000
2	2.0000	2.039	3-1/8	3.125	3.025	3.608	3.449	1-11/32	1.388	1.175	0.12	0.04	4.250	4.500
2-1/4	2.2500	2.305	3-1/2	3.500	3.388	4.041	3.862	1-1/2	1.548	1.327	0.19	0.06	4.750	5.000
2-1/2	2.5000	2.559	3-7/8	3.875	3.750	4.474	4.275	1-21/32	1.708	1.479	0.19	0.06	5.250	5.500
2-3/4	2.7500	2.827	4-1/4	4.250	4.112	4.907	4.688	1-13/16	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	3.081	4-5/8	4.625	4.475	5.340	5.102	2	2.060	1.815	0.19	0.06	6.250	6.500
3-1/4	3.2500	--	5	--	--	5-11/16	--	2-5/32	--	--	--	--	--	7.000
3-1/2	3.5000	--	5-3/8	--	--	6-1/8	--	2-5/16	--	--	--	--	--	7.500
3-3/4	3.7500	--	5-3/4	--	--	6-35/64	--	2-15/32	--	--	--	--	--	8.000
4	4.0000	--	6-1/8	--	--	6-63/64	--	2-11/16	--	--	--	--	--	8.500



HIGH STRENGTH STRUCTURAL BOLTS

Dimensions of Heavy Hex Structural Bolts

Nominal Size or Basic Product Diameter		E		F			G		H			R		L_T	Y	Runout of Bearing Surface FIM
		Body Diameter		Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length	Transi-tion Thread Length	
		Max	Min	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Max	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	0.016
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	0.019
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	0.062	0.021	1.38	0.25	0.022
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	0.062	0.031	1.50	0.28	0.025
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	0.028
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	0.093	0.062	2.00	0.34	0.032
1-1/4	1.2500	1.277	1.223	2	2.000	1.938	2.309	2.209	25/32	0.813	0.749	0.093	0.062	2.00	0.38	0.035
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	0.093	0.062	2.25	0.44	0.038
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	0.093	0.062	2.25	0.44	0.041



HIGH-STRENGTH STRUCTURAL BOLTING, Washer Dimensions and Bolt Strengths

Dimensions[1] of Washers for High Strength Bolts

Bolt Size D	Flat Circular Washers				Square or Rectangular Beveled Washers for American Standard Beams and Channels		
	Nominal Outside Diameter[2]	Nominal Diameter of Hole	Thickness		Minimum Side Dimension	Mean Thickness	Slope or Taper in Thickness
			Min	Max			
½	1-1/16	17/32	0.097	0.177	1-3/4	5/16	1:6
5/8	1-5/16	21/32	0.122	0.177	1-3/4	5/16	1:6
¾	1-15/32	13/16	0.122	0.177	1-3/4	5/16	1:6
7/8	1-3/4	15/16	0.136	0.177	1-3/4	5/16	1:6
1	2	1-1/16	0.136	0.177	1-3/4	5/16	1:6
1-1/8	2-1/4	1-1/4	0.136	0.177	2-1/4	5/16	1:6
1-1/4	2-1/2	1-3/8	0.136	0.177	2-1/4	5/16	1:6
1-3/8	2-3/4	1-1/2	0.136	0.177	2-1/4	5/16	1:6
1-1/2	3	1-5/8	0.136	0.177	2-1/4	5/16	1:6
1-3/4	3-3/8	1-7/8	0.178*	0.28*	--	--	--
2	3-3/4	2-1/8	0.178	0.28	--	--	--
Over 2 to 4 incl.	2D-1/2	D+1/8	0.24**	0.34**	--	--	--

NOTES:
1. All dimensions are in inches.
2. May be exceeded by 1/4 in.
3. *3/16 in. nominal
4. **1/4 in. nominal – Washers shall be flat within 0.030 in. There shall be no projection exceeding .030 inches above the flat of either face of the washer.

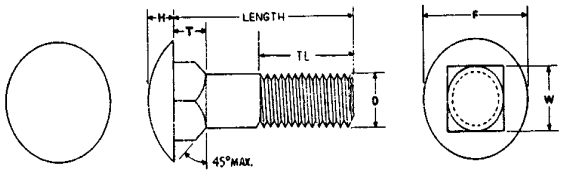
Strength Properties of High Strength Structural Bolts and Nuts

Nominal Bolt/Nut Size, Thrds per Inch and Thread Series		A325 Bolts		A490 Bolts		A325 Nuts	A194 Grade 2H Nuts
		Proof[1] Load lb	Tensile[2] Strength Min lb	Proof[1] Load Lb	Tensile[2] Strength Min lb	Proof[3] Load lb	Proof[3] Load Lb
½	13 UNC	12,050	17,050	17,050	21,300	20,450	24,850
5/8	11 UNC	19,200	27,100	27,100	33,900	32,550	39,550
¾	10 UNC	28,400	40,100	40,100	50,100	48,100	58,450
7/8	9 UNC	39,250	55,450	55,450	69,300	66,550	80,850
1	8 UNC	51,500	72,700	72,700	90,900	87,250	106,000
1-1/8	7 UNC	56,450	80,100	91,550	114,450	109,900	133,500
1-1/8	8 UN	58,450	82,950	94,800	118,500	113,800	138,200
1-1/4	7 UNC	71,700	101,700	116,300	145,350	139,500	169,600
1-1/4	8 UN	74,000	105,000	120,000	150,000	144,000	175,000
1-3/8	6 UNC	85,450	121,300	138,600	173,250	166,300	202,100
1-3/8	8 UN	91,250	129,500	148,000	185,000	177,600	215,800
1-1/2	6 UNC	104,000	147,500	168,600	210,750	202,300	245,900
1-1/2	8 UN	110,400	156,700	175,050	223,800	214,800	261,100

NOTES:
1. Proof load of bolt is the load the bolt must support in axial tension without permanent deformation.
2. Tensile strength of bolt is the minimum load the bolt must support in axial tension without failure of the bolt.
3. Proof load of nut is the load the nut must support axially without evidence of thread stripping or rupture.

DIMENSIONAL DATA

CARRIAGE BOLTS



BASIC SIZE	Threads per inch UNC	Body Dia (D)	Diameter of Head (F)		Height of Head (H)		Depth of Square (T)		Width of Square (W)	
		Max	Min	Max	Min	Max	Min	Max	Min	Max
#10	24	.199	.438	.469	.094	.114	.094	.125	.185	.199
¼"	20	.260	.563	.594	.125	.145	.125	.156	.245	.260
5/16"	18	.324	.688	.719	.156	.176	.156	.187	.307	.324
3/8"	16	.388	.782	.844	.188	.208	.188	.219	.368	.388
7/16"	14	.452	.907	.969	.219	.239	.219	.250	.431	.452
½"	13	.515	1.032	1.094	.250	.270	.250	.281	.492	.515
5/8"	11	.642	1.219	1.344	.313	.344	.313	.344	.616	.642
¾"	10	.768	1.469	1.594	.375	.406	.375	.406	.741	.768

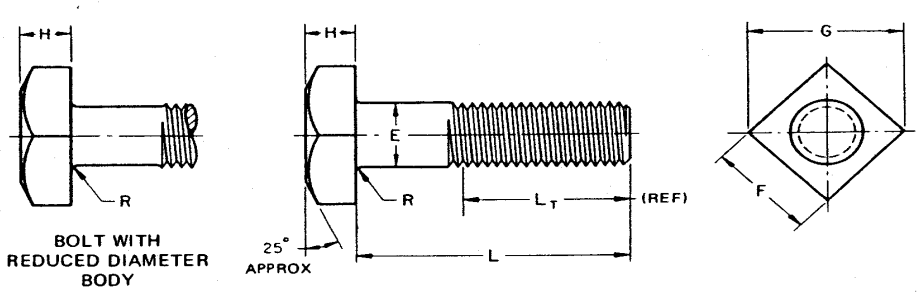
THREAD LENGTH (TL) = 2D+1/4" up to and including 6" in length. Carriage bolts too short for this formula shall be threaded as close to the head as practicable. For longer than 6", formula is TL = 2D+1/2". Threads to Class 2A Tolerance.

LAG BOLTS

Basic Size (D)	Threads per Inch	Thread Dimensions				Width Across Flats (F)		Height (H)	
		Pitch (P)	Flat at Root (B)	Depth of Thread (T)	Root Dia (R)	Min	Max	Min	Max
¼″	10	.100	.043	.039	.173	.362	.3750	.156	.188
5/16″	9	.111	.048	.043	.227	.484	.5000	.186	.220
3/8″	7	.143	.062	.055	.265	.544	.5625	.232	.268
7/16″	7	.143	.062	.055	.328	.603	.625	.278	.316
½″	6	.167	.072	.064	.371	.725	.7500	.308	.348
5/8″	5	.200	.086	.077	.471	.096	.9375	.400	.444
¾″	4-1/2	.222	.096	.085	.579	1.088	1.1250	.476	.524

THREAD LENGTH (TL) = 1/2 Length (L)+1/2". Lag screws too short for this formula shall be threaded as close to the head as practical.

SQUARE BOLTS

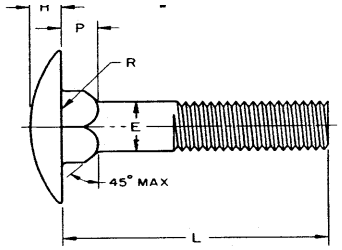


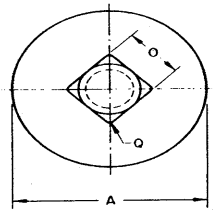
Dimensions of Square Bolts

Nominal Size or Basic Bolt Diameter		E	F			G		H			R		L_T (Ref)	
		Body Dia	Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length	
													For Bolt Lgths ≤ 6 in.	For Bolt Lgths ≥ 6 in.
		Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Basic
1/4	0.2500	0.260	3/8	0.375	0.362	0.530	0.498	11/64	0.188	0.156	0.03	0.01	0.750	1.000
5/16	0.3125	0.324	1/2	0.500	0.484	0.707	0.665	13/64	0.220	0.186	0.03	0.01	0.875	1.125
3/8	0.3750	0.388	9/16	0.562	0.544	0.795	0.747	1/4	0.268	0.232	0.03	0.01	1.000	1.250
7/16	0.4375	0.452	5/8	0.625	0.603	0.884	0.828	19/64	0.316	0.278	0.03	0.01	1.125	1.375
1/2	0.5000	0.515	3/4	0.750	0.725	1.061	0.995	21/64	0.348	0.308	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	15/16	0.938	0.906	1.326	1.244	27/64	0.444	0.400	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1-1/8	1.125	1.088	1.591	1.494	1/2	0.524	0.476	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	1-5/16	1.312	1.269	1.856	1.742	19/32	0.620	0.568	0.06	0.02	2.000	2.250
1	1.0000	1.022	1-1/2	1.500	1.450	2.121	1.991	21/32	0.684	0.628	0.09	0.03	2.250	2.500
1-1/8	1.1250	1.149	1-11/16	1.688	1.631	2.386	2.239	3/4	0.780	0.720	0.09	0.03	2.500	2.750
1-1/4	1.2500	1.277	1-7/8	1.875	1.812	2.652	2.489	27/32	0.876	0.812	0.09	0.03	2.750	3.000
1-3/8	1.3750	1.404	2-1/16	2.062	1.994	2.917	2.738	29/32	0.940	0.872	0.09	0.03	3.000	3.250
1-1/2	1.5000	1.531	2-1/4	2.250	2.175	3.182	2.986	1	1.036	0.964	0.09	0.03	3.250	3.500

NOTE: Square bolts are not regularly available and have been replaced by Finished Hex Head bolts.

STEP BOLT AND FLAT COUNTERSUNK HEAD ELEVATOR BOLTS

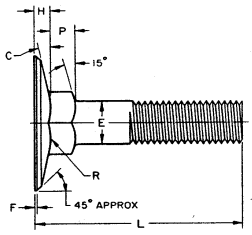


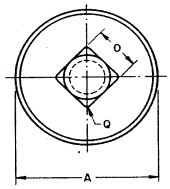


Step Bolts

Nominal Size[1] or Basic Bolt Diameter		E		A		H		O		P		Q	R
		Body Diameter		Head Diameter		Head Height		Square Width		Square Depth		Corner Radius on Square	Fillet Radius
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
#10	0.1900	0.199	0.182	0.656	0.625	0.114	0.094	0.199	0.185	0.125	0.094	0.031	0.031
¼	0.2500	0.260	0.237	0.844	0.813	0.145	0.125	0.260	0.245	0.156	0.125	0.031	0.031
5/16	0.3125	0.324	0.298	1.031	1.000	0.176	0.156	0.324	0.307	0.187	0.156	0.031	0.031
3/8	0.3750	0.388	0.360	1.219	1.188	0.208	0.188	0.388	0.368	0.219	0.188	0.047	0.031
7/16	0.4375	0.452	0.421	1.406	1.375	0.239	0.219	0.452	0.431	0.250	0.219	0.047	0.031
½	0.5000	0.515	0.483	1.594	1.563	0.270	0.250	0.515	0.492	0.281	0.250	0.047	0.031

Flat Countersunk Head Elevator Bolts





Nominal Size[1] or Basic Bolt Diameter		E		A			C	F	H		O		P		Q	R
		Body Diameter		Head Diameter			Head Angle	Flat on Min Dia Head	Head Height		Square Width		Square Depth		Corner Radius on Square	Fillet Radius
		Max	Min	Max Edge Sharp	Min Edge Sharp	Min Edge Flat	Ref	Max	Max	Min	Max	Min	Max	Min	Max	Min
#10	0.1900	0.199	0.182	0.790	0.750	0.740	9°	0.025	0.082	0.062	0.210	0.185	0.125	0.094	0.031	0.031
1/4	0.2500	0.260	0.237	1.008	0.969	0.938	9°	0.035	0.098	0.078	0.280	0.245	0.219	0.188	0.031	0.031
5/16	0.3125	0.324	0.298	1.227	1.188	1.157	9°	0.035	0.114	0.094	0.342	0.307	0.250	0.219	0.031	0.031
3/8	0.3750	0.388	0.360	1.352	1.312	1.272	11°	0.040	0.145	0.125	0.405	0.368	0.250	0.219	0.047	0.031
7/16	0.4375	0.452	0.421	1.477	1.438	1.397	13°	0.040	0.176	0.156	0.468	0.431	0.281	0.250	0.047	0.031
1/2	0.5000	0.515	0.483	1.607	1.562	1.522	12°	0.040	0.176	0.156	0.530	0.492	0.281	0.250	0.047	0.031

NOTES: 1. Where specifying nominal size in decimals, zeros preceding decimal and in the fourth decimal place shall be omitted.

DESCRIPTION	PAGE
Hex Cap Screws (Finished Hex Bolts)	3-1
Wrench Openings for Square and Hex Bolts and Screws	3-2 to 3-3
Heavy Hex Bolts	3-4
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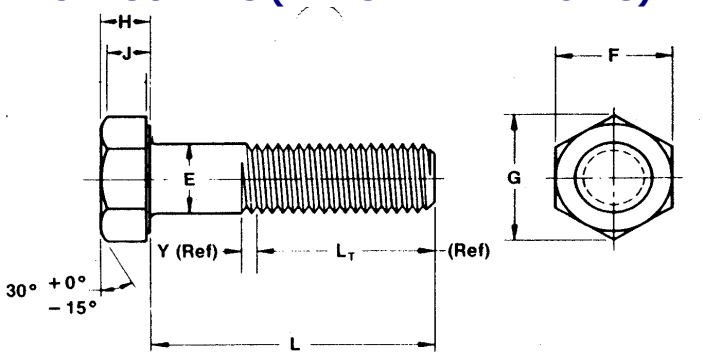
HEX CAP SCREWS (FINISHED HEX BOLTS)



Dimensions of Hex Head Screws

Nominal Size or Basic Product Diameter		E		F			G		H			J	L_T		Y	Runout of Bearing Surface FIM
		Body Diameter		Width Across Flats			Width Across Corners		Height			Wrenching Height	Thread Length for Screw Lengths		Transition Thread Length	
													6 in. & Shorter	Over 6 in.		
		Max	Min	Basic	Max	Min	Max	Min	Basic	Max	Min	Min	Basic	Basic	Max	Max
¼	0.2500	0.2500	0.2450	7/16	0.438	0.428	0.505	0.488	5/32	0.163	0.150	0.106	0.750	1.000	0.250	0.010
5/16	0.3125	0.3125	0.3065	1/2	0.500	0.489	0.577	0.557	13/64	0.211	0.195	0.140	0.875	1.125	0.278	0.011
3/8	0.3750	0.3750	0.3690	9/16	0.562	0.551	0.650	0.628	15/64	0.243	0.226	0.160	1.000	1.250	0.312	0.012
7/16	0.4375	0.4375	0.4305	5/8	0.625	0.612	0.722	0.698	9/32	0.291	0.272	0.195	1.125	1.375	0.357	0.013
½	0.5000	0.5000	0.4930	3/4	0.750	0.736	0.866	0.840	5/16	0.323	0.302	0.215	1.250	1.500	0.385	0.014
9/16	0.5625	0.5625	0.5545	13/16	0.812	0.798	0.938	0.910	23/64	0.371	0.348	0.250	1.375	1.625	0.417	0.015
5/8	0.6250	0.6250	0.6170	15/16	0.938	0.922	1.083	1.051	25/64	0.403	0.378	0.269	1.500	1.750	0.455	0.017
¾	0.7500	0.7500	0.7410	1-1/8	1.125	1.100	1.299	1.254	15/32	0.483	0.455	0.324	1.750	2.000	0.500	0.020
7/8	0.8750	0.8750	0.8660	1-5/16	1.312	1.285	1.516	1.465	35/64	0.563	0.531	0.378	2.000	2.250	0.556	0.023
1	1.0000	1.0000	0.9900	1-1/2	1.500	1.469	1.732	1.675	39/64	0.627	0.591	0.416	2.250	2.500	0.625	0.026
1-1/8	1.1250	1.1250	1.1140	1-11/16	1.688	1.631	1.949	1.859	11/16	0.718	0.658	0.461	2.500	2.750	0.714	0.029
1-1/4	1.2500	1.2500	1.2390	1-7/8	1.875	1.812	2.165	2.066	25/32	0.813	0.749	0.530	2.750	3.000	0.714	0.033
1-3/8	1.3750	1.3750	1.3630	2-1/16	2.062	1.994	2.382	2.273	27/32	0.878	0.810	0.569	3.000	3.250	0.833	0.036
1-1/2	1.5000	1.5000	1.4880	2-1/4	2.250	2.175	2.598	2.480	1-5/16	0.974	0.902	0.640	3.250	3.500	0.833	0.039
1-3/4	1.7500	1.7500	1.7380	2-5/8	2.625	2.538	3.031	2.890	1-3/32	1.134	1.054	0.748	3.750	4.000	1.000	0.046
2	2.0000	2.0000	1.9880	3	3.000	2.900	3.464	3.306	1-7/32	1.263	1.175	0.825	4.250	4.500	1.111	0.052
2-1/4	2.2500	2.2500	2.2380	3-3/8	3.375	3.262	3.897	3.719	1-3/8	1.423	1.327	0.933	4.750	5.000	1.111	0.059
2-1/2	2.5000	2.5000	2.4880	3-3/4	3.750	3.625	4.330	4.133	1-17/32	1.583	1.479	1.042	5.250	5.500	1.250	0.065
2-3/4	2.7500	2.7500	2.7380	4-1/8	4.125	3.988	4.763	4.546	1-11/16	1.744	1.632	1.151	5.750	6.000	1.250	0.072
3	3.00	3.0000	2.9880	4-1/2	4.500	4.350	5.196	4.959	1-7/8	1.935	1.815	1.290	6.250	6.500	1.250	0.079

WRENCH OPENINGS FOR SQUAREAND HEX BOLTS AND SCREWS

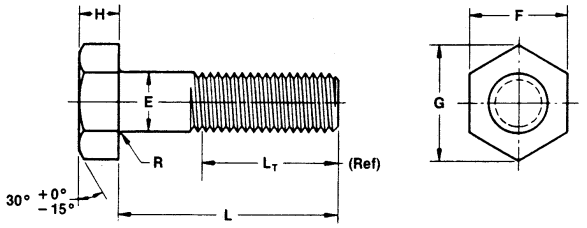
Nominal Size of Wrench (1) also Basic (Maximum) Width Across Flats of Bolt and Screw Heads		Allowance between Bolt or Screw Head and Jaws of Wrench (2)	Wrench Openings			Square Bolts Hex Bolts Hex Cap Screw (Finished Hex Bolt) Lag Screw	Heavy Hex Bolt Heavy Hex Screw Heavy Hex Structural Bolt
			Min	Tol (2)	Max	Nominal Product Sizes	
1/8	0.1250	0.002	0.127	0.005	0.132	...	...
5/32	0.1562	0.002	0.158	0.005	0.163	...	...
3/16	0.1875	0.002	0.190	0.005	0.195	...	...
7/32	0.2188	0.002	0.220	0.005	0.225	...	...
¼	0.2500	0.002	0.252	0.005	0.257	...	...
9/32	0.2812	0.002	0.283	0.005	0.288	No. 10	...
5/16	0.3125	0.003	0.316	0.006	0.322	...	...
11/32	0.3438	0.003	0.347	0.006	0.353	...	...
3/8	0.3750	0.003	0.378	0.006	0.384	1.4 (3)	...
7/16	0.4375	0.003	0.440	0.006	0.446	1/4	...
½	0.5000	0.004	0.504	0.006	0.510	5/16	...
9/16	0.5625	0.004	0.566	0.007	0.573	3/8	...
5/8	0.6250	0.004	0.629	0.007	0.636	7/16	...
11/16	0.6875	0.004	0.692	0.007	0.699	...	...
¾	0.7500	0.005	0.755	0.008	0.763	1/2	...
13/16	0.8125	0.005	0.818	0.008	0.826	9/16	...
7/8	0.8750	0.005	0.880	0.008	0.888	...	½
15/16	0.9375	0.006	0.944	0.009	0.953	5/8	...
1	1.0000	0.006	1.006	0.009	1.015	...	...
1-1/16	1.0625	0.006	1.068	0.009	1.077	...	5/8
1-1/8	1.1250	0.007	1.132	0.010	1.142	3/4	...
1-1/4	1.2500	0.007	1.257	0.010	1.267	...	¾
1-5/16	1.3125	0.008	1.320	0.011	1.331	7/8	...
1-3/8	1.3750	0.008	1.383	0.011	1.394	...	...
1-7/16	1.4375	0.008	1.446	0.011	1.457	...	7/8
1-1/2	1.5000	0.008	1.508	0.012	1.520	1	
1-5/8	1.6250	0.009	1.634	0.012	1.646	...	1
1-11/16	1.6875	0.009	1.696	0.012	1.708	1-1/8	
1-13/16	1.8125	0.010	1.822	0.013	1.835	...	1-1/8
1-7/8	1.8750	0.010	1.885	0.013	1.898	1-1/4	
2	2.0000	0.011	2.011	0.014	2.025	...	1-1/4
2-1/16	2.0625	0.011	2.074	0.014	2.088	1-3/8	
2-3/16	2.1875	0.012	2.200	0.015	2.215	...	1-3/8
2-1/4	2.2500	0.012	2.262	0.015	2.277	1-1/2	

WRENCH OPENINGS FOR SQUARE AND HEX BOLTS AND SCREWS

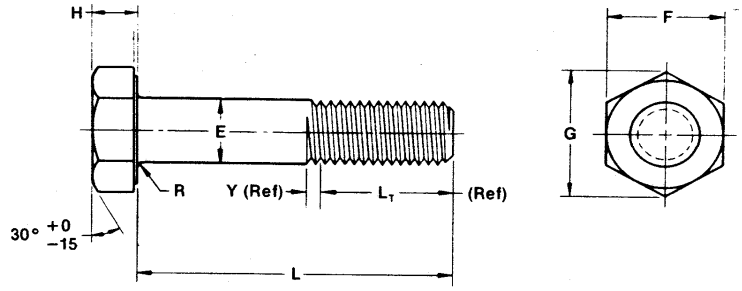
Nominal Size of Wrench (1) also Basic (Maximum) Width Across Flats of Bolt and Screw Heads		Allowance between Bolt or Screw Head and Jaws of Wrench (2)	Wrench Openings			Square Bolts	Heavy Hex Bolt
						Hex Bolts	Heavy Hex Screw
						Hex Cap Screw (Finished Hex Bolt)	Heavy Hex Structural Bolt
						Lag Screw	
			Min	Tol (2)	Max	Nominal Product Sizes	
2-3/8	2.3750	0.013	2.388	0.016	2.404	...	1-1/2
2-7/16	2.4375	0.013	2.450	0.016	2.466	1-5/8	...
2-9/16	2.5625	0.014	2.576	0.017	2.593	...	1-5/8
2-5/8	2.6250	0.014	2.639	0.017	2.656	1-3/4	...
2-3/4	2.7500	0.014	2.766	0.017	2.783	...	1-3/4
2-13/16	2.8125	0.015	2.827	0.018	2.845	1-7/8	...
2-15/16	2.9375	0.016	2.954	0.019	2.973	...	1-7/8
3	3.0000	0.016	3.016	0.019	3.035	2	...
3-1/8	3.1250	0.017	3.142	0.020	3.162	...	2
3-3/8	3.3750	0.018	3.393	0.021	3.414	2-1/4	...
3-1/2	3.5000	0.019	3.518	0.022	3.540	...	2-1/4
3-3/4	3.7500	0.020	3.770	0.023	3.793	2-1/2	...
3-7/8	3.8750	0.020	3.895	0.023	3.918	...	2-1/2
4-1/8	4.1250	0.022	4.147	0.025	4.172	2-3/4	...
4-1/4	4.2500	0.022	4.272	0.025	4.297	...	2-3/4
4-1/2	4.5000	0.024	4.524	0.026	4.550	3	...
4-5/8	4.6250	0.024	4.649	0.027	4.676	...	3
4-7/8	4.8750	0.025	4.900	0.028	4.928	3-1/4	...
5	5.0000	0.026	5.026	0.029	5.055	...	...
5-1/4	5.2500	0.027	5.277	0.030	5.307	3-1/2	...
5-3/8	5.3750	0.028	5.403	0.031	5.434	...	...
5-5/8	5.6250	0.029	5.654	0.032	5.686	3-3/4	...
5-3/4	5.7500	0.030	5.780	0.033	5.813	...	...
6	6.0000	0.031	6.031	0.034	6.065	4	...
6-1/8	6.1250	0.032	6.157	0.035	6.192	...	...

HEAVY HEX BOLTS

Dimensions of Heavy Hex Bolts



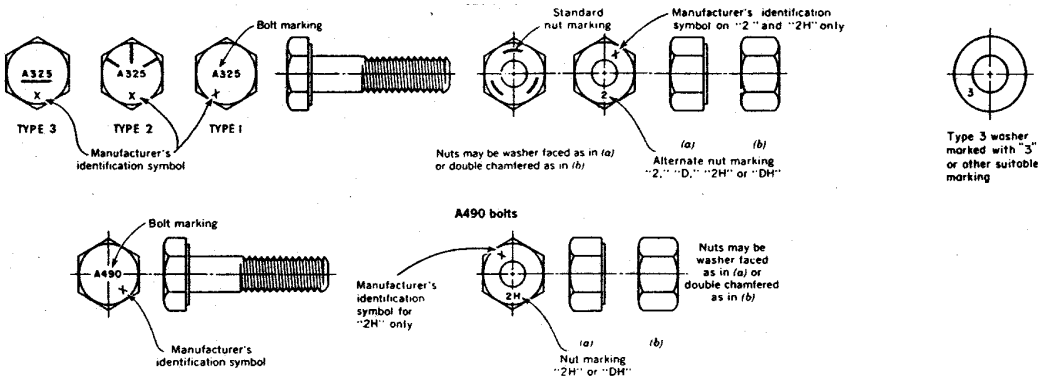
Nominal Size or Basic Product Diameter	E	F			G		H			R		L_T		
	Body Dia	Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length for Bolt Lengths		
												6 in. & Shorter		Over 6 in.
	Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic		Basic
1/2	0.5000	0.515	7/8	0.875	0.850	1.010	0.969	11/32	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	1-1/16	1.062	1.031	1.227	1.175	27/64	.0444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1-1/4	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	1-7/16	1.438	1.394	1.660	1.589	37/64	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	1.022	1-5/8	1.625	1.575	1.876	1.796	43/64	0.700	0.591	0.09	0.03	2.250	2.500
1-1/8	1.1250	1.149	1-13/16	1.812	1.756	2.093	2.002	3/4	0.780	0.658	0.09	0.03	2.500	2.750
1-1/4	1.2500	1.277	2	2.000	1.938	2.309	2.209	27/32	0.876	0.749	0.09	0.03	2.750	3.000
1-3/8	1.3750	1.404	2-3/16	2.188	2.119	2.526	2.416	29/32	0.940	0.810	0.09	0.03	3.000	3.250
1-1/2	1.5000	1.531	2-3/8	2.375	2.300	2.742	2.622	1	1.036	0.902	0.09	0.03	3.250	3.500
1-3/4	1.7500	1.785	2-3/4	2.750	2.662	3.175	3.035	1-5/32	1.196	1.054	0.12	0.04	3.750	4.000
2	2.0000	2.039	3-1/8	3.125	3.025	3.608	3.449	1-11/32	1.388	1.175	0.12	0.04	4.250	4.500
2-1/4	2.2500	2.305	3-1/2	3.500	3.388	4.041	3.862	1-1/2	1.548	1.327	0.19	0.06	4.750	5.000
2-1/2	2.5000	2.559	3-7/8	3.875	3.750	4.474	4.275	1-21/32	1.708	1.479	0.19	0.06	5.250	5.500
2-3/4	2.7500	2.827	4-1/4	4.250	4.112	4.907	4.688	1-13/16	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	3.081	4-5/8	4.625	4.475	5.340	5.102	2	2.060	1.815	0.19	0.06	6.250	6.500
3-1/4	3.2500	--	5	--	--	5-11/16	--	2-5/32	--	--	--	--	--	7.000
3-1/2	3.5000	--	5-3/8	--	--	6-1/8	--	2-5/16	--	--	--	--	--	7.500
3-3/4	3.7500	--	5-3/4	--	--	6-35/64	--	2-15/32	--	--	--	--	--	8.000
4	4.0000	--	6-1/8	--	--	6-63/64	--	2-11/16	--	--	--	--	--	8.500



HIGH STRENGTH STRUCTURAL BOLTS

Dimensions of Heavy Hex Structural Bolts

Nominal Size or Basic Product Diameter		E		F			G		H			R		L_T	Y	Runout of Bearing Surface FIM
		Body Diameter		Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length	Transi-tion Thread Length	
		Max	Min	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Max	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	0.016
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	0.019
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	0.062	0.021	1.38	0.25	0.022
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	0.062	0.031	1.50	0.28	0.025
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	0.028
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	0.093	0.062	2.00	0.34	0.032
1-1/4	1.2500	1.277	1.223	2	2.000	1.938	2.309	2.209	25/32	0.813	0.749	0.093	0.062	2.00	0.38	0.035
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	0.093	0.062	2.25	0.44	0.038
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	0.093	0.062	2.25	0.44	0.041



HIGH-STRENGTH STRUCTURAL BOLTING, Washer Dimensions and Bolt Strengths

Dimensions[1] of Washers for High Strength Bolts

Bolt Size D	Flat Circular Washers				Square or Rectangular Beveled Washers for American Standard Beams and Channels		
	Nominal Outside Diameter[2]	Nominal Diameter of Hole	Thickness		Minimum Side Dimension	Mean Thickness	Slope or Taper in Thickness
			Min	Max			
½	1-1/16	17/32	0.097	0.177	1-3/4	5/16	1:6
5/8	1-5/16	21/32	0.122	0.177	1-3/4	5/16	1:6
¾	1-15/32	13/16	0.122	0.177	1-3/4	5/16	1:6
7/8	1-3/4	15/16	0.136	0.177	1-3/4	5/16	1:6
1	2	1-1/16	0.136	0.177	1-3/4	5/16	1:6
1-1/8	2-1/4	1-1/4	0.136	0.177	2-1/4	5/16	1:6
1-1/4	2-1/2	1-3/8	0.136	0.177	2-1/4	5/16	1:6
1-3/8	2-3/4	1-1/2	0.136	0.177	2-1/4	5/16	1:6
1-1/2	3	1-5/8	0.136	0.177	2-1/4	5/16	1:6
1-3/4	3-3/8	1-7/8	0.178*	0.28*	--	--	--
2	3-3/4	2-1/8	0.178	0.28	--	--	--
Over 2 to 4 incl.	2D-1/2	D+1/8	0.24**	0.34**	--	--	--

NOTES:
1. All dimensions are in inches.
2. May be exceeded by 1/4 in.
3. *3/16 in. nominal
4. **1/4 in. nominal – Washers shall be flat within 0.030 in. There shall be no projection exceeding .030 inches above the flat of either face of the washer.

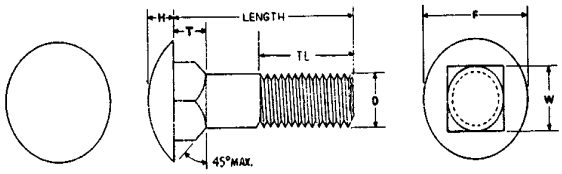
Strength Properties of High Strength Structural Bolts and Nuts

Nominal Bolt/Nut Size, Thrds per Inch and Thread Series		A325 Bolts		A490 Bolts		A325 Nuts	A194 Grade 2H Nuts
		Proof[1] Load lb	Tensile[2] Strength Min lb	Proof[1] Load Lb	Tensile[2] Strength Min lb	Proof[3] Load lb	Proof[3] Load Lb
½	13 UNC	12,050	17,050	17,050	21,300	20,450	24,850
5/8	11 UNC	19,200	27,100	27,100	33,900	32,550	39,550
¾	10 UNC	28,400	40,100	40,100	50,100	48,100	58,450
7/8	9 UNC	39,250	55,450	55,450	69,300	66,550	80,850
1	8 UNC	51,500	72,700	72,700	90,900	87,250	106,000
1-1/8	7 UNC	56,450	80,100	91,550	114,450	109,900	133,500
1-1/8	8 UN	58,450	82,950	94,800	118,500	113,800	138,200
1-1/4	7 UNC	71,700	101,700	116,300	145,350	139,500	169,600
1-1/4	8 UN	74,000	105,000	120,000	150,000	144,000	175,000
1-3/8	6 UNC	85,450	121,300	138,600	173,250	166,300	202,100
1-3/8	8 UN	91,250	129,500	148,000	185,000	177,600	215,800
1-1/2	6 UNC	104,000	147,500	168,600	210,750	202,300	245,900
1-1/2	8 UN	110,400	156,700	175,050	223,800	214,800	261,100

NOTES:
1. Proof load of bolt is the load the bolt must support in axial tension without permanent deformation.
2. Tensile strength of bolt is the minimum load the bolt must support in axial tension without failure of the bolt.
3. Proof load of nut is the load the nut must support axially without evidence of thread stripping or rupture.

DIMENSIONAL DATA

CARRIAGE BOLTS



BASIC SIZE	Threads per inch UNC	Body Dia (D)	Diameter of Head (F)		Height of Head (H)		Depth of Square (T)		Width of Square (W)	
		Max	Min	Max	Min	Max	Min	Max	Min	Max
#10	24	.199	.438	.469	.094	.114	.094	.125	.185	.199
¼"	20	.260	.563	.594	.125	.145	.125	.156	.245	.260
5/16"	18	.324	.688	.719	.156	.176	.156	.187	.307	.324
3/8"	16	.388	.782	.844	.188	.208	.188	.219	.368	.388
7/16"	14	.452	.907	.969	.219	.239	.219	.250	.431	.452
½"	13	.515	1.032	1.094	.250	.270	.250	.281	.492	.515
5/8"	11	.642	1.219	1.344	.313	.344	.313	.344	.616	.642
¾"	10	.768	1.469	1.594	.375	.406	.375	.406	.741	.768

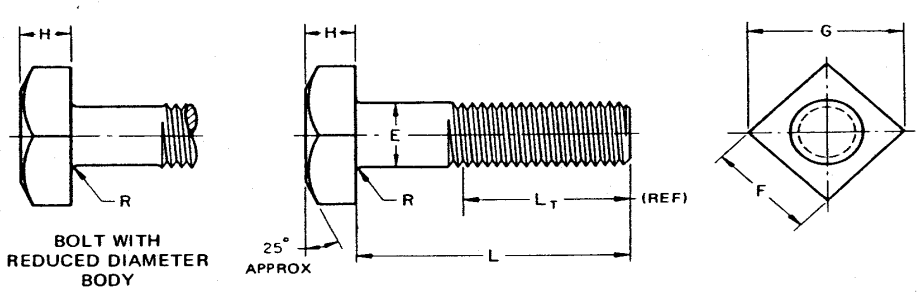
THREAD LENGTH (TL) = 2D+1/4" up to and including 6" in length. Carriage bolts too short for this formula shall be threaded as close to the head as practicable. For longer than 6", formula is TL = 2D+1/2". Threads to Class 2A Tolerance.

LAG BOLTS

Basic Size (D)	Threads per Inch	Thread Dimensions				Width Across Flats (F)		Height (H)	
		Pitch (P)	Flat at Root (B)	Depth of Thread (T)	Root Dia (R)	Min	Max	Min	Max
¼″	10	.100	.043	.039	.173	.362	.3750	.156	.188
5/16″	9	.111	.048	.043	.227	.484	.5000	.186	.220
3/8″	7	.143	.062	.055	.265	.544	.5625	.232	.268
7/16″	7	.143	.062	.055	.328	.603	.625	.278	.316
½″	6	.167	.072	.064	.371	.725	.7500	.308	.348
5/8″	5	.200	.086	.077	.471	.096	.9375	.400	.444
¾″	4-1/2	.222	.096	.085	.579	1.088	1.1250	.476	.524

THREAD LENGTH (TL) = 1/2 Length (L)+1/2". Lag screws too short for this formula shall be threaded as close to the head as practical.

SQUARE BOLTS

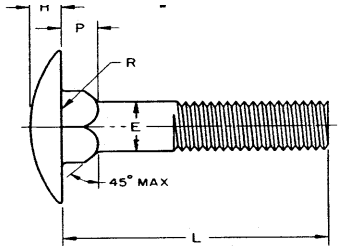


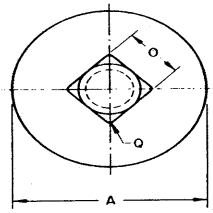
Dimensions of Square Bolts

Nominal Size or Basic Bolt Diameter		E	F			G		H			R		L_T (Ref)	
		Body Dia	Width Across Flats			Width Across Corners		Height			Radius of Fillet		Thread Length	
													For Bolt Lgths ≤ 6 in.	For Bolt Lgths ≥ 6 in.
		Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Basic
1/4	0.2500	0.260	3/8	0.375	0.362	0.530	0.498	11/64	0.188	0.156	0.03	0.01	0.750	1.000
5/16	0.3125	0.324	1/2	0.500	0.484	0.707	0.665	13/64	0.220	0.186	0.03	0.01	0.875	1.125
3/8	0.3750	0.388	9/16	0.562	0.544	0.795	0.747	1/4	0.268	0.232	0.03	0.01	1.000	1.250
7/16	0.4375	0.452	5/8	0.625	0.603	0.884	0.828	19/64	0.316	0.278	0.03	0.01	1.125	1.375
1/2	0.5000	0.515	3/4	0.750	0.725	1.061	0.995	21/64	0.348	0.308	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	15/16	0.938	0.906	1.326	1.244	27/64	0.444	0.400	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1-1/8	1.125	1.088	1.591	1.494	1/2	0.524	0.476	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	1-5/16	1.312	1.269	1.856	1.742	19/32	0.620	0.568	0.06	0.02	2.000	2.250
1	1.0000	1.022	1-1/2	1.500	1.450	2.121	1.991	21/32	0.684	0.628	0.09	0.03	2.250	2.500
1-1/8	1.1250	1.149	1-11/16	1.688	1.631	2.386	2.239	3/4	0.780	0.720	0.09	0.03	2.500	2.750
1-1/4	1.2500	1.277	1-7/8	1.875	1.812	2.652	2.489	27/32	0.876	0.812	0.09	0.03	2.750	3.000
1-3/8	1.3750	1.404	2-1/16	2.062	1.994	2.917	2.738	29/32	0.940	0.872	0.09	0.03	3.000	3.250
1-1/2	1.5000	1.531	2-1/4	2.250	2.175	3.182	2.986	1	1.036	0.964	0.09	0.03	3.250	3.500

NOTE: Square bolts are not regularly available and have been replaced by Finished Hex Head bolts.

STEP BOLT AND FLAT COUNTERSUNK HEAD ELEVATOR BOLTS

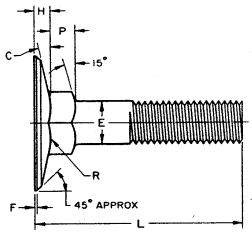


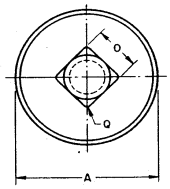


Step Bolts

Nominal Size[1] or Basic Bolt Diameter		E		A		H		O		P		Q	R
		Body Diameter		Head Diameter		Head Height		Square Width		Square Depth		Corner Radius on Square	Fillet Radius
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
#10	0.1900	0.199	0.182	0.656	0.625	0.114	0.094	0.199	0.185	0.125	0.094	0.031	0.031
¼	0.2500	0.260	0.237	0.844	0.813	0.145	0.125	0.260	0.245	0.156	0.125	0.031	0.031
5/16	0.3125	0.324	0.298	1.031	1.000	0.176	0.156	0.324	0.307	0.187	0.156	0.031	0.031
3/8	0.3750	0.388	0.360	1.219	1.188	0.208	0.188	0.388	0.368	0.219	0.188	0.047	0.031
7/16	0.4375	0.452	0.421	1.406	1.375	0.239	0.219	0.452	0.431	0.250	0.219	0.047	0.031
½	0.5000	0.515	0.483	1.594	1.563	0.270	0.250	0.515	0.492	0.281	0.250	0.047	0.031

Flat Countersunk Head Elevator Bolts





Nominal Size[1] or Basic Bolt Diameter		E		A			C	F	H		O		P		Q	R
		Body Diameter		Head Diameter			Head Angle	Flat on Min Dia Head	Head Height		Square Width		Square Depth		Corner Radius on Square	Fillet Radius
		Max	Min	Max Edge Sharp	Min Edge Sharp	Min Edge Flat	Ref	Max	Max	Min	Max	Min	Max	Min	Max	Min
#10	0.1900	0.199	0.182	0.790	0.750	0.740	9°	0.025	0.082	0.062	0.210	0.185	0.125	0.094	0.031	0.031
1/4	0.2500	0.260	0.237	1.008	0.969	0.938	9°	0.035	0.098	0.078	0.280	0.245	0.219	0.188	0.031	0.031
5/16	0.3125	0.324	0.298	1.227	1.188	1.157	9°	0.035	0.114	0.094	0.342	0.307	0.250	0.219	0.031	0.031
3/8	0.3750	0.388	0.360	1.352	1.312	1.272	11°	0.040	0.145	0.125	0.405	0.368	0.250	0.219	0.047	0.031
7/16	0.4375	0.452	0.421	1.477	1.438	1.397	13°	0.040	0.176	0.156	0.468	0.431	0.281	0.250	0.047	0.031
1/2	0.5000	0.515	0.483	1.607	1.562	1.522	12°	0.040	0.176	0.156	0.530	0.492	0.281	0.250	0.047	0.031

NOTES: 1. Where specifying nominal size in decimals, zeros preceding decimal and in the fourth decimal place shall be omitted.

DESCRIPTION	PAGE
Nuts	
Hex Nuts (Finished) and Hex Nuts (Heavy)	4-1
Hexagon Machine Screw Nuts	4-2
Type A Forged Wing Nuts	4-3
Hex Slotted Nuts	4-4
Hex and Heavy Hex Jam Nuts	4-5 to 4-6
Hex Castle Nuts	4-7
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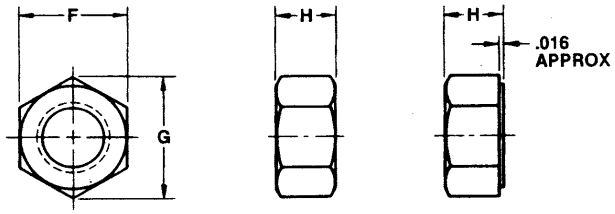
Round Spanner Nuts	4-9
Heavy Hex Nuts with Tommy Bar Holes	4-10

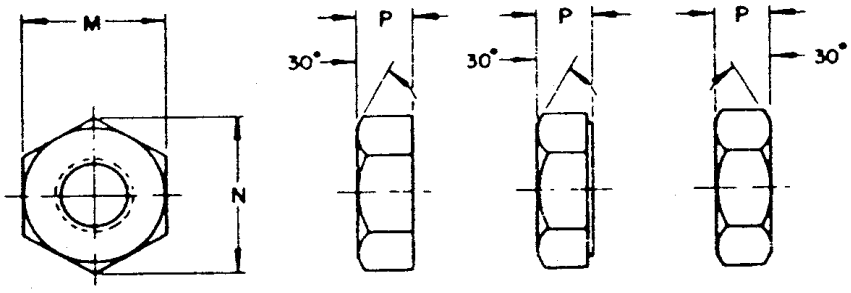
HEX NUTS (FINISHED)
HEAVY HEX NUTS



Threads to Class 2B Tolerance

Nominal Size or Basic Major Diameter of Thread	Threads Per Inch		Hex Nuts (Finished)				Heavy Hex Nuts			
			Width Across Flats Nominal F	Width Across Corners Minimum G	Thickness H		Width Across Flats Nominal F	Width Across Corners Minimum G	Thickness H	
	UNC	UNF			Full	Jam			Full	Jam
1/4	**20**	**28**	7/16	**.488**	7/32	5/32	1/2	**.556**	15/64	11/64
5/16	**18**	**24**	1/2	**.557**	17/64	3/16	9/16	**.622**	19/64	13/64
3/8	**16**	**24**	9/16	**.628**	21/64	7/32	11/16	**.763**	23/64	15/64
7/16	**14**	**20**	11/16	**.768**	3/8	1/4	3/4	**.830**	27/64	17/64
1/2	**13**	**20**	3/4	**.840**	7/16	5/16	7/8	**.969**	31/64	19/64
9/16	**12**	**18**	7/8	**.982**	31/64	5/16	15/16	**1.037**	35/64	21/61
5/8	**11**	**18**	15/16	**1.051**	35/64	3/8	1-1/16	**1.175**	39/64	23/64
3/4	**10**	**16**	1-1/8	**1.240**	41/64	27/64	1-1/4	**1.382**	47/64	27/64
7/8	**9**	**14**	1-5/16	**1.447**	3/4	31/64	1-7/16	**1.589**	55/64	31/64
1	**8**	**14NF**	1-1/2	**1.653**	55/64	35/64	1-5/8	**1.796**	63/64	35/64
1-1/8	**7**	**12**	1-11/16	**1.859**	31/32	39/64	1-13/16	**2.002**	1-7/64	39/64
1-1/4	**7**	**12**	1-7/8	**2.066**	1-1/16	23/32	2	**2.209**	1-7/32	23/32
1-3/8	**6**	**12**	2-1/16	**2.273**	1-11/64	25/32	2-3/16	**2.416**	1-11/32	25/32
1-1/2	**6**	**12**	2-1/4	**2.480**	1-9/32	27/64	2-3/8	**2.622**	1-15/32	27/32
1-5/8	**5-1/2**	**12**	2-7/16	**2.686**	1-25/64	29/32	2-9/16	**2.828**	1-19/32	29/32
1-3/4	**5**	**12**	2-5/8	**2.893**	1-1/2	31/32	2-3/4	**3.035**	1-23/32	31/32
1-7/8	**5**	**12**	2-13/16	**3.100**	1-39/64	1-1/32	2-15/16	**3.242**	1-27/32	1-1/32
2	**4-1/2**	**12**	3	**3.306**	1-23/32	1-3/32	3-1/8	**3.449**	1-31/32	1-3/32
2-1/4	**4-1/2**	**12**	3-3/8	**3.719**	1-59/64	1-13/64	3-1/2	**3.862**	2-13/64	1-13/64
2-1/2	**4**	**12**	3-3/4	**4.133**	2-9/64	1-29/64	3-7/8	**4.275**	2-29/64	1-29/64
2-3/4	**4**	**12**	4-1/8	**4.546**	2-23/64	1-37/64	4-1/4	**4.688**	2-45/64	1-37/64
3	**4**	**12**	4-1/2	**4.959**	2-37/64	1-45/64	4-5/8	**5.102**	2-61/64	1-45/64
3-1/4	**4**						5	**5.515**	3-3/16	1-13/16
3-1/2	**4**						5-3/8	**5.928**	3-7/16	1-15/16
3-3/4	**4**						5/3/4	**6.341**	3-11/16	2-1/16
4	**4**						6-1/8	**6.755**	3-15/16	2-3/16
4-1/4	**4**						6-1/2	**7-13/32**		
4-1/2	**4**						6-7/8	**7-53/64**		
4-3/4	**4**						7-1/4	**8-17/64**		
5	**4**						7-5/8	**8-11/16**		
5-1/4	**4**						8	**9-1/8**		
5-1/2	**4**						8-3/8	**9-35/64**		
5-3/4	**4**						8-3/4	**9-31/32**		
6	4						9-1/8	**10-13/32**		

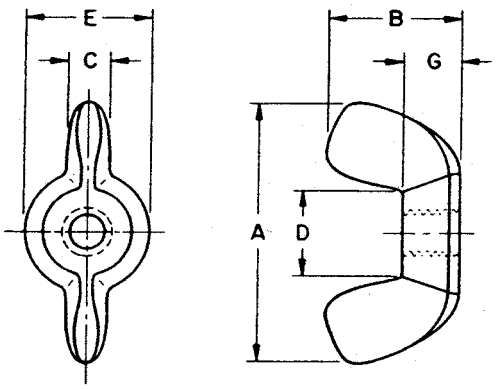
HEXAGON MACHINE SCREW NUTS



	N		P		
	Across Corners		Thickness		
Min	Max	Min	Nom	Max	Min
.180	.217	.205	1/16	.066	.057
.180	.217	.205	1/16	.066	.057
.180	.217	.205	1/16	.066	.057
.180	.217	.205	1/16	.066	.057
.241	.289	.275	3/32	.098	.087
.241	.289	.275	3/32	.098	.087
.302	.361	.344	7/64	.114	.102
.302	.361	.344	7/64	.114	.102
.302	.361	.344	7/64	.114	.102
.302	.361	.344	7/64	.114	.102
.332	.397	.378	1/8	.130	.117
.332	.397	.378	1/8	.130	.117
.362	.433	.413	1/8	.130	.117
.362	.433	.413	1/8	.130	.117
.423	.505	.482	5/32	.161	.148
.423	.505	.482	5/32	.161	.148
.423	.505	.482	3/16	.193	.178
.423	.505	.482	3/16	.193	.178
.545	.650	.621	7/32	.225	.208
.545	.650	.621	7/32	.225	.208
.607	.722	.692	1/4	.257	.239
.607	.722	.692	1/4	.257	.239

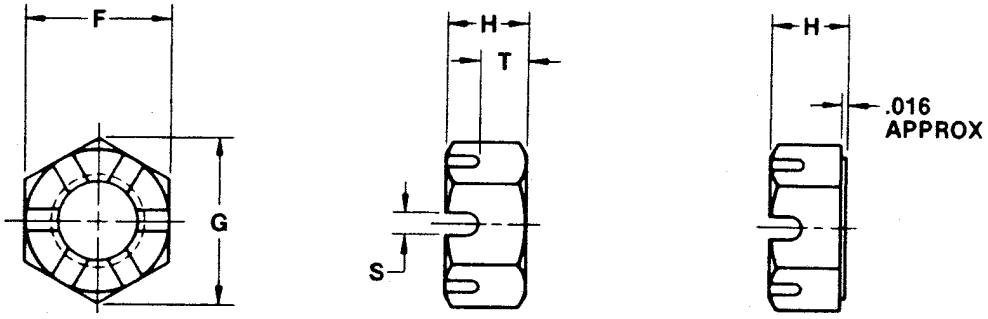
Threads: Unified and American Standard Class 2B unless otherwise specified.

TYPE A FORGED WING NUTS



Nominal Size or Basic Major Diameter of Thread[2]		Threads Per Inch	Series	Nut Blank Size (Ref)	A Wing Spread		B Wing Height		C Wing Thickness		D Between Wings		E Boss Diameter		G Boss Height	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	0.0990	48 & 56	Heavy	AA	0.72	0.59	0.41	0.28	0.11	0.07	0.21	0.17	0.33	0.29	0.14	0.10
4	0.1120	40 & 48	Heavy	AA	0.72	0.59	0.41	0.28	0.11	0.07	0.21	0.17	0.33	0.29	0.14	0.10
5	0.1250	40 & 44	**Light**	**AA**	**0.72**	**0.59**	**0.41**	**0.28**	**0.11**	**0.07**	**0.21**	**0.17**	**0.33**	**0.29**	**0.14**	**0.10**
			Heavy	A	0.91	0.78	0.47	0.34	0.14	0.10	0.27	0.22	0.43	0.39	0.18	0.14
6	0.1380	32 & 40	Light	AA	0.72	0.59	0.41	0.28	0.11	0.07	0.21	0.17	0.33	0.29	0.14	0.10
			Heavy	**A**	**0.91**	**0.78**	**0.47**	**0.34**	**0.14**	**0.10**	**0.27**	**0.22**	**0.43**	**0.39**	**0.18**	**0.14**
8	0.1640	32 & 36	**Light**	**A**	**0.91**	**0.78**	**0.47**	**0.34**	**0.14**	**0.10**	**0.27**	**0.22**	**0.43**	**0.39**	**0.18**	**0.14**
			Heavy	B	1.10	0.97	0.57	0.43	0.18	0.14	0.33	0.26	0.50	0.45	0.22	0.17
10	0.1900	24 & 32	**Light**	**A**	**0.91**	**0.78**	**0.47**	**0.34**	**0.14**	**0.10**	**0.27**	**0.22**	**0.43**	**0.39**	**0.18**	**0.14**
			Heavy	B	1.10	0.97	0.57	0.43	0.18	0.14	0.33	0.26	0.50	0.45	0.22	0.17
12	0.2160	24 & 28	**Light**	**B**	**1.10**	**0.97**	**0.57**	**0.43**	**0.18**	**0.14**	**0.33**	**0.26**	**0.50**	**0.45**	**0.22**	**0.17**
			Heavy	C	1.25	1.12	0.66	0.53	0.21	0.17	0.39	0.32	0.58	0.51	0.25	0.20
1/4	0.250	20 & 28	**Light**	**B**	**1.10**	**0.97**	**0.57**	**0.43**	**0.18**	**0.14**	**0.39**	**0.26**	**0.50**	**0.45**	**0.22**	**0.17**
			Regular	C	1.25	1.12	0.66	0.53	0.21	0.17	0.39	0.32	0.58	0.51	0.25	0.20
			Heavy	D	1.44	1.31	0.79	0.65	0.24	0.20	0.48	0.42	0.70	0.64	0.30	0.26
5/16	0.3125	18 & 24	**Light**	**C**	**1.25**	**1.12**	**0.66**	**0.53**	**0.21**	**0.17**	**0.39**	**0.32**	**0.58**	**0.51**	**0.25**	**0.20**
			Regular	D	1.44	1.31	0.79	0.65	0.24	0.20	0.48	0.42	0.70	0.64	0.30	0.26
			Heavy	E	1.94	1.81	1.00	0.87	0.33	0.26	0.65	0.54	0.93	0.86	0.39	0.35
3/8	0.3750	16 & 24	**Light**	**D**	**1.44**	**1.31**	**0.79**	**0.65**	**0.24**	**0.20**	**0.48**	**0.42**	**0.70**	**0.64**	**0.30**	**0.26**
			Regular	E	1.94	1.81	1.00	0.87	0.33	0.26	0.65	0.54	0.93	0.86	0.39	0.35
7/16	0.4375	14 & 20	**Light**	**E**	**1.94**	**1.81**	**1.00**	**0.87**	**0.33**	**0.26**	**0.65**	**0.54**	**0.93**	**0.86**	**0.39**	**0.35**
			Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	0.90	0.80	1.19	1.13	0.55	0.51
1/2	0.5000	13 & 20	**Light**	**E**	**1.94**	**1.81**	**1.00**	**0.87**	**0.33**	**0.26**	**0.65**	**0.54**	**0.93**	**0.86**	**0.39**	**0.35**
			Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	0.90	0.80	1.19	1.13	0.55	0.51
9/16	0.5825	12 & 18	Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	0.90	0.80	1.19	1.13	0.55	0.51
5/8	0.6250	11 & 18	Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	0.90	0.80	1.19	1.13	0.55	0.51
3/4	0.7500	10 & 16	Heavy	F	2.76	2.62	1.44	1.31	0.40	0.34	0.90	0.80	1.19	1.13	0.55	0.51

HEX SLOTTED NUTS

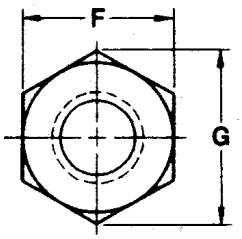


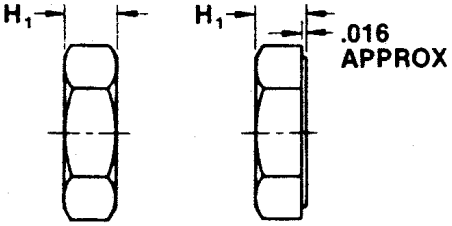
Dimensions of Hex Slotted Nuts

Nominal Size or Basic Major Diameter of Thread		F			G		H			T		S		Runout of Bearing Surface FIM
		Width Across Flats			Width Across Corners		Thickness			Unslotted Thickness		Width of Slot		
		Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Max	Min	Max
1/4	0.2500	7/16	0.438	0.428	0.505	0.488	7/32	0.226	0.212	0.14	0.12	0.10	0.07	0.015
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	17/64	0.273	0.258	0.18	0.16	0.12	0.09	0.016
3/8	0.3750	9/16	0.562	0.551	0.650	0.625	21/64	0.337	0.320	0.21	0.19	0.15	0.12	0.018
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	3/8	0.385	0.365	0.23	0.21	0.15	0.12	0.018
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	7/16	0.448	0.427	0.29	0.27	0.18	0.15	0.019
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	31/64	0.496	0.473	0.31	0.29	0.18	0.15	0.020
5/8	0.6250	15/16	0.938	0.922	1.083	1.051	35/64	0.559	0.535	0.34	0.32	0.24	0.18	0.021
3/4	0.7500	1-1/8	1.125	1.088	1.299	1.240	41/64	0.665	0.617	0.40	0.38	0.24	0.18	0.023
7/8	0.8750	1-5/16	1.312	1.269	1.516	1.447	3/4	0.776	0.724	0.52	0.49	0.24	0.18	0.025
1	1.0000	1-1/2	1.500	1.450	1.732	1.653	55/64	0.887	0.831	0.59	0.56	0.30	0.24	0.027
1-1/8	1.1250	1-11/16	1.688	1.631	1.949	1.859	31/32	0.999	0.939	0.64	0.61	0.33	0.24	0.030
1-1/4	1.2500	1-7/8	1.875	1.812	2.165	2.066	1-1/16	1.094	1.030	0.70	0.67	0.40	0.31	0.033
1-3/8	1.3750	2-1/16	2.062	1.994	2.382	2.273	1-11/64	1.206	1.138	0.82	0.78	0.40	0.31	0.036
1-1/2	1.5000	2-1/4	2.250	2.175	2.598	2.480	1-9/32	1.317	1.245	0.86	0.82	0.46	0.37	0.039

Available in NC Threads only.

HEX JAM NUTS

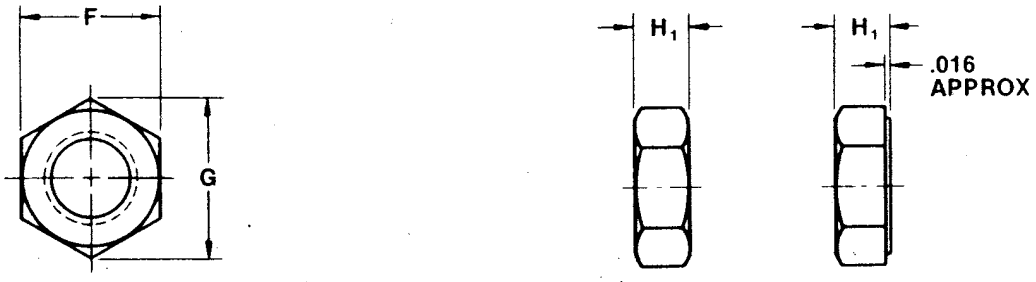




Dimensions of Hex Jam Nuts

Nominal Size or Basic Major Diameter of Thread		F			G		H_1			Runout of Bearing Face, up to 150,000 psi proofload
		Width Across Flats			Width Across Corners		Thickness Hex Jam Nuts			
		Basic	Max	Min	Max	Min	Basic	Max	Min	Max
1/4	0.2500	7/16	0.438	0.428	0.505	0.488	5/32	0.163	0.150	0.015
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	3/16	0.195	0.180	0.016
3/8	0.3750	9/16	0.562	0.551	0.650	0.628	7/32	0.227	0.210	0.017
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	1/4	0.260	0.240	0.018
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	5/16	0323	0.302	0.019
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	5/16	0.324	0.301	0.020
5/8	0.6250	15/16	0.938	0.922	1.083	1.051	3/8	0.387	0.363	0.021
3/4	0.7500	1-1/8	1.125	1.088	1.299	1.240	27/64	0.446	0.398	0.023
7/8	0.8750	1-5/16	1.312	1.269	1.516	1.447	31/64	0.510	0.458	0.025
1	1.0000	1-1/2	1.500	1.450	1.732	1.653	35/64	0.575	0.519	0.027
1-1/8	1.1250	1-11/16	1.688	1.631	1.949	1.859	39/64	0.639	0.579	0.030
1-1/4	1.2500	1-7/8	1.875	1.812	2.165	2.066	23/32	0.751	0.687	0.033
1-3/8	1.3750	2-1/16	2.062	1.994	2.382	2.273	25/32	0.815	0.747	0.036
1-1/2	1.5000	2-1/4	2.250	2.175	2.598	2.480	27/32	0.880	0.808	0.039

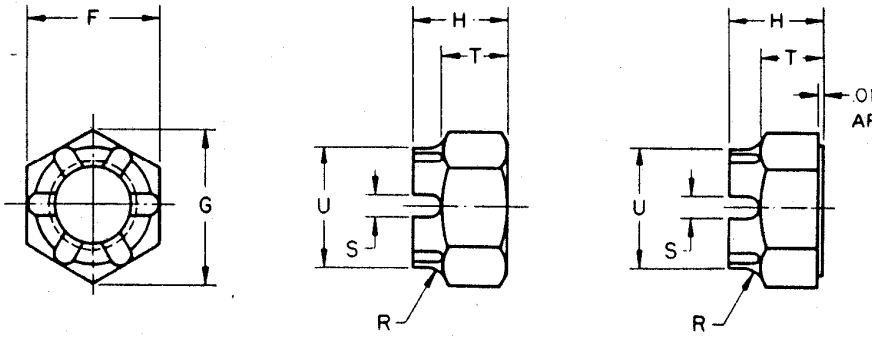
HEAVY HEX JAM NUTS



Dimensions of Heavy Hex Jam Nuts

Nominal Size or Basic Major Diameter of Thread		F			G		H_1			Runout of Bearing Face, up to 150,000 psi proofload
		Width Across Flats			Width Across Corners		Thickness Hex Jam Nuts			
		Basic	Max	Min	Max	Min	Basic	Max	Min	Max
1/4	0.2500	½	.0500	0.488	0.577	0.556	11/64	0.188	0.156	0.017
5/16	0.3125	9/16	0.562	0.546	0.650	0.622	13/64	0.220	0.186	0.020
3/8	0.3750	11/16	0.688	0.669	0.794	0.763	15/64	0.252	0.216	0.021
7/16	0.4375	¾	0.750	0.728	0.866	0.830	17/64	0.285	0.247	0.022
1/2	0.5000	7/8	0.875	0.850	1.010	0.969	19/64	0.317	0.277	0.023
9/16	0.5625	15/16	0.938	0.909	1.083	1.037	21/64	0.349	0.307	0.024
5/8	0.6250	1-1/16	1.062	1.031	1.227	1.175	23/64	0.381	0.337	0.025
3/4	0.7500	1-1/4	1.250	1.212	1.443	1.382	27/64	0.446	0.398	0.027
7/8	0.8750	1-7/16	1.438	1.394	1.660	1.589	31/64	0.510	0.458	0.029
1	1.0000	1-5/8	1.625	1.575	1.876	1.796	35/64	0.575	0.519	0.031
1-1/8	1.1250	1-13/16	1.812	1.756	2.093	2.002	39/64	0.639	0.579	0.033
1-1/4	1.2500	2	2.000	1.938	2.309	2.209	23/32	0.751	0.687	0.035
1-3/8	1.3750	2-3/16	2.188	2.119	2.526	2.416	25/32	0.815	0.747	0.038
1-1/2	1.5000	2-3/8	2.375	2.300	2.742	2.622	27/32	0.880	0.808	0.041
1-5/8	1.6250	2-9/16	2.562	2.481	2.959	2.828	29/32	0.944	0.868	0.044
1-3/4	1.7500	2-3/4	2.750	2.662	3.175	3.035	31/32	1.009	0.929	0.048
1-7/8	1.8750	2-15/16	2.938	2.844	3.392	3.242	1-1/32	1.073	0.989	0.051
2	2.0000	3-1/8	3.125	3.025	3.608	3.449	1-3/32	1.138	1.050	0.055
2-1/4	2.2500	3-1/2	3.500	3.388	4.041	3.862	1-13/64	1.251	1.155	0.061
2-1/2	2.5000	3-7/8	3.875	3.750	4.474	4.275	1-29/64	1.505	1.401	0.068
2-3/4	2.7500	4-1/4	4.250	4.112	4.907	4.688	1-37/64	1.634	1.522	0.074
3	3.0000	4-5/8	4.625	4.475	5.340	5.102	1-45/64	1.763	1.643	0.081
3-1/4	3.2500	5	5.000	4.838	5.774	5.515	1-13/16	1.876	1.748	0.087
3-1/2	3.5000	5-3/8	5.375	5.200	6.207	5.928	1-15/16	2.006	1.870	0.094
3-3/4	3.7500	5-3/4	5.750	5.562	6.640	6.341	2-1/16	2.134	1.990	0.100
4	4.0000	6-1/8	6.125	5.925	7.073	6.755	2-3/16	2.264	2.112	0.107

HEX CASTLE NUTS



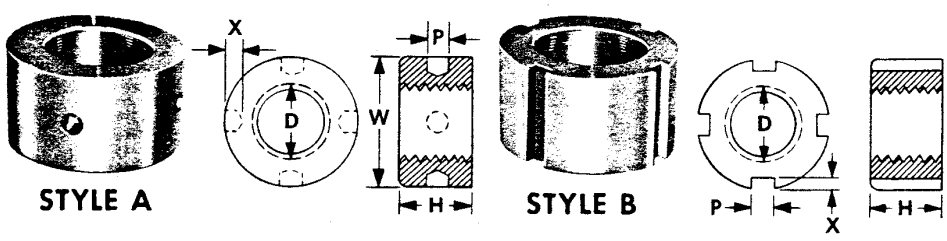
Nominal Size or Basic Major Diameter of Thread		F Width Across Flats			G Width Across Corners		H Thickness			T Unslotted Thickness and Height of Flats			S Width of Slot		R Radius of Fillet
		Basic	Max	Min	Max	Min	Basic	Max	Min	Nom	Max	Min	Max	Min	±.010
1/4	0.2500	7/16	0.438	0.428	0.505	0.488	9/32	0.288	0.274	3/16	0.20	0.18	0.10	0.07	0.094
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	21/64	0.336	0.320	15/64	0.24	0.22	0.12	0.09	0.094
3/8	0.3750	9/16	0.562	0.551	0.650	0.628	13/32	0.415	0.398	9/32	0.29	0.27	0.15	0.12	0.094
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	29/64	0.463	0.444	19/64	0.31	0.29	0.15	0.12	0.094
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	9/16	0.573	0.552	13/32	0.42	0.40	0.18	0.15	0.125
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	39/64	0.621	0.598	27/64	0.43	0.41	0.18	0.15	0.156
5/8	0.6250	15/16	0.938	0.922	1.083	1.051	23/32	0.731	0.706	1/2	0.51	0.49	0.24	0.18	0.156
3/4	0.7500	1-1/8	1.125	1.088	1.299	1.240	13/16	0.827	0.798	9/16	0.57	0.55	0.24	0.18	0.188
7/8	0.8750	1-5/16	1.312	1.269	1.516	1.447	29/32	0.922	0.890	21/32	0.67	0.64	0.24	0.18	0.188
1	1.0000	1-1/2	1.500	1.450	1.732	1.653	1	1.018	0.982	23/32	0.73	0.70	0.30	0.24	0.188
1-1/8	1.1250	1-11/16	1.688	1.631	1.949	1.859	1-5/32	1.176	1.136	13/16	0.83	0.80	0.33	0.24	0.250
1-1/4	1.2500	1-7/8	1.875	1.812	2.165	2.066	1-1/4	1.272	1.228	7/8	0.89	0.86	0.40	0.31	0.250
1-3/8	1.3750	2-1/16	2.062	1.994	2.382	2.273	1-3/8	1.399	1.351	1	1.02	0.98	0.40	0.31	0.250
1-1/2	1.5000	2-1/4	2.250	2.175	2.598	2.480	1-1/2	1.526	1.474	1-1/16	1.08	1.04	0.46	0.37	0.250

Available in NF Threads Only

LARGE DIAMETER
HEXAGON HEAD CAP NUTS

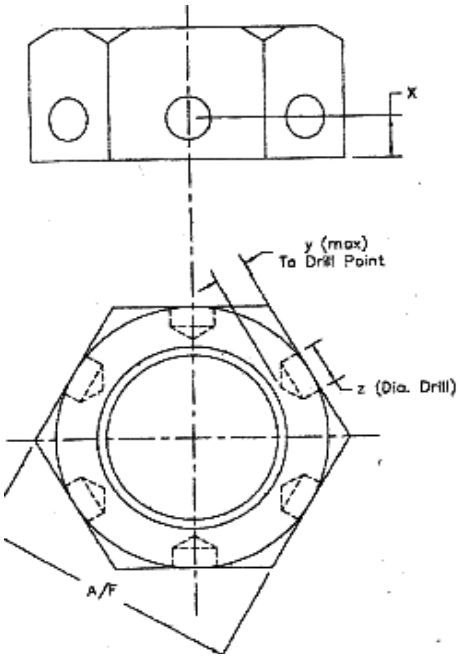
Size Inches	**Basic Dimensions** Inches							**Weight** Lbs
Thread Dia	Nut Dia	Height	Thread Length	Hex Width Across Flats	Hex Height	Base Height	Hex Nut Size	Each
D	**OD**	**H**	**L**	**W**	**E**	**B**	**F**	
1-3/4	2-5/8	4	1-3/4	1-1/4	3/4	3-1/4	3/4	4.2
1-7/8	2-7/8	4-3/8	1-7/8	1-7/16	7/8	2-1/2	7/8	5.2
2	3	4-3/4	2	1-5/8	1	3-3/4	1	5.9
2-1/4	3-3/8	5-1/4	2-1/4	2	1-1/4	4	1-1/4	7.8
2-1/2	3-3/4	5-3/4	2-1/2	2-3/8	1-1/2	4-1/4	1-1/2	10.1
2-3/4	4-1/8	6-1/4	2-3/4	2-3/4	1-3/4	4-1/2	1-3/4	13.5
3	4-1/2	6-3/4	3	3-1/8	2	4-3/4	2	17.7
3-1/4	4-7/8	7-1/4	3-1/4	3-1/2	2-1/4	5	2-1/4	22.6
3-1/2	5-1/4	7-3/4	3-1/2	3-7/8	2-1/2	5-1/4	2-1/2	28.4
3-3/4	5-3/4	8-1/4	3-3/4	4-1/4	2-3/4	5-1/2	2-3/4	37.0
4	6	8-3/4	4	4-5/8	3	5-3/4	3	43.1
4-1/4	6-1/4	9-1/4	4-1/4	5	3-1/4	6	3-1/4	49.9
4-1/2	6-3/4	10	4-1/2	5-3/8	3-1/2	6-1/2	3-1/2	64.8
4-3/4	7-1/8	10-1/2	4-3/4	5-3/4	3-3/4	6-3/4	3-3/4	76.5

ROUND SPANNER NUTS



Size	Tapped			Blank	Basic Dimensions				
Inches	Class 2-B				Inches				
Thread Dia D	**Threads per Inch**	**Weight Each**	**Keg Qty**	**Weight Each**	**D**	**W**	**H**	**P**	**X**
1-3/4	5-8-12	1.4	142	1.6	1-3/4	2-5/8	1-5/8	3/8	3/16
1-7/8	5-8-12	1.7	117	1.9	1-7/8	2-13/16	1-3/4	3/8	3/16
2	4-1/2-6-8-12	2.3	87	2.5	2	3	1-7/8	3/8	3/16
2-1/4	4-1/2-6-8-12	3.2	62	3.4	2-1/4	3-3/8	2-1/8	1/2	1/4
2-1/2	4-6-8-12	4.4	45	4.8	2-1/2	3-3/4	2-3/8	1/2	1/4
2-3/4	4-6-8	6.0	40	6.4	2-3/4	4-1/8	2-5/8	1/2	1/4
3	3-1/2-4-6-8	7.9	25	8.4	3	4-1/2	2-7/8	1/2	1/4
3-1/4	3-1/2-4-6-8	9.7	20	10.3	3-1/4	4-7/8	3-1/8	1/2	¼
3-1/2	3-1/4-4-6-8	12.4	16	13.1	3-1/2	5-1/4	3-3/8	1/2	5-16
3-3/4	4-6-8	15.1	13	15.9	3-3/4	5-5/8	3-5/8	5/8	5/16
4	3-4-6-8	18.3	10	19.2	4	6	3-7/8	5/8	5/16
4-1/4	4-6-8	21.6	9	22.5	4-1/4	6-3/8	4-1/8	5/8	3/8
4-1/2	2-3/4-4-6-8	24.8	8	25.8	4-1/2	6-3/4	4-3/8	5/8	3/8
4-3/4	4-6-8	30.2	6	31.4	4-3/4	7-1/8	4-5/8	5/8	3/8
5	2-1/2-4-6-8	35.0	6	36.4	5	7-1/2	4-7/8	5/8	3/8
5-1/4	2-1/2-4-6-8	41.0	5	42.5	5-1/4	7-7/8	5-1/8	3/4	3/8
5-1/2	4-6-8	46.0	4	47.7	5-1/2	8-1/4	5-3/8	3/4	3/8
5-3/4	4-6-8	56.0	3	57.8	5-3/4	8-5/8	5-5/8	3/4	3/8
6	2-1/4-4-6-8	62.0	3	64.0	6	9	5-7/8	3/4	3/8

Heavy Hex Nuts with Tommy Bar Holes



DASH NO.	NOMINAL THREAD DIA.		A/F*		X		Y		Z		Tommy Bar Size	
-1	3/4"	(19.05)	1.250	(31.75)	.354	(9)	.197	(5)**	.244	(6.2)	.236	(6)
-2	7/8"	(22.23)	1.437	(36.50)	.354	(9)	.197	(5)**	.244	(6.2)	.236	(6)
-3	1"	(25.4)	1.625	(41.28)	.354	(9)	.236	(6)**	.244	(6.2)	.236	(6)
-4	1 1/8"	(28.58)	1.812	(46.02)	.354	(9)	.236	(6)**	.244	(6.2)	.236	(6)
-5	1 1/4"	(31.75)	2.000	(50.8)	.472	(12)	.236	(6)**	.323	(8.2)	.315	(8)
-6	1 3/8"	(34.93)	2.187	(55.55)	.472	(12)	.315	(8)**	.323	(8.2)	.315	(8)
-7	1 1/2"	(38.10)	2.375	(60.33)	.591	(15)	.354	(9)	.402	(10.2)	.394	(10)
-8	1 5/8"	(41.28)	2.562	(65.07)	.591	(15)	.354	(9)	.402	(10.2)	.394	(10)
-9	1 3/4"	(44.45)	2.750	(69.85)	.591	(15)	.394	(10)	.402	(10.2)	.394	(10)
-10	1 7/8"	(47.63)	2.937	(74.60)	.591	(15)	.394	(10)	.402	(10.2)	.394	(10)
-11	2"	(50.8)	3.125	(79.38)	.708	(18)	.472	(12)	.488	(12.4)	.472	(12)
-12	2 1/4"	(57.15)	3.500	(88.9)	.708	(18)	.472	(12)	.488	(12.4)	.472	(12)
-13	2 1/2"	(63.5)	3.875	(98.43)	.826	(21)	.551	(14)	.567	(14.4)	.472	(12)
-14	2 3/4"	(69.85)	4.250	(107.95)	.826	(21)	.551	(14)	.567	(14.4)	.472	(12)
-15	3"	(76.2)	4.625	(117.48)	.945	(24)	.630	(16)	.646	(16.4)	.630	(16)
-16	3 1/4"	(82.55)	5.000	(127.00)	.945	(24)	.670	(17)	.646	(16.4)	.630	(16)
-17	3 1/2"	(88.9)	5.375	(136.53)	.945	(24)	.709	(18)	.646	(16.4)	.630	(16)
-18	3 3/4"	(95.25)	5.750	(146.05)	.945	(24)	.709	(18)	.648	(16.4)	.630	(16)
-19	4"	(101.6)	6.125	(155.58)	.945	(24)	.709	(18)	.648	(16.4)	.630	(16)

NOTES:
* WIDTH ACROSS FLAT
** USE FLAT BOTTOM DRILL

DESCRIPTION	PAGE
Sockets & Pins	
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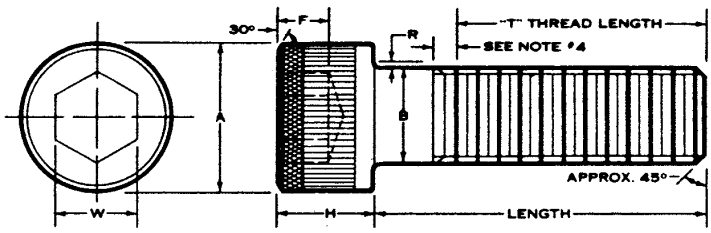
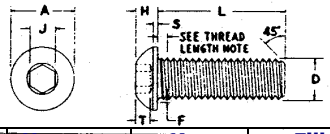
SOCKET HEAD CAP SCREWS



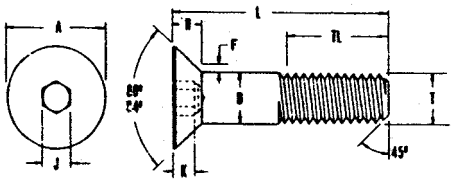
Size		A	B	F	H	R	T	W	X	Tap Drill Size		Body Drill Size
UNC	UNF			Min		Max	Min	Nom	Note G	UNC	UNF	
---	#0-80 UNF-3A	.096 .091	.0600 .0568	.025	.0600 .057	.007	.500	.050	.006	--	1.25 mm	#51
#1-64 UNC-3A	#1-72 UNF-3A	.118 .112	.0730 .0695	.031	.0730 .070	.007	.625	.0625	.006	1.5 mm	1.5 mm	#46
#2-56 UNC-3A	#2-64 UNF-3A	.140 .134	.0860 .0822	.038	.086 .083	.008	.625	.0781	.006	#50	1.85 mm	3/32
#3-48 UNC-3A	#3-56 UNF-3A	.161 .154	.0990 .0949	.044	.099 .095	.008	.625	.0781	.006	#46	2.1 mm	#36
#4-40 UNC-3A	#4-48 UNF-3A	.183 .176	.1120 .1075	.051	.112 .108	.009	.750	.0937	.006	2.3 mm	#42	#31
#5-40 UNC-3A	#5-44 UNF-3A	.205 .198	.1250 .1202	.057	.125 .121	.010	.750	.0937	.006	#37	#37	9/64
#6-32 UNC-3A	#6-40 UNF-3A	.226 .218	.1380 .1329	.064	.138 .134	.010	.750	.1093	.006	#33	#32	#23
#8-32 UNC-3A	#8-36 UNF-3A	.270 .262	.1640 .1585	.077	.164 .159	.012	.875	.1406	.006	#29	3.5 mm	#15
#10-24 UNC-3A	#10-32 UNF-3A	.312 .303	.1900 .1840	.090	.190 .185	.014	.875	.1562	.006	#24	#20	#5
1/4-20 UNC-3A	1/4-28 UNF-3A	.375 .365	.2500 .2435	.120	.250 .244	.014	1.000	.1875	.006	#6	5.5 mm	17/64
5/16-18 UNC-3A	5/16-24 UNF-3A	.468 .457	.3125 .3053	.151	.312 .306	.017	1.125	.2500	.006	G	1	21/64
3/8-16 UNC-3A	3/8-24 UNF-3A	.562 .550	.3750 .3678	.182	.375 .368	.020	1.250	.3125	.008	O	8.6 mm	23/64
7/16-14 UNC-3A	7/16-20 UNF-3A	.656 .642	.4375 .4294	.213	.437 .430	.023	1.375	.3750	.009	9.4 mm	25/64	29/64
1/2-13 UNC-3A	1/2-20 UNF-3A	.750 .735	.5000 .4919	.245	.500 .492	.026	1.500	.3750	.010	27/64	11.5 mm	33/64
9/16-12 UNC-3A	9/16-18 UNF-3A	.843 .827	.5625 .5538	.265	.562 .554	.028	1.625	.4375	.011	31/64	1/2	37/64
5/8-11 UNC-3A	5/8-18 UNF-3A	.937 .921	.6250 .6163	.307	.625 .616	.032	1.750	.5000	.013	17/32	14.5 mm	41/64
3/4-10 UNC-3A	3/4-16 UNF-3A	1.125 1.107	.7500 .7406	.370	.750 .740	.039	2.000	.6250	.015	21.32	17.5 mm	49/64
7/8-9 UNC-3A	7/8-14 UNF-3A	1.312 1.293	.8750 .8647	.432	.875 .864	.044	2.250	.7500	.018	49/64	20.5 mm	57/64
1-8 UNC-3A	1-14 UNF-3A	1.500 1.479	1.0000 .9886	.495	1.000 .988	.050	2.500	.7500	.020	7/8	23.5 mm	1-1/64
1-1/8-7 UNC-2A	1-1/8-12 UNF-2A	1.687 1.665	1.1250 1.1086	.557	1.125 1.111	.055	2.812	.8750	.023	25 mm	1-3/64	1-5/32
1-1/4-7 UNC-2A	1-1/4-12 UNF-2A	1.875 1.852	1.2500 1.2336	.620	1.250 1.236	.060	3.125	.8750	.025	1-7/64	1-11/64	1-9/32
1-3/8-6 UNC-2A	1-3/8-12 UNF-2A	2.062 2.038	1.3750 1.3568	.682	1.375 1.360	.065	3.437	1.0000	.028	1-7/32	1-19/564	1-13/32
1-1/2-6 UNC-2A	1-1/2-12 UNF-2A	2.250 2.224	1.5000 1.4818	.745	1.500 1.485	.070	3.750	1.0000	.030	34 mm	36 mm	1-19/32
1-3/4-5 UNC-2A	1-3/4-12 UN-2A	2.625 2.597	1.7500 1.7295	.870	1.750 1.734	.080	4.375	1.2500	.035	1-35/64		1-25/32
2-4-1/2 UNC-2A	2-12 UN-2A	3.000 2.970	2.0000 1.9780	.995	2.000 1.983	.090	5.000	1.5000	.040	1-25/32		2-1/32
2-1/4-4-1/2 UNC-2A	2-1/4-12 UN-2A	3.375 3.344	2.2500 2.2280	1.120	2.250 2.232	.100	5.625	1.7500	.045	2-1/32		2-9/32
2-1/2-4 UNC-2A	2-1/2-12 UN-2A	3.750 3.717	2.5000 2.4762	1.245	2.500 2.481	.110	6.250	1.7500	.050	2-1/4		2-17/32
2-3/4-4 UNC-2A	2-3/4-12 UN-2A	4.125 4.090	2.7500 2.7262	1.370	2.750 2.730	.120	6.875	2.0000	.055	2-1/2		2-25/32
3-4 UNC-2A	3-12 UN-2A	4.500 4.464	3.0000 2.9762	1.495	3.000 2.979	.130	7.500	2.2500	.060	2-3/4		3-1/32
3-1/4-4 UNC-2A		4.875	3.2500	1.625	3.250	.140		2.2500				
3-1/2-4 UNC-2A		5.250	3.5000	1.750	3.500	.150		2.7500				
3-3/4-4 UNC-2A		5.625	3.7500	1.875	3.750	.160		2.7500				
4-4 UNC 2A		6.000	4.0000	2.000	4.000	.170		3.0000				

BUTTON HEAD SOCKET CAP SCREWS



Screw Size		Major Diameter		Head Diameter		Head Height		Head Side Height	Hexagon Socket Size	Key Engage-ment	Fillet	
		D		A		H		S	J	T	F	
	Nom	Min	Max	Min	Max	Min	Max	Ref	Nom	Min	Min	Max
#4	40 NC 48 NF	.1072 .1073	.1120	.201	.213	.051	.059	.015	1/16	.035	.005	.010
#6	32 NC 40 NF	.1362 .1332	.1380	.250	.262	.063	.073	.015	5/64	.044	.005	.010
#8	32 NC 36 NF	.1586 .1590	.1640	.298	.312	.077	.087	.015	3/32	.052	.010	.015
#10	24 NC 32 NF	.1834 .1846	.1900	.347	.361	.091	.101	.020	1/8	.070	.010	.015
1/4	20 UNC 28 UNF	.2419 .2435	.2500	.419	.437	.122	.132	.031	5/32	.087	.015	.020
5/16	18 UNC 24 UNF	.3038 .3053	.3125	.527	.547	.152	.166	.031	3/16	.105	.015	.020
3/8	16 UNC 24 UNF	.3656 .3678	.3750	.636	.656	.185	.199	.031	7/32	.122	.015	.020
1/2	13 UNC 20 UNF	.4891 .4919	.5000	.851	.875	.245	.265	.046	5/16	.175	.020	.030
5/8	11 UNC 18 UNF	.6129 .6163	.6250	.970	1.000	.311	.331	.062	3/8	.210	.020	.030

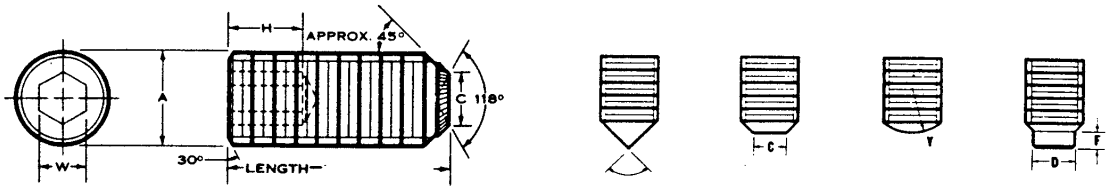
Thread Length Note: All standard lengths threaded to within two threads of head.



FLAT HEAD SOCKET CAP SCREWS

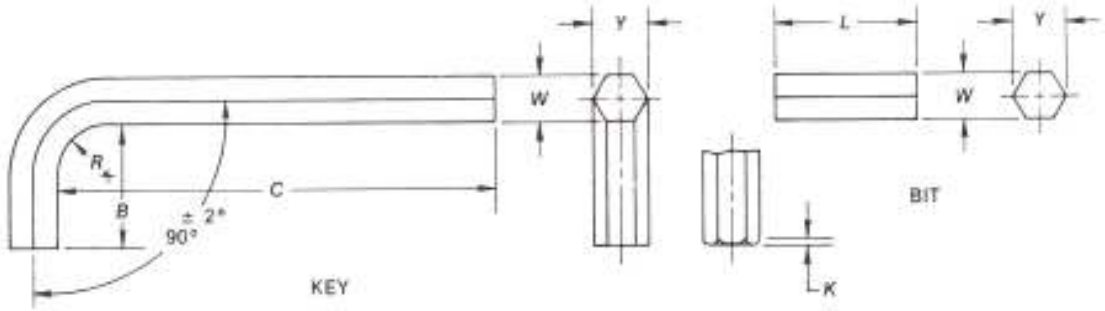
Thread Size T		Body Diameter D		Head Diameter A		Head Height H		Hexagon Socket Size	Key Engage-ment	Fillet	Basic Thread Length TL
				Absolute Min (w/Flat)	Theoretical Sharp	Flushness Tolerance	Ref	J	K	F	
		Min	Max		Max		Max	Nom	Min	Max	
#4	40 NC 48 NF	.1075	.1120	.218	.255	.011	.083	1/16	.055	.011	0.750
#5	40 NC 44 NF	.1202	.1250	.240	.281	.012	.090	5/64	.061	.012	0.750
#6	32 NC 40 NF	.1329	.1380	.263	.307	.013	.097	5/64	.066	.014	0..750
#8	32 NC 36 NF	.1585	.1640	.311	.359	.014	.112	3/32	.076	.016	0.875
#10	24 NC 32 NF	.1840	.1900	.359	.411	.015	.127	1/8	.087	.019	0.875
1/4	20 UNC 28 UNF	.2435	.2500	.480	.531	.016	.161	5/32	.111	.025	1.000
5/16	18 UNC 24 UNF	.3053	.3125	.600	.656	.017	.198	3/16	.135	.031	1.125
3/8	16 UNC 24 UNF	.3678	.3750	.720	.781	.018	.234	7/32	.159	.037	1.250
7/16	14 UNC 20 UNF	.4294	.4375	.781	.844	.018	.234	1/4	.159	.044	1.375
1/2	13 UNC 20 UNF	.4919	.5000	.872	.937	.018	.251	5/16	.172	.050	1.500
5/8	11 UNC 18 UNF	.6163	.6250	1.112	1.188	.022	.324	3/8	.220	.050	1.750
3/4	10 UNC 16 UNF	.7406	.7500	1.355	1.438	.024	.396	3/8	.270	.050	2.000

SOCKET SET SCREWS (ALL POINT TYPES)



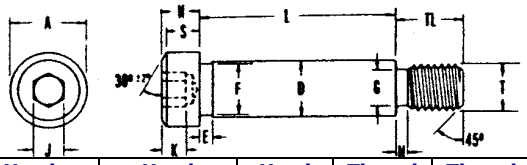
Screw Size		A		C	D	F	H	W	T	Tap Drill Size	
UNC	UNF	UNC	UNF				Min	Nom	Rad	UNC	UNF
---	#0-80 UNF-3A	---	.0600 .0568	.033 .027	.040 .037	.017 .013	.022	.028	.047	---	1.25 mm
#1-64 UNC-3A	#1-72 UNF-3A	.0730 .0692	.0730 .0695	.040 .033	.049 .045	.021 .017	.028	.035	.055	1.5 mm	1.5 mm
#2-56 UNC-3A	#2-64 UNF-3A	.0860 .0819	.0860 .0822	.047 .039	.057 .053	024 .020	.028	.035	.062	#50	1.85 mm
#3-48 UNC-3A	#3-56 UNF-3A	.0990 .0945	.0990 .0949	.054 .045	.066 .062	.027 .023	.040	.050	.078	#46	2.1 mm
#4-40 UNC-3A	#4-48 UNF-3A	.1120 .1069	.1120 .1075	.061 .051	.075 .070	.030 .026	.040	.050	.084	2.3 mm	#42
#5-40 UNC-3A	#5-44 UNF-3A	.1250 .1199	.1250 .1202	.067 .057	.083 .078	.033 .027	.050	.0625	.093	#37	#37
#6-32 UNC-3A	#6-40 UNF-3A	.1380 .1320	.1380 .1329	.074 .064	.092 .087	.038 .032	.050	.0625	.109	#33	#32
#8-32 UNC-3A	#8-36 UNF-3A	.1640 .1580	.1640 .1585	.087 .076	.109 .103	.043 .037	.062	.0781	.125	#29	3.5 mm
#10-24 UNC-3A	#10-32 UNF-3A	.1900 .1828	.1900 .1840	.102 .088	.127 .120	.049 .041	.075	.0937	.141	#24	#20
1/4-20 UNC-3A	1/4-28 UNF-3A	.2500 .2419	.2500 .2435	.132 .118	.156 .149	.0665 .0585	.100	.125	.188	#6	5.5 mm
5/16-18 UNC-3A	5/16-24 UNF-3A	.3125 .3038	.3125 .3053	.172 .156	.203 .195	.082 .074	.125	.1562	.234	G	1
3/8-16 UNC-3A	3/8-24 UNF-3A	.3750 .3656	.3750 .3678	.212 .194	.250 .241	.0987 .0887	.150	.1875	.281	O	8.6 mm
7/16-14 UNC-3A	7/16-20 UNF-3A	.4375 .4272	.4375 .4294	.252 .232	.296 .287	.114 .104	.175	.2187	.328	9.4 mm	25/64
1/2-13 UNC-3A	1/2-20 UNF-3A	.5000 .4891	.5000 .4919	.291 .270	.343 .334	.130 .120	.200	.250	.375	27/64	11.5 mm
9/16-12 UNC-3A	9/16-18 UNF-3A	.5625 .5511	.5625 .5538	.332 .309	.390 .379	.1456 .1356	.200	.250	.422	31/64	½
5/8-11 UNC-3A	5/8-18 UNF-3A	.6250 .6129	.6250 .6163	.371 .347	.468 .456	.164 .148	.250	.3125	.468	17/32	14.5 mm
3/4-10 UNC-3A	3/4-16 UNF-3A	.7500 .7371	.7500 .7406	.450 .425	.562 .549	.1955 .1795	.300	.375	.562	21.32	17.5 mm
7/8-9 UNC-3A	7/8-14 UNF-3A	.8750 .8611	.8750 .8647	.530 .502	.656 .642	.2267 .2107	.400	.500	.656	49/64	20.5 mm
1-8 UNC-3A	1-14 UNF-3A	1.0000 .9850	1.0000 .9897	.609 .579	.750 .734	.260 .240	.450	.5625	.750	7/8	23.5 mm
1-1/8-7 UNC-2A	1-1/8-12 UNF-2A	1.1250 1.1086	1.1250 1.1136	.689 .655	.843 .826	.291 .271	.450	.5625	.844	25 mm	1-3/64
1-1/4-7 UNC-2A	1-1/4-12 UNF-2A	1.2500 1.2336	1.2500 1.2386	.767 .733	.937 .920	.3225 .3025	.500	.625	.938	1-7/64	1-11/64
1-3/8-6 UNC-3A	1-3/8-12 UNF-2A	1.3750 1.3568	1.3750 1.3636	.848 .808	1.031 1.011	.3537 .3337	.500	.625	1.032	1-7/32	1-19/564
1-1/2-6 UNC-3A	1-1/2-12 UNF-2A	1.5000 1.4818	1.5000 1.4886	.926 .886	1.125 1.105	.385 .365	.600	.750	1.125	34 mm	36 mm

HEXAGON KEYS AND BITS



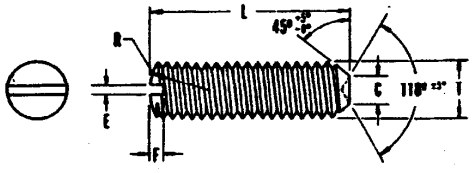
Nominal Key or Bit Socket Size		W		Y		B		C				R	L	K
		Hexagon Width Across Corners		Hexagon Width Across Corners		Length of Short Arm		Length of Long Arm				Radius of Bend	Length of Bit	Chamfer
								Short Series		Long Series				
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Min	=0.062	Max
---	0.028	0.0280	0.0275	0.0314	0.0300	0.312	0.125	1.312	1.125	2.688	2.500	0.062	---	0.003
---	0.035	0.0350	0.0345	0.0939	0.0378	0.438	0.250	1.312	1.125	2.766	2.578	0.062	---	0.004
---	0.050	0.0500	0.0490	0.0560	0.0540	0.625	0.438	1.750	1.562	2.938	2.750	0.062	---	0.006
1/16	0.062	0.0625	0.0615	0.0701	0.0680	0.656	0.469	1.844	1.656	3.094	2.906	0.062	---	0.008
5/64	0.078	0.0781	0.0771	0.0880	0.0859	0.703	0.516	1.969	1.781	3.281	3.094	0.078	---	0.008
3/32	0.094	0.0937	0.0927	0.1058	0.1035	0.750	0.562	2.094	1.906	3.469	3.281	0.094	---	0.009
7/64	0.109	0.1094	0.1079	0.1238	0.1210	0.797	0.609	2.219	2.031	3.656	3.469	0.109	---	0.014
1/8	0.125	0.1250	0.1235	0.1418	0.1390	0.844	0.656	2.344	2.156	3.844	3.656	0.125	--	0.015
9/64	0.141	0.1406	0.1391	0.1593	0.1566	0.891	0.703	2.469	2.281	4.031	3.844	0.141	---	0.016
5/32	0.156	0.1562	0.1547	0.1774	0.1745	0.938	0.750	2.594	2.406	4.219	4.031	0.156	---	0.016
3/16	0.188	0.1875	0.1860	0.2135	0.2105	1.031	0.844	2.844	2.656	4.594	4.406	0.188	---	0.022
7/32	0.219	0.2187	0.2172	0.2490	0.2460	1.125	0.938	3.094	2..906	4.969	4.781	0.219	---	0.024
1/4	0.250	0.2500	0.2485	0.2845	0.2815	1.219	1.031	3.344	3.156	5.344	5.156	0.250	---	0.030
5/16	0.312	0.3125	0.3110	0.3570	0.3531	1.344	1.156	3.844	3.656	6.094	5.906	0.312	---	0.032
3/8	0.375	0.3750	0.3735	0.4285	0.4238	1.469	1.281	4.344	4.156	6.844	6.656	0.375	---	0.044
7/16	0.438	0.4375	0.4355	0.5005	0.4944	1.594	1.406	4.844	4.656	7.594	7.406	0.438	---	0.047
1/2	0.500	0.5000	0.4975	0.5715	0.5650	1.719	1.531	5.344	5.156	8.344	8.156	0.500	---	0.050
9/16	0.562	0.5625	0.5600	0.6420	0.6356	1.844	1.656	5.844	5.656	9.094	8.906	0.562	---	0.053
5/8	0.625	0.6250	0.6225	0.7146	0.7080	1.969	1.781	6.344	6.156	9.844	9.656	0.625	---	0.055
3/4	0.750	0.7500	0.7470	0.8580	0.8512	2.219	2.031	7.344	7.156	11.344	11.156	0.750	---	0.070
7/8	0.875	0.8750	0.8720	1.0020	0.9931	2.469	2.281	8.344	8.156	12.844	12.656	0.875	---	0.076
1	1.000	1.0000	0.9970	1.1470	1.1350	2.719	2.531	9.344	9.156	14.344	14.456	1.000	---	0.081
1-1/4	1.250	1.2500	1.2430	---	---	3.250	2.750	11.500	11.000	---	---	1.250	3.750	0.092
1-1/2	1.500	1.5000	1.4930	---	---	3.750	3.250	13.500	13.000	---	---	1.500	4.500	0.104
1-3/4	1.750	1.7500	1.7430	---	---	4.250	3.750	15.500	15.000	---	---	1.750	5.250	0.115
2	2.000	2.0000	1.9930	---	---	4.750	4.250	17.500	17.000	---	---	2.000	6.000	0.126
2-1/4	2.250	2.2500	2.2430	---	---	5.250	4.750	19.500	19.000	---	---	2.250	6.750	0.137
2-3/4	2.750	2.7500	2.7420	---	---	6.250	5.750	23.500	23.000	---	---	2.750	8.250	0.159
3	3.000	3.0000	2.9920	---	---	6.750	6.250	25.500	25.000	---	---	3.000	9.000	0.171

SOCKET HEAD SHOULDER SCREWS



GROUND ON BODY AND UNDERSIDE OF HEAD—BLUE-BLACK RUST RESISTANT FINISH

Shoulder Diameter D			Head Diameter A		Head Weight H		Head Side Height S	Thread Size T	Thread Length TL	Thread Neck Width N	Thread Neck Diam G	Hexagon Socket Size J	Key Engage-ment K	Shoulder Neck Width E	Shoulder Neck Diam F
Nom	Min	Max	Min	Max	Min	Max	Min	Nom		Max	Min	Nom	Min	Max	Min
1/4	.2460	.2480	.357	3/8	.182	3/16	.157	#10-24 NC	3/8	.062	.133	1/8	.094	.093	.236
5/16	.3085	.3105	.419	7/16	.213	7/32	.183	1/4-20 UNC	7/16	.075	.182	5/32	.117	.093	.298
3/8	.3710	.3730	.543	9/16	.244	1/4	.209	5/16-18 UNC	1/2	.083	.237	3/16	.141	.093	.361
1/2	.4960	.4980	.729	3/4	.306	5/16	.262	3/8-16 UNC	5/8	.093	.291	1/4	.188	.093	.486
5/8	.6210	.6230	.853	7/8	.368	3/8	.315	1/2-13 UNC	3/4	.115	.397	5/16	.234	.093	.603
3/4	.7460	.7480	.977	1	.492	1/2	.421	5/8-11 UNC	7/8	.136	.502	3/8	.281	.093	.728

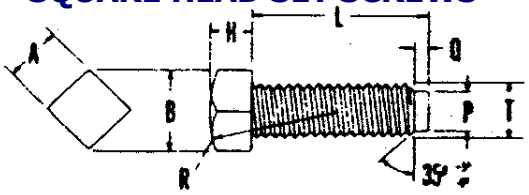


SLOTTED SET SCREWS

Threads to Class 2A Tolerance

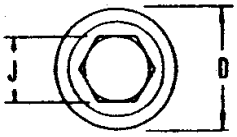
Thread Size T		Cup Diameter C		Slot Width E	Slot Depth F	Radius R	Thread Size T		Cup Diameter C		Slot Width E	Slot Depth F	Radius R
Nom	Threads Per Inch	Min	Max	Nom	Nom	Nom	Nom	Threads Per Inch	Min	Max	Nom	Nom	Nom
#6	32 NC	.064	.074	.025	.035	.138	3/8	16 UNC	.194	.212	.064	.094	.375
#8	32 NC	.076	.087	.029	.041	.164	7/16	14 UNC	.232	.252	.072	.109	.438
#10	24 NC	.088	.102	.032	.048	.190	1/2	13 UNC	.270	.291	.081	.125	.500
#10	32 NF						5/8	11 UNC	.347	.371	.102	.156	.625
1/4	20 UNC	.118	.132	.045	.063	.250	3/4	10 UNC	.425	.450	.129	.188	.750
5/16	18 UNC	.156	.172	.051	.078	.313							

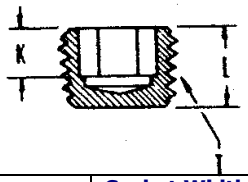
SQUARE HEAD SET SCREWS



Thread Size		Head Height			Width Across Flats			Width Across Corners	Radius	Cup Point Diameter			Lgth Half Cup Point
T		H			A			B	R	P			Q
Nom	Thrds / In.	Nom	Min	Max	Nom	Min	Max	Min	Nom	Nom	Min	Max	Nom
1/4	20 UNC	3/16	.178	.196	1/4	.241	.2500	.331	5/8	5/32	.149	.156	1/16
5/16	18 UNC	15/64	.224	.245	5/16	.302	.3125	.415	25/32	13/64	.195	.203	5/64
3/8	16 UNC	9/32	.270	.293	3/8	.362	.3750	.497	15/16	1/4	.241	.250	3/32
7/16	14 UNC	21/64	.315	.341	7/16	.423	.4375	.581	1-3/32	19/64	.287	.297	7/64
1/2	13 UNC	3/8	.361	.389	1/2	.484	.5000	.665	1-1/4	11/32	.334	.344	1/8
5/8	11 UNC	15/32	.452	.485	5/8	.606	.6250	.833	1-9/16	15/32	.456	.469	5/32
3/4	10 UNC	9/16	.544	.582	3/4	.729	.7500	1.001	1-7/8	9/16	.549	.563	3/16
7/8	9 UNC	21/32	.635	.678	7/8	.852	.8750	1.170	2-3/16	21/32	.656	.642	7/32
1	8 UNC	3/4	.729	.774	1	.974	1.0000	1.337	2-1/2	3/4	.750	.734	1/4

SOCKET PIPE PLUGS





Thread Size		Diam @ Large End	Length	Socket Width Across Flats		Thread Size		Diam @ Large End	Length	Socket Width Across Flats	
T		D	L	J		T		D	L	J	
Nom	Thrds / In	Max	Nom	Min	Max	Nom	Thds / In.	Max	Nom	Min	Max
1/16	27 NPT	.3125	5/16	.1562	.1582	1/2	14 NPT	.8400	9/16	.3750	.3780
1/8	27 NPT	.4050	5/16	.1875	.1895	3/4	14 NPT	1.0500	5/8	.5625	.5655
1/4	18 NPT	.5400	7/16	.2500	.2520	1	11-1/2 NPT	1.3150	3/4	.6250	.6290
3/8	18 NPT	.6750	1/2	.3125	.3155	1-1/4	11-1/2 NPT	1.6600	13/16	.7500	.7540

Socket Depth (K). The depth of socket shall be as great as practicable but varying conditions render it inadvisable to specify definite values for this dimension.

TYPICAL PHYSICAL PROPERTIES OF SOCKETS

Product	Ultimate Tensile Strength P.S.I.		Yield Point P.S.I.		Min % Elong. in 2"	Min Reduction In Area %	Hardness Rockwell "C"
	Min	Max	Min	Max			
Socket Head Cap Screws (Alloy)	160,000	185,000	135,000	160,000	10	38	36-40
Socket Set Screws (Alloy)	245,000	275,000	225,000	255,000	8	25	45-53
Socket Shoulder Screws	160,000	185,000	135,000	160,000	10	38	36-40
Socket Pipe Plugs	160,000	185,000	135,000	160,000	10	38	36-40
Sq. Hd Cup Pt Set Screws	245,000	275,000	225,000	255,000	8	25	48-52
Hexagon Keys	---	---	---	---	---	---	50.54
Dowel Pins	250,000	275,000	225,000	250,000	10	---	60-64 Surface 50-54 Core

SET SCREW POINT TERMINOLOGY

Flat Point: One of the least expensive pointing operations applied at the time of heading. This operation provides an end chamfer starting with a diameter smaller than the root diameter of the thread. The minimum reduction of the point is approximately 10% below the maximum minor diameter with an included angle of 40° to 50°.

Dog Point: A straight pointed section reduced in diameter slightly below the root diameter of the thread, usually extending in length about two-thirds the diameter of the thread. Recommended for ease in starting, to ensure against stripping fine threaded products, and to increase efficiency along production lines.

Rolled Point: An efficient method of producing pointed long studs or long screws with an end chamfer similar to the Flat Point. The last thread and a half is slightly cupped by the thread rollover operation.

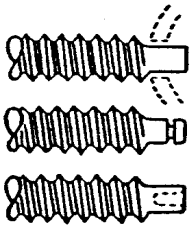
Pinch Point (Rounded): An inexpensive method of applying a 60° lead-in point having a slightly rounded contour but with pinch-off marks on its surface. Used for aligning several sheets or assembling several parts requiring pilot action.

Nail Point (Pinched): Usually supplied with an approximate 45° included angle having a sharp point and slightly squared surface. Used for impinging or locking against wood or other soft material. Other degrees of included angle and sharpness are available.

Cupped Point: A special cup section supplied on the end of the threaded member having a depression in the end to reduce the area in contact with the surface which increases its holding and locking power under pressure.

Round Point: A dome-like rounded surface applied to the end of a threaded member in order to offer pressure without disfigurement. Used for adjusting members where friction without cutting action is desired.

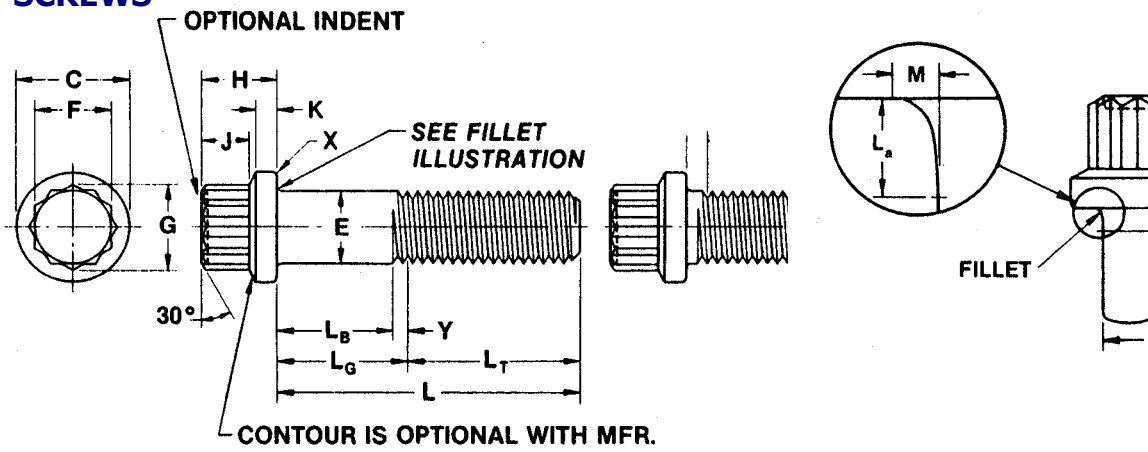
Cone Point: A precision cut-pointing operation to provide any required included angle. Offers a smooth surface, accurate length, and a sharp point that can be produced to any desired contour to fit your particular requirements.



Cut Points: We illustrate a variety of tenon ends that can be supplied in the form of straight cut points wherein the diameter of the tenon end is substantially below the root diameter of the thread and a square abutment surface is required. As illustrated, this style of point offers excellent bearing surface when assembled into prepared washers or other assemblies requiring free turning pressure surfaces, as in clamps, etc.

Cut points can also be grooved for special locking rings, cupped for ease in riveting operating, or machined to other contours to meet your specific requirements.

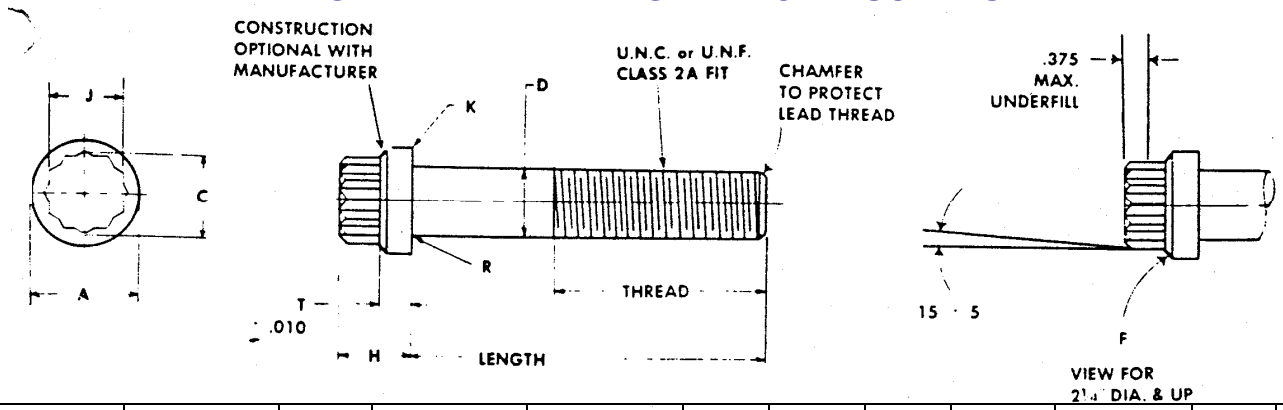
FLANGE 12-POINT SCREWS



Nominal Size or Basic		E	C		F		G	H	J	K	Runout of Bearing Surface FIM	M		L_a	Bearing Surface Juncture Radius	X	A	
		Body Diam Min (Max Equal to Nom Size)	Flange Diameter		Width Across Flats		Width Across Corners	Head Height	Wrenching Height	Flange Thickness		Fillet Extension		Fillet Lgth		Chamfer or Radius	Gaging Ring Thickness	
			Max	Min	Max	Min	Min	Max	Min	Min	Max	Max	Min	Max	Min	Max	Max	Min
1/4	0.2500	0.2435	0.375	0.365	0.252	0.244	0.278	0.260	0.15	0.058	0.007	0.014	0.009	0.087	0.007	0.020	0.0525	0.052
5/16	0.3125	0.3053	0.469	0.457	0.315	0.306	0.348	0.312	0.18	0.074	0.008	0.017	0.012	0.087	0.009	0.020	0.0600	00597
3/8	0.3750	0.3678	0.562	0.550	0.377	0.368	0.420	0.375	0.21	0.095	0.010	0.020	0.015	0.087	0.012	0.020	0.0711	0.070
7/16	0.4375	0.4294	0.656	0.642	0.438	0.429	0.489	0.438	0.26	0.109	0.011	0.023	0.018	0.087	0.014	0.030	0.0840	0.083
1/2	0.5000	0.4919	0.750	0.735	0.502	0.493	0.562	0.500	0.29	0.129	0.013	0.026	0.020	0.087	0.016	0.030	0.0948	0.094
9/16	0.5625	0.5538	0.844	0.828	0.564	0.555	0.633	0.563	0.33	0.145	0.015	0.029	0.022	0.157	0.018	0.030	0.1071	0.106
5/8	0.6250	0.6163	0.938	0.921	0.627	0.618	0.705	0.625	0.36	0.166	0.016	0.032	0.024	0.157	0.021	0.040	0.1179	0.117
3/4	0.7500	0.7406	1.125	1.107	0.752	0.743	0.847	0.750	0.44	0.200	0.020	0.039	0.030	0.157	0.025	0.040	0.1416	0.141
7/8	0.8750	0.8647	1.312	1.293	0.877	0.866	0.987	0.875	0.51	0.234	0.023	0.044	0.034	0.227	0.031	0.040	0.1656	0.165
1	1.0000	0.9886	1.500	1.479	1.003	0.991	1.130	1.000	0.60	0.268	0.026	0.050	0.040	0.332	0.034	0.040	0.1893	0.189
1-1/8	1.1250	1.1086	1.688	1.665	1.128	1.115	1.271	1.125	0.66	0.310	0.029	0.055	0.045	0.332	0.039	0.050	0.2109	0.210
1-1/4	1.2500	1.2336	1.875	1.852	1.253	1.240	1.414	1.250	0.73	0.350	0.033	0.060	0.050	0.332	0.044	0.050	0.2331	0.232
1-3/8	1.3750	1.3568	2.062	2.038	1.378	1.365	1.556	1.375	0.80	0.392	0.036	0.065	0.055	0.332	0.048	0.050	0.2544	0.254
1-1/2	1.5000	1.4818	2.250	2.224	1.503	1.489	1.697	1.500	0.87	0.433	0.039	0.070	0.060	0.332	0.052	0.050	0.2763	0.276

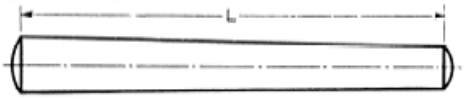
Material – Alloy Steel (Typically AISI 8640, but can be made from other alloys as well.
Length and thread length specifications are in accordance with ANSI B18.3.

LARGE DIAMETER FLANGE 12-POINT SCREWS



Size	D		A		C	H		J		K	T	F	Socket Wrench Size	R		Thrds per Inch	Pitch Diameter
	Diameter of Body		Diameter of Collar		Across Corn.	Height of Head		Across Flats		Break Edge	Hght of Collar	Rad Top of Collar		Radius			
	Max	Min	Max	Min	Min	Max	Min	Max	Min	Max				Max	Min		
1-1/8	1.125	1.109	1.684	1.665	1.276	1.125	1.111	1.128	1.117	.015	7/16	--	1-1/8	.055	.045	7 12	1.0300-1.0228 1.0691-1.0631
1-1/4	1.250	1.234	1.871	1.852	1.418	1.250	1.236	1.254	1.241	.015	31/64	--	1-1/4	0.60	0.50	7 12	1.1550-1.1476 1.1941-1.1879
1-3/8	1.375	1.357	2.058	2.038	1.561	1.375	1.360	1.379	1.366	.015	17/32	--	1-3/8	.060	.055	6 12	1.2643-1.2563 1.3190-1.3127
1-1/2	1.500	1.482	2.245	2.224	1.705	1.500	1.485	1.505	1.491	.015	19/32	--	1-1/2	.070	.060	6 12	1.3893-1.3812 1.4440-1.4376
1-3/4	1.750	1.730	2.620	2.597	1.985	1.750	1.734	1.755	1.740	.015	3/4	--	1-3/4	.080	.070	5 8	1.6174-1.6085 1.6665-1.6590
2	2.000	1.980	2.995	2.970	2.268	2.000	1.983	2.005	1.990	0.15	7/8	--	2	.090	.075	4-1/2 8	1.8528-1.8433 1.9165-1.9087
2-1/4	2.250	2.227	3.375	3.344	2.480	2.250	2.232	2.255	2.200	.030	1	.100 .060	2-1/4	.125	.100	4-1/2 8	2.1028-2.0931 2.1664-2.1584
2-1/2	2.500	2.477	3.750	3.717	2.760	2.500	2.481	2.505	2.455	.030	1-7/64	.100 .060	2-1/2	.150	.110	4 8	2.3345-2.3241 2.4164-2.4082
2-3/4	2.750	2.727	4.125	4.090	3.040	2.750	2.730	2.755	2.700	.030	1-7/32	.150 .090	2-3/4	.150	.110	4 8	2.5844-2.5739 2.6663-2.6580
3	3.000	2.977	4.500	4.464	3.320	3.000	2.979	3.005	2.950	.030	1-11/32	.150 .090	3	.190	.150	4 8	2.8344-2.8237 2.9162-2.9077

TAPER PINS



Dimensions of Taper Pins

Number	7/0	6/0	5/0	4/0	3/0	2/0	0	1	2	3	4	5	6	7	8	9	10
Size (Large End)	0.0625	0.0780	0.0940	0.1090	0.1250	0.1410	0.1560	0.1720	0.1930	0.2190	0.2500	0.2890	0.3410	0.4090	0.4920	0.5910	0.7060
Length, L																	
0.375	X	X															
0.500	X	X	X	X	X	X	X										
0.625	X	X	X	X	X	X	X										
0.750		X	X	X	X	X	X	X	X	X							
0.875					X	X	X	X	X	X							
1.000			X	X	X	X	X	X	X	X	X	X					
1.250						X	X	X	X	X	X	X	X				
1.500							X	X	X	X	X	X	X				
1.750								X	X	X	X	X	X				
2.000								X	X	X	X	X	X	X	X		
2.250									X	X	X	X	X	X	X		
2.500									X	X	X	X	X	X	X		
2.750										X	X	X	X	X	X	X	
3.000										X	X	X	X	X	X	X	
3.250													X	X	X	X	
3.500													X	X	X	X	X
3.750													X	X	X	X	X
4.000													X	X	X	X	X
4.250															X	X	X
4.500															X	X	X
4.750															X	X	X
5.000															X	X	X
5.250																X	X
5.500																X	X
5.750																X	X
6.000																X	X

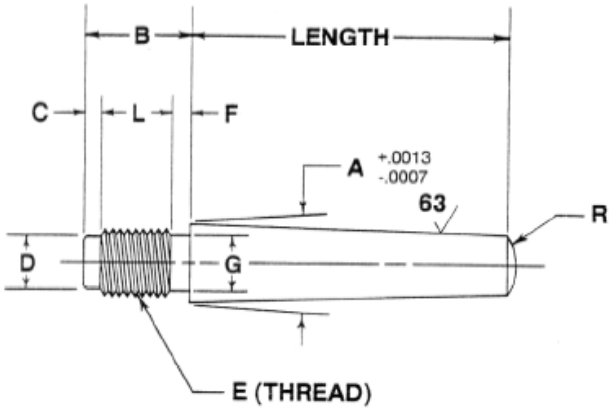
All dimensions are given in inches. Standard reamers are available for pins given above the line.

Pins Nos. 11 (size 0.8600), 12 (size 1.032), 13 (size 1.241), and 14 (1.523) are special sizes—hence their lengths are special.

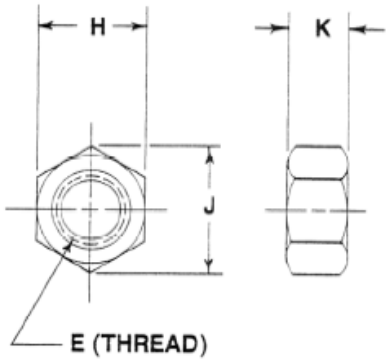
To find small diameter of pin, multiply the length by 0.02083 and subtract the result from the large diameter.

TYPES	COMMERCIAL TYPE	PRECISION TYPE
Sizes	7/0 to 14	7/0 to 10
Tolerance on Diameter	(+0.0013, − 0.0007)	(+0.0013, − 0.0007)
Taper	¼ In. per Ft.	¼ In. per Ft.
Length Tolerance	(±0.030)	(±0.030)
Concavity Tolerance	None	0.0005 up to 1 in. long 0.001 1 1/16 to 2 in. long 0.002 2 1/16 and longer

THREADED TAPER PINS



NOTE: Tolerances unless otherwise specified:
Taper 1/4" per foot or 0.02083" per inch.
Fractions ± .010 Decimals ± .005

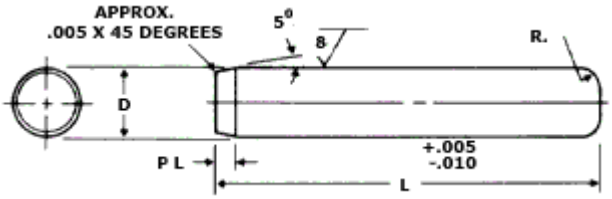


Finished Hex Nut
SAE Fine Thread
(Except #0 & #1 Sizes)

NUMBER OF TAPER PIN	LARGE END DIA. A	THREAD END LENGTH B	NOSE LENGTH C	NOSE DIA. D	UNF FINE THREAD E	NECK WIDTH F	NECK DIA. G	REF. THREAD LENGTH L	APPROX. END RADIUS R	HEX ACROSS FLATS H	HEX ACROSS CORNERS J	HEX NUT THICK. K
0	.154	7/32	1/16	3/32	6-32 NC	—	—	5/32	5/32	5/16	11/32	7/64
1	.170	1/4	1/16	7/64	8-32 NC	1/16	.118	1/8	3/16	11/32	3/8	1/8
2	.191	1/4	1/16	9/64	10-32	1/16	.144	1/8	7/32	3/8	27/64	1/8
3	.217	1/4	1/16	9/64	10-32	1/16	.144	1/8	7/32	3/8	27/64	1/8
4	.248	13/32	5/64	3/16	1/4-28	3/32	.198	15/64	9/32	7/16	31/64	7/32
5	.287	13/32	5/64	3/16	1/4-28	3/32	.198	15/64	9/32	7/16	31/64	7/32
6	.339	15/32	5/64	15/64	5/16-24	3/32	.253	19/64	11/32	1/2	9/16	17/64
7	.407	9/16	5/64	19/64	3/8-24	3/32	.315	25/64	13/32	9/16	5/8	21/64
8	.490	11/16	7/64	11/32	7/16-20	1/8	.368	29/64	1/2	11/16	49/64	3/8
9	.589	3/4	7/64	13/32	1/2-20	1/8	.430	33/64	9/16	3/4	27/32	7/16
10	.704	15/16	7/64	17/32	5/8-18	1/8	.547	45/64	11/16	15/16	1 1/16	35/64
11	.858	1 1/8	1/8	41/64	3/4-16	5/32	.663	27/32	7/8	1 1/8	1 1/4	41/64
12	1.030	1 9/32	9/64	3/4	7/8-14	3/16	.777	61/64	1 1/4	1 5/16	1 29/64	3/4
13	1.239	1 9/32	9/64	3/4	7/8-14	3/16	.777	61/64	1 1/4	1 5/16	1 29/64	3/4
14	1.521	1 7/16	3/16	1	1 1/8-12	3/16	1.000	1 1/16	1 1/2	1 11/16	1 55/64	31/32

Threaded Taper Pins are used whenever a taper pin has to be removed from the driven side! Threaded Taper are .002" smaller on the large end diameter than Standard Taper Pins to allow the Threaded Taper Pin to be inserted approx. 3/32" deeper into the taper-reamed hole. The large end of the Threaded Taper Pin is recessed below the surface which allows the nut to bear on the surface when tightened to pull the pin out. Threaded Taper Pins are used when it is inconvenient or impractical to remove a Standard Taper Pin by striking the small end. Diameters of Threaded Taper Pins allow them to be used interchangeably with Plain Taper Pins.

DOWEL PINS



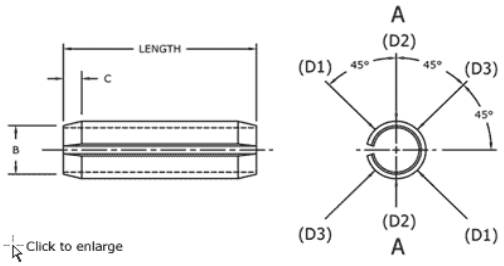
NOMINAL SIZE	DIAMETER D				P L (1)	R
	STANDARD PIN		OVERSIZE PIN		POINT LENGTH (REF)	TOP RADIUS BASIC
	MAX	MIN.	MAX.	MIN.	MAX.	MIN.
1/8	0.1253	0.1251	0.1261	0.1259	0.045	0.031
3/16	0.1878	0.1876	0.1886	0.1884	0.060	0.046
1/4	0.2503	0.2501	0.2511	0.2509	0.070	0.062
5/16	0.3128	0.3126	0.3136	0.3134	0.070	0.062
3/8	0.3753	0.3751	0.3761	0.3759	0.080	0.078
7/16	0.4378	0.4376	0.4386	0.4384	0.090	0.093
1/2	0.5003	0.5001	0.5011	0.5009	0.090	0.125
5/8	0.6253	0.6251	0.6261	0.6259	0.090	0.125
3/4	0.7503	0.7501	0.7511	0.7509	0.120	0.125
7/8	0.8753	0.8751	.8761	0.8759	0.120	0.125
1	1.0003	1.0001	1.0011	1.0009	0.120	0.125

Hardened and ground alloy steel, surface hardness 60 RC+
Core hardness 58-60 RC
ANSI B18.8.2

Diameter tolerances +.0000, -.0002
Length Tolerances +/- .010

Also available in 303 Stainless

ROLLPINS



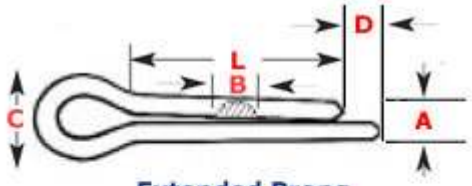
Dia (A) **Length**

		1/16	5/64	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2	5/8	¾
3/16	.187	0.1	0.2	.26											
1/4	.250	0.2	0.2	0.3	.60										
5/16	.312	0.2	0.3	0.4	.75										
3/8	.375	0.2	0.3	0.5	.89										
7 16	.437	0.3	0.4	0.6	1.0	1.5									
1/2	.500	0.3	0.5	0.7	1.1	1.7	2.5	3.5	4.5						
9/16	.562	0.3	0.5	0.8	1.3	1.9	2.9	4.0	5.0						
5/8	.625	0.4	0.6	0.8	1.5	2.1	3.2	4.5	5.3		13.0				
11/16	.687	0.4	0.6	0.9	1.6	2.4	3.5	4.7	5.9						
3/4	.750	0.5	0.7	1.0	1.8	2.6	3.8	5.3	6.3	9.9	150				
13/16	.812	0.5	0.7	1.1	1.9	2.8	4.1	5.8	6.9	11.0					
7/8	.875	0.5	0.8	1.2	2.1	3.0	4.5	6.2	7.4	12.0	18.0				
15/16	.937	0.6	0.9	1.3	2.2	3.2	4.8	6.7	8.0	12.5					
1	1.000	0.6	0.9	1.4	2.4	3.4	5.1	7.0	8.5	13.0	20.0	24.0		26.0	
1 1/8	1.125		1.0	1.5	2.7	3.8	5.7	7.9	9.5	14.0	23.0				
1 1/4	1.250		1.2	1.7	3.0	4.3	6.4	8.8	11.0	16.0	24.0	30.0	41.0	33.0	
1 3/8	1.375		1.4	1.8	3.3	4.7	7.0	9.7	12.0	18.0					
1 1/2	1.500		1.4	2.0	3.6	5.1	7.6	11.0	13.0	19.0	29.0	36.0	49.0	38.0	58.0
1 5/8	1.625				3.9	5.5	8.3	12.0	14.0	21.0					
1 3/4	1.750				4.2	6.0	8.9	12.5	15.0	22.0	34.0	42.0	57.0	48.0	
1 7/8	1.875				4.5	6.4	9.6	13.0	16.0	24.0				49.0	
2	2.000				4.7	6.8	10.0	14.0	17.0	25.0	38.0	48.0	65.0	50.0	76.0
2 1/4	2.250					7.8	12.0	16.0	19.0	29.0	43.0	54.0	73.0	59.0	86.0
2 1/2	2.500					8.6	13.0	18.0	21.0	32.0	48.0	60.0	81.0	64.0	96.0
2 3/4	2.750							19.0	23.0	35.0	53.0	66.0	89.0	72.0	105.0
3	3.000							21.0	25.0	38.0	58.0	72.0	97.0	76.0	116.0
3 1/4	3.250								28.0	41.0	62.0	77.0	105.0	85.0	124.0
3 1/2	3.500								31.0	44.0	67.0	83.0	114.0	88.0	134.0
3 3/4	3.750									48.0	72.0	89.0	122.0	97.0	103.0
4	4.000									51.0	77.0	95.0	130.0	102.0	154.0

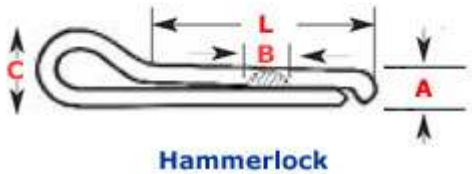
Cotter Pins

Cotter Pin Size Range

Diameter (inch)	Lengths (inch)
1/32 and 3/64	1/4 thru 1-1/2
1/16	1/4 thru 3
3/32 and 5/64	1/2 thru 4
1/8 and 7/64	1/2 thru 4
5/32 and 9/64	3/4 thru 4
3/16	3/4 thru 4
1/4 and 7/32	1 thru 6
5/16	1 thru 6
3/8	1-1/2 thru 18
1/2 and 7/16	2 thru 22
5/8	3 thru 22
3/4	3 thru 22
7/8	to order
1	to order
1-1/4	to order



Extended Prong
Chisel Point



Hammerlock

DESCRIPTION	PAGE
Washers	
USS Wrought Washers	6-1
Stainless Steel Washers	6-2 to 6-3
S.A.E. Washers	6-4
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Spring Lock Washers	6-6 to 6-7
Tooth Lock Washers	6-8 to 6-10
Belleville Washers	6-11 to 6-12

USS WROUGHT WASHERS

Bolt Size Inches	Estimated Pieces per 100 Lbs	Approx. Lbs. per 1000 Pieces	Outside Diameter Inches	Size of Hole Inches	Thickness U.S. Plate Gauge
#10 (3/16)	36200	2.8	9/16	1/4	#18 (3/64)
1/4	14900	6.7	3/4	5/16	#16 (1/16)
5/16	9000	11.1	7/8	3/8	#14 (5/64)
3/8	6700	14.9	1	7/16	#14 (5/64)
7/16	4100	24.4	1-1/4	1/2	#14 (5/64)
1/2	2600	38.5	1-3/8	9/16	#14 (5/64)
9/16	2200	45.5	1-1/2	5/8	#12 (7/64)
5/8	1300	77.0	1-3/4	11/16	#10 (9/64)
3/4	910	110.0	2	13/16	#9 (5/32)
7/8	650	153.0	2-1/4	15/16	#8 (11/64)
1	530	188.0	2-1/2	1-1/16	#8 (11/64)
1-1/8	450	220.0	2-3/4	1-1/4	#8 (11/64)
1-1/4	380	260.0	3	1-3/8	#8 (11/64)
1-3/8	300	333.0	3-1/4	1-1/2	#7 (3/16)
1-1/2	260	385.0	3-1/2	1-5/8	#7 (3/16)
1-5/8	230	440.0	3-3/4	1-3/4	#7 (3/16)
1-3/4	200	500.0	4	1-7/8	#7 (3/16)
2	159	630.0	4-1/2	2-1/8	#7 (3/16)
2-1/4	121	826.0	4-3/4	2-3/8	#5 (7/32)
2-1/2	104	961	5	2-5/8	.210/.280
2-3/4	90	1100	5-1/4	2-7/8	.228/.310
3	86	1300	5-1/2	3-1/8	.249/.327

NOTE: For structural washers, please see the high-strength structural bolting section (Section 3).

STAINLESS STEEL COMMERCIAL FLAT WASHERS
18-8 AND 316

Bolt Size Inches	O.D. Inches	I.D. Inches	Thickness Inches
1/4	5/8	9/32	.050
5/16	3/4	11/32	.050
3/8	7/8	13/32	.050
1/2	1-1/4	17/32	.078
9/16	1-3/8	5/8	.093
5/8	1-1/2	11/16	.078
3/4	1-7/8	13/16	.125
7/8	2	15/16	.125
1	2	1-1/16	.125
1-1/8	2-1/2	1.1875	
1-1/4	2-3/4	1.3120	
1-1/2	3-1/4	1.5620	

STAINLESS STEEL FLAT WASHERS
AN 960C

Bolt Size Inches	AN Specification	O.D. Inches	I.D. Inches	Thickness Inches
No. 3	AN-960-C-3	.250	.109	1/32
No. 4	AN-960-C-4	.3125	.125	1/32
No. 6	AN-960-C-6	.375	.149	1/32
No. 8	AN-960-C-8	.375	.174	1/32
No. 10	AN-960-C-10L	.4375	.203	1/32
No. 10	AN-960-C-10	.4375	.203	1/16
1/4	AN-960-C-416L	.500	.265	1/32
1/4	AN-960-C-416	.500	.265	1/16
5/16	AN-960-C-516	.5625	.328	1/16
3/8	AN-960-C-616	.625	.390	1/16
7/16	AN-960-C-716	.750	.453	1/16
1/2	AN-960-C-816	.875	.516	1/16
9/16	AN-960-C-916	1.0625	.578	1/16
5/8	AN-960-C-1016	1.1875	.641	1/16
3/4	AN-960-C-1216	1.3125	.766	3/32
7/8	AN-960-C-1416	1.500	.890	3/32
1	AN-960-C-1616	1.750	1.016	3/32

STAINLESS STEEL MS FLAT WASHERS
MS 15795

Bolt Size	I.D. Inches	O.D. Inches	Thickness		MS Dash No.
			Max	Min	
0	.078	.187	.025	.016	-801
2	.093	.250	.025	.016	-802
4	.125	.250	.028	.017	-803
4	.125	.312	.040	.025	-804
6	.156	.312	.048	.027	-805
6	.156	.375	.065	.036	-806
8	.187	.375	.065	.036	-807
10	.218	.437	.065	.036	-808
10	.250	.562	.080	.051	-809
¼	.281	.625	.080	.051	-810
¼	.312	.750	.080	.051	-811
5/16	.343	.687	.080	.051	-812
5/16	.375	.875	.104	.064	-813
3/8	.406	.812	.080	.051	-814
3/8	.437	1.000	.104	.064	-815
7/16	.468	.921	.080	.051	-816
7/16	.500	1.250	1.04	.064	-817
½	.531	1.062	.121	.074	-818
½	.562	1.375	.132	.086	-819
5/8	.656	1.312	.121	.074	-820
5/8	.687	1.750	.160	.108	-821
¾	.812	1.500	.160	.108	-822
¾	.812	2.000	.177	.122	-823
7/8	.937	1.750	.160	.108	-824
7/8	.937	2.250	.192	.136	-825
1	1.062	2.000	.160	.108	-826
1	1.062	2.500	.192	.136	-827

S.A.E. WASHERS

O.D.	I.D.	Thickness Gauge	Size of Bolt	Est. Pcs. per 100 lbs.	Approx. Wt. per 1000
3/8	8/32	#18	#6 (1/8)	79000	1.26
7/16	3/16	#18	#8 (5/32)	58500	1.7
1/2	7/32	#18	#10 (3/16)	43500	2.3
9/16	1/2	#18	#12 (7/32)	36200	2.8
5/8	9/32	#16	1/4	22200	4.5
11/16	11/32	#16	5/16	19200	5.2
13/16	13/32	#16	3/8	14000	7.2
59/64	15/32	#16	7/16	10500	9.5
1-1/16	17/32	#13	1/2	5500	18.3
1-3/16	19/32	#13	9/16	4300	23.4
1-5/16	21/32	#13	5/8	3600	27.7
1-1/2	13/16	#10	3/4	2100	47.4
1-3/4	15/16	#10	7/8	1600	63.0
2"	1-1/16	#10	1"	1200	83.0
2-1/4	1-3/16	#10	1-1/8	920	109.0
2-1/2	1-5/16	#9	1-1/4	630	160.0
2-3/4	1-7/16	#9	1-3/8	525	190.0
3"	1-9/16	#9	1-1/2	425	240.0

BRASS WASHERS

Size of Mach. Screw or Bolt	Outside Diam.	Inside Diam.	Thickness B&S Gauge	Est. Pcs per lb.	Approx. Wt. per 1000
Small Pattern					
No. 0	7/32	.070	.015 (#26)	6670	.15
No. 1	7/32	.083	.018 (#25)	5555	.18
No. 2	7/32	.093	.020 (#24)	5200	.19
No. 3	1/4	.110	.020 (#24)	4200	.24
No. 4	9/32	.125	.025 (#22)	2700	.37
No. 6	5/16	.147	.028 (#21)	1920	.52
No. 8	3/8	.172	.032 (#20)	1190	.84
No. 10	7/16	.200	.036 (#19)	760	1.3
No. 12	1/2	.228	.040 (#18)	525	1.9
No. 14	9/16	.264	.040 (#18)	425	2.36
No. 16	5/8	.283	.040 (#18)	340	3.0
No. 18	11/16	.312	.051 (#16)	230	4.35
No. 20	3/4	.343	.064 (#14)	150	6.7
No. 24	7/8	.393	.064 (#14)	110	9.1
Large Pattern					
No. 6	3/8	.150	.032 (#20)	1100	.91
No. 8	7/16	.172	.036 (#19)	720	1.39
No. 10	1/2	.200	.040 (#18)	490	2.05
No. 12	9/16	.228	.040 (#18)	390	2.57
No. 14	11/16	.264	.051 (#16)	202	4.95
No. 16	3/4	.283	.064 (#14)	135	7.4
No. 18	7/8	.312	.064 (#14)	100	10.0
No. 20	7/8	.343	.064 (#14)	107	9.35
No. 24	1"	.393	.081 (#12)	62	16.1

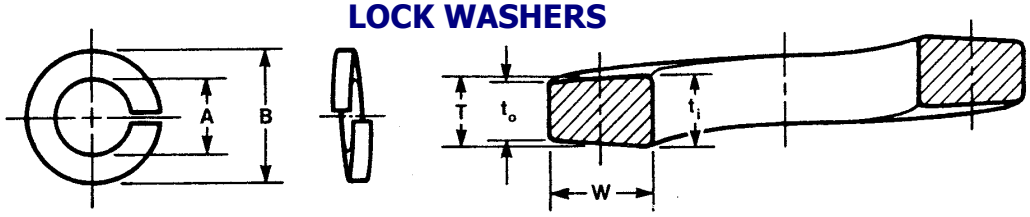
BRASS WASHERS (continued)

Size of Mach. Screw or Bolt	Outside Diam.	Inside Diam.	Thickness B&S Gauge	Est. Pcs per lb.	Approx. Wt. per 1000
Bolt Sizes					
1/8	1/4	.144	.025 (#22)	4000	.25
3/16	1/2	.200	.040 (#18)	490	2.05
1/4	11/16	.264	.051 (#16)	202	4.95
5/16	7/8	.343	.064 (#14)	107	9.35
3/8	1"	.393	.081 (#12)	62	16.1
7/16	1-1/8	.500	.081 (#12)	50	20.0
1/2	1-1/4	.562	.089 (#11)	34	29.0
5/8	1-1/2	.687	.102 (#10)	25	40.0
3/4	1-7/8	.812	.114 (#9)	12	83.0
7/8	2-1/4	.937	.128 (#8)	8	125.0
1"	2-1/2	1.062	.144 (#7)	5.75	125.0
1-1/8	2-3/4	1.187	.162 (#6)	4.15	240.0
1-1/4	3"	1.375	.162 (#6)	3.7	270.0

BEVELED WASHERS

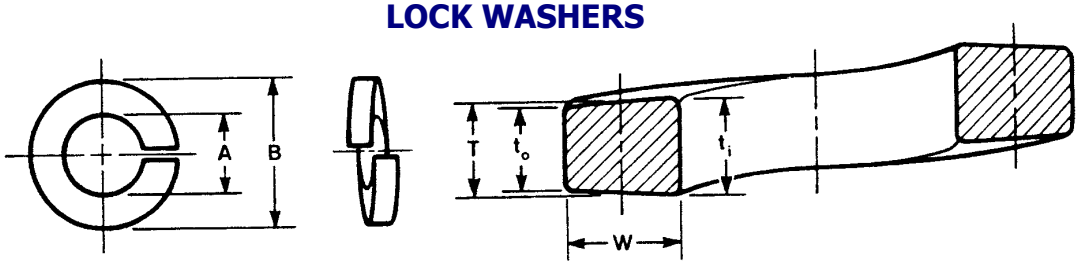
Size of Bolt	Size of Washer	Thickness		Approx. Wt. per 100 Pcs.
		Heavy End	Light End	
3/8	1-1/4 x 1-1/4	11/32	5/32	8.8
1/2	1-1/4 x 1-1/4	11/32	5/32	8.1
5/8	1-1/2 x 1-1/2	13/32	7/32	13
3/4	1-1/2 x 1-1/2	15/32	7/32	14.3
7/8	2 x 2	9/16	7/32	32
1	2 x 2	9/16	7/32	32

REGULAR HELICAL SPRING LOCK WASHERS



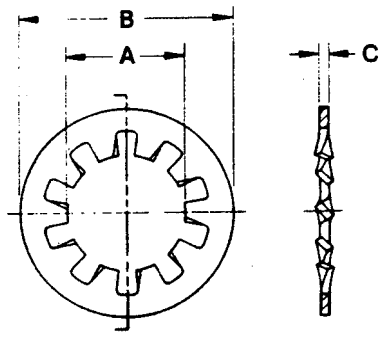
Nominal Washer Size		A		B	T	W
		Inside Diameter		Outside Diameter	Mean Section Thickness $\frac{(t_i + t_o)}{2}$	Section Width
		Max	Min	Max[2]	Min	Min
No. 2	0.086	0.094	0.088	0.172	0.020	0.035
No. 3	0.099	0.107	0.101	0.195	0.025	0.040
No. 4	0.112	0.120	0.114	0.209	0.025	0.040
No. 5	0.125	0.133	0.127	0.236	0.031	0.047
No. 6	0.138	0.148	0.141	0.250	0.031	0.047
No. 8	0.164	0.174	0.167	0.293	0.040	0.055
No. 10	0.190	0.200	0.193	0.334	0.047	0.062
No. 12	0.216	0.227	0.220	0.377	0.056	0.070
¼	0.250	0.262	0.254	0.489	0.062	0.109
5/16	0.312	0.326	0.317	0.586	0.078	0.125
3/8	0.375	0.390	0.380	0.683	0.094	0.141
7/16	0.438	0.455	0.443	0.779	0.109	0.156
½	0.500	0.518	0.506	0.873	0.125	0.171
9/16	0.562	0.582	0.570	0.971	0.141	0.188
5/8	0.625	0.650	0.635	1.079	0.156	0.203
11/16	0.688	0.713	0.698	1.176	0.172	0.219
¾	0.750	0.775	0.760	1.271	0.188	0.234
13/16	0.812	0.843	0.824	1.367	0.203	0.250
7/8	0.875	0.905	0.887	1.464	0.219	0.266
15/16	0.938	0.970	0.950	1.560	0.234	0.281
1	1.000	1.042	0.017	1.661	0.250	0.297
1-1/16	1.062	1.107	1.080	1.756	0.266	0.312
1-1/8	1.125	1.172	1.144	1.853	0.281	0.328
1-3/16	1.188	1.237	1.208	1.950	0.297	0.344
1-1/4	1.250	1.302	1.271	2.045	0.312	0.359
1-5/16	1.312	1.366	1.334	2.141	0.328	0.375
1-3/8	1.375	1.432	1.398	2.239	0.344	0.391
1-7/16	1.438	1.497	1.462	2.334	0.359	0.406
1-1/2	1.500	1.561	1.525	2.430	0.375	0.422

HEAVY HELICAL SPRING LOCK WASHERS

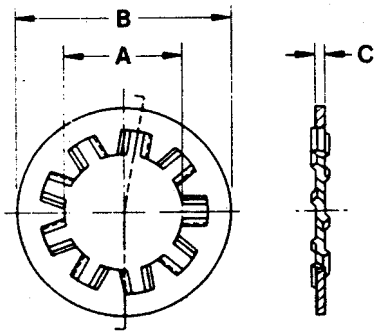


Nominal Washer Size		A		B	T	W
		Inside Diameter		Outside Diameter	Mean Section Thickness $\frac{(t_i + t_o)}{2}$	Section Width
		Max	Min	Max[2]	Min	Min
No. 2	0.086	0.094	0.088	0.182	0.025	0.040
No. 3	0.099	0.107	0.101	0.209	0.031	0.047
No. 4	0.112	0.120	0.114	0.223	0.031	0.047
No. 5	0.125	0.133	0.127	0.252	0.040	0.055
No. 6	0.138	0.148	0.141	0.266	0.040	0.055
No. 8	0.164	0.174	0.167	0.307	0.047	0.062
No. 10	0.190	0.200	0.193	0.350	0.056	0.070
No. 12	0.216	0.227	0.220	0.391	0.063	0.077
1/4	0.250	0.262	0.254	0.491	0.077	0.110
5/16	0.312	0.326	0.317	0.596	0.097	0.130
3/8	0.375	0.390	0.380	0.691	0.115	0.145
7/16	0.438	0.455	0.443	0.787	0.133	0.160
1/2	0.500	0.518	0.506	0.883	0.151	0.176
9/16	0.562	0.582	0.570	0.981	0.170	0.193
5/8	0.625	0.650	0.635	1.093	0.189	0.210
11/16	0.688	0.713	0.698	1.192	0.207	0.227
3/4	0.750	0.775	0.760	1.291	0.226	0.244
13/16	0.812	0.843	0.824	1.391	0.246	0.262
7/8	0.875	0.905	0.887	1.494	0.266	0.281
15/16	0.938	0.970	0.950	1.594	0.284	0.298
1	1.000	1.042	0.017	1.705	0.306	0.319
1-1/16	1.062	1.107	1.080	1.808	0.326	0.338
1-1/8	1.125	1.172	1.144	1.909	0.375	0.356
1-3/16	1.188	1.237	1.208	2.008	0.364	0.373
1-1/4	1.250	1.302	1.271	2.113	0.384	0.393
1-5/16	1.312	1.366	1.334	2.211	0.403	0.410
1-3/8	1.375	1.432	1.398	2.311	0.422	0.427
1-7/16	1.438	1.497	1.462	2.406	0.440	0.442
1-1/2	1.500	1.561	1.525	2.502	0.458	0.458

INTERNAL TOOTH LOCK WASHERS



TYPE A



TYPE B

Dimensions of Internal Tooth Lock Washers

Nominal Washer Size		A Inside Diameter		B Outside Diameter		C Thickness	
		Max	Min	Max	Min	Max	Min
No. 2	0.086	0.095	0.089	0.200	0.175	0.015	0.010
No. 3	0.099	0.109	0.102	0.232	0.215	0.019	0.012
No. 4	0.112	0.123	0.115	0.270	0.255	0.019	0.015
No. 5	0.125	0.136	0.129	0.280	0.245	0.021	0.017
No. 6	0.138	0.150	0.141	0.295	0.275	0.021	0.017
No. 8	0.164	0.176	0.168	0.340	0.325	0.023	0.018
No. 10	0.190	0.204	0.195	0.381	0.365	0.025	0.020
No. 12	0.216	0.231	0.221	0.410	0.394	0.025	0.020
1/4	0.250	0.267	0.256	0.478	0.460	0.028	0.023
5/16	0.312	0.332	0.320	0.610	0.594	0.034	0.028
3/8	0.375	0.398	0.384	0.692	0.670	0.040	0.032
7/16	0.438	0.464	0.448	0.789	0.740	0.040	0.032
1/2	0.500	0.530	0.512	0.900	0.867	0.045	0.037
9/16	0.562	0.596	0.576	0.985	0.957	0.045	0.037
5/8	0.625	0.663	0.640	1.071	1.045	0.050	0.042
11/16	0.688	0.728	0.704	1.166	1.130	0.050	0.042
3/4	0.750	0.795	0.769	1.245	1.220	0.055	0.047
13/16	0.812	0.861	0.832	1.315	1.290	0.055	0.047
7/8	0.875	0.928	0.894	1.410	1.364	0.060	0.052
1	1.000	1.060	1.019	1.637	1.590	0.067	0.059
1-1/8	1.125	1.192	1.144	1.830	1.799	0.067	0.059
1-1/4	1.250	1.325	1.275	1.975	1.921	0.067	0.059

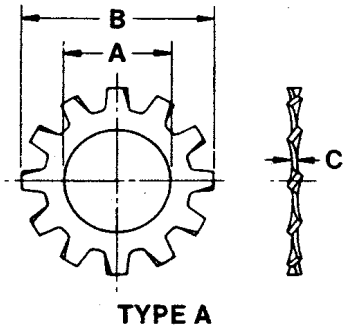
Dimensions of Heavy Internal Tooth Lock Washers

Nominal Washer Size		A Inside Diameter		B Outside Diameter		C Thickness	
		Max	Min	Max	Min	Max	Min
1/4	0.250	0.267	0.256	0.536	0.500	0.045	0.035
5/16	0.312	0.332	0.320	0.607	0.590	0.050	0.040
3/8	0.375	0.398	0.384	0.748	0.700	0.050	0.042
7/16	0.438	0.464	0.448	0.858	0.800	0.067	0.050
1/2	0.500	0.530	0.512	0.924	0.880	0.067	0.055
9/16	0.562	0.596	0.576	1.034	0.990	0.067	0.055
5/8	0.625	0.663	0.640	1.135	1.100	0.067	0.059
3/4	0.750	0.795	0.768	1.265	1.240	0.084	0.070
7/8	0.875	0.927	0.894	1.447	1.400	0.084	0.075

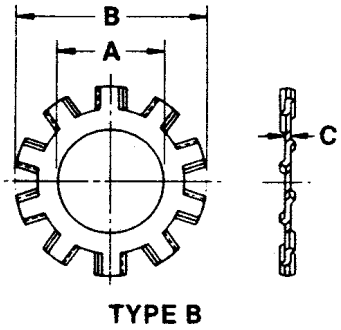
EXTERNAL TOOTH LOCK WASHERS

Dimensions of External Tooth Lock Washers

Nominal Washer Size		A Inside Diameter Max	A Inside Diameter Min	B Outside Diameter Max	B Outside Diameter Min	C Thickness Max	C Thickness Min
No. 3	0.099	0.109	0.102	0.235	0.220	0.015	0.012
No. 4	0.112	0.123	0.115	0.260	0.245	0.019	0.015
No. 5	0.125	0.136	0.129	0.285	0.270	0.019	0.014
No. 6	0.138	0.150	0.141	0.320	0.305	0.022	0.016
No. 8	0.164	0.176	0.168	0.381	0.365	0.023	0.018
No. 10	0.190	0.204	0.195	0.410	0.395	0.025	0.020
No. 12	0.216	0.231	0.221	0.475	0.460	0.028	0.023
¼	0.250	0.267	0.256	0.510	0.494	0.028	0.023
5/16	0.312	0.332	0.320	0.610	0.588	0.034	0.028
3/8	0.375	0.398	0.384	0.694	0.670	0.040	0.032
7/16	0.438	0.464	0.448	0.760	0.740	0.040	0.032
½	0.500	0.530	0.513	0.900	0.880	0.045	0.037
9/16	0.562	0.596	0.576	0.985	0.960	0.045	0.037
5/8	0.625	0.663	0.641	1.070	1.045	0.050	0.042
11/16	0.688	0.728	0.704	1.155	1.130	0.050	0.042
¾	0.750	0.795	0.768	1.260	1.220	0.055	0.047
13/16	0.812	0.861	0.833	1.315	1.290	0.055	0.047
7/8	0.875	0.927	0.897	1.410	1.380	0.060	0.052
1	1.000	1.060	1.025	1.620	1.590	0.067	0.059

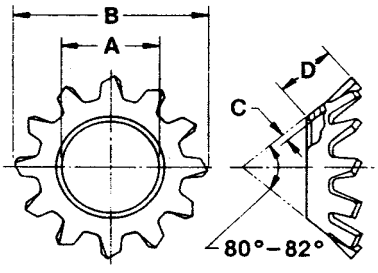


TYPE A

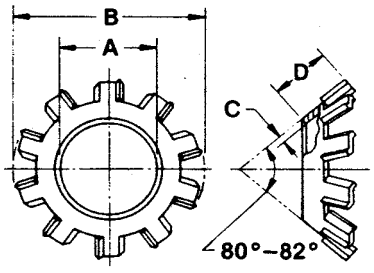


TYPE B

Dimensions of Countersunk External Tooth Lock Washers



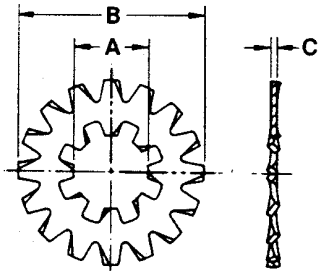
TYPE A



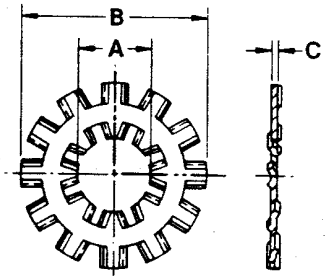
TYPE B

Nominal Washer Size		A Inside Diameter Max	A Inside Diameter Min	B[1] Outside Diameter Approx	C Thickness Max	C Thickness Min	D Length Max	D Length Min
No. 4	0.112	0.123	0.113	0.213	0.019	0.015	0.065	0.050
No. 6	0.138	0.150	0.140	0.289	0.021	0.017	0.092	0.082
No. 8	0.164	0.177	0.167	0.322	0.021	0.017	0.105	0.088
No. 10	0.190	0.205	0.195	0.354	0.025	0.020	0.099	0.083
No. 12	0.216	0.231	0.220	0.421	0.025	0.020	0.128	0.118
1/4	0.250	0.267	0.255	0.454	0.025	0.020	0.128	0.113
No. 16	0.268	0.287	0.273	0.505	0.028	0.023	0.147	0.137
5/16	0.312	0.333	0.318	0.599	0.028	0.023	0.192	0.165
3/8	0.375	0.398	0.383	0.765	0.034	0.028	0.255	0.242
7/16	0.438	0.463	0.448	0.867	0.045	0.037	0.270	0.260
1/2	0.500	0.529	0.512	0.976	0.045	0.037	0.304	0.294

INTERNAL-EXTERNAL TOOTH LOCK WASHERS



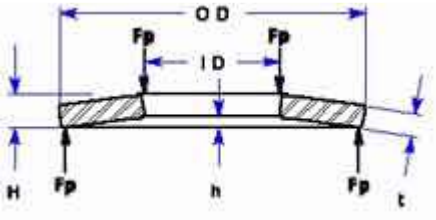
TYPE A



TYPE B

Nominal Washer Size	A		B		C		Nominal Washer Size	A		B		C	
	Inside Diameter		Outside Diameter		Thickness			Inside Diameter		Outside Diameter		Thickness	
	Max	Min	Max	Min	Max	Min		Max	Min	Max	Min	Max	Min
No. 4 0.112	0.123	0.115	0.475 0.510 0.610	0.460 0.495 0.580	0.021 0.021 0.021	0.016 0.017 0.017	5/16 0.312	0.332	0.320	0.900 0.985 1.070 1.155	0.865 0.965 1.045 1.130	0.040 0.045 0.050 0.050	0.032 0.037 0.042 0.042
No. 6 0.138	0.150	0.141	0.510 0.610 0.690	0.495 0.580 0.670	0.028 0.028 0.028	0.023 0.023 0.023	3/8 0.375	0.398	0.384	0.985 1.070 1.155 1.260	0.965 1.045 1.130 1.220	0.045 0.050 0.050 0.050	0.037 0.042 0.042 0.042
No. 8 0.164	0.176	0.168	0.610 0.690 0.760	0.580 0.670 0.740	0.034 0.034 0.034	0.028 0.028 0.028	7/16 0.438	0.464	0.448	1.070 1.155 1.260 1.315	1.045 1.030 1.220 1.290	0.050 0.050 0.055 0.055	0.042 0.042 0.047 0.047
No. 10 0.190	0.204	0.195	0.610 0.690 0.760 0.900	0.580 0.670 0.740 0.880	0.034 0.040 0.040 0.040	0.028 0.032 0.032 0.032	1/2 0.500	0.530	0.512	1.260 1.315 1.410 1.620	1.220 1.290 1.380 1.590	0.055 0.055 0.060 0.067	0.047 0.047 0.052 0.059
No. 12 0.216	0.231	0.221	0.690 0.760 0.900 0.985	0.670 0.725 0.880 0.965	0.040 0.040 0.040 0.045	0.032 0.032 0.032 0.037	9/16 0.562	0.596	0.576	1.315 1.430 1.620 1.830	1.290 1.380 1.590 1.797	0.055 0.060 0.067 0.067	0.047 0.052 0.059 0.059
1/4 0.250	0.267	0.256	0.760 0.900 0.985 1.070	0.725 0.880 09965 1.045	0.040 0.040 0.045 0.045	0.032 0.032 0.037 0.037	5/8 0.625	0.663	0.640	1.410 1.620 1.830 1.975	1.380 1.590 1.797 1.935	0.060 0.067 0.067 0.067	0.052 0.059 0.059 0.059

BELLEVILLE WASHERS



OD	Outside Diameter
t	Thickness
h	Deflection
H	Overall Height
Fp	Rounded Edges

Belleville Washer Materials: 6150 High Carbon Alloy Steel; 17-7 PH Stainless Steel; 301 Stainless Steel; Inconel 718; Phosphor Bronze; H-13 Tool Steel

Belleville Washers

This information reprinted from the Manufacturer, Solon Manufacturing.

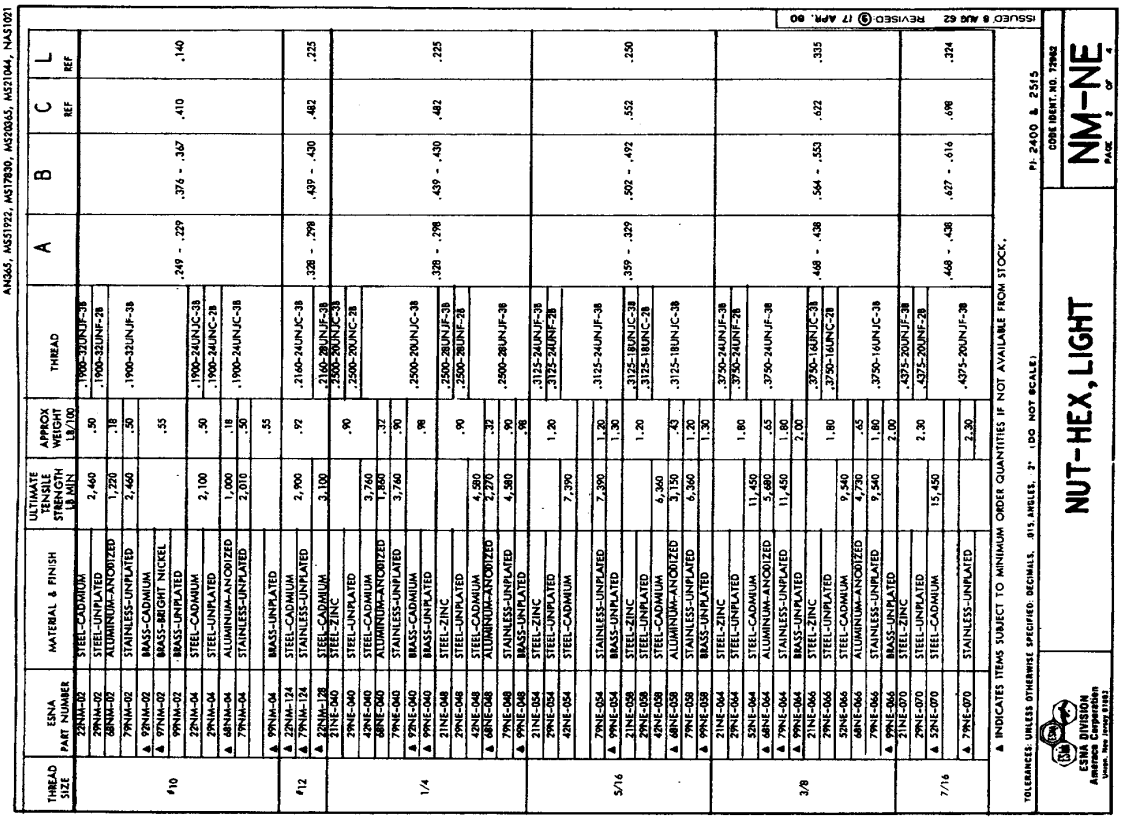
Bolt Size	Part #	ID	OD	Thickness	Overall Height	Deflection	Load (100%)	APW per 1000 PCs
#10	010H42	0.196"	0.563"	0.043"	0.072"	0.014"	800.0lbs	2.70lbs
1/4	4L42	0.258"	0.563"	0.043"	0.068"	0.012"	870.0lbs	2.40lbs
1/4	4M52	0.258"	0.688"	0.053"	0.089"	0.016"	1200.0lbs	4.80lbs
1/4	4H61	0.258"	0.813"	0.063"	0.083"	0.021"	1600.0lbs	8.30lbs
1/4	4EH70	0.258"	0.938"	0.072"	0.097"	0.025"	2000.0lbs	13.00lbs
5/16	51032	0.317"	0.630"	0.032"	0.053"	0.016"	400.0lbs	2.00lbs
5/16	5L52	0.322"	0.688"	0.053"	0.085"	0.014"	1300.0lbs	4.40lbs
5/16	5M61	0.322"	0.813"	0.063"	0.081"	0.019"	1800.0lbs	7.40lbs
5/16	5H70	0.322"	0.938"	0.072"	0.095"	0.023"	2300.0lbs	12.40lbs
5/16	5EH80	0.322"	1.063"	0.082"	0.110"	0.028"	2800.0lbs	18.70lbs
3/8	61042	0.380"	0.640"	0.043"	0.067"	0.011"	850.0lbs	2.30lbs
3/8	6S33	0.380"	0.730"	0.035"	0.046"	0.018"	500.0lbs	2.80lbs
3/8	61240	0.380"	0.755"	0.043"	0.065"	0.018"	800.0lbs	3.80lbs
3/8	61232	0.382"	0.750"	0.032"	0.055"	0.023"	246.0lbs	2.97lbs
3/8	6L61	0.386"	0.813"	0.063"	0.078"	0.016"	1800.0lbs	7.10lbs
3/8	614112	0.386"	0.875"	0.115"	0.136"	0.012"	6500.0lbs	14.10lbs
7/16	71445	0.442"	0.880"	0.045"	0.067"	0.022"	800.0lbs	5.70lbs
7/16	7L70	0.450"	0.938"	0.072"	0.091"	0.019"	2400.0lbs	10.80lbs
7/16	7M80	0.450"	1.063"	0.082"	0.105"	0.023"	3100.0lbs	16.90lbs
7/16	7H42	0.450"	1.188"	0.043"	0.132"	0.045"	640.0lbs	11.60lbs
7/16	7H89	0.450"	1.188"	0.091"	0.119"	0.028"	3700.0lbs	24.50lbs
1/2	81680	0.505"	1.000"	0.082"	0.100"	0.018"	3200.0lbs	12.30lbs
1/2	81650	0.505"	1.005"	0.050"	0.076"	0.020"	550.0lbs	8.20lbs
1/2	81628	0.505"	1.010"	0.028"	0.060"	0.036"	250.0lbs	4.59lbs
1/2	81635	0.505"	1.010"	0.035"	0.070"	0.032"	450.0lbs	5.90lbs
1/2	820131	0.512"	1.259"	0.134"	0.172"	0.020"	7500.0lbs	36.80lbs
1/2	8L42	0.515"	1.063"	0.043"	0.086"	0.033"	500.0lbs	8.30lbs
1/2	8L80	0.515"	1.063"	0.082"	0.103"	0.021"	3200.0lbs	15.80lbs
1/2	818125	0.515"	1.125"	0.125"	0.142"	0.017"	7700.0lbs	28.50lbs
1/2	8M89	0.515"	1.188"	0.091"	0.117"	0.026"	3800.0lbs	23.20lbs
1/2	82062	0.515"	1.250"	0.065"	0.144"	0.036"	1880.0lbs	19.32lbs
1/2	8H98	0.515"	1.313"	0.101"	0.131"	0.030"	4600.0lbs	32.60lbs
1/2	8H112	0.515"	1.313"	0.115"	0.142"	0.027"	6200.0lbs	37.30lbs
1/2	8EH112	0.515"	1.500"	0.115"	0.152"	0.037"	6000.0lbs	50.70lbs
1/2	828131	0.515"	1.750"	0.134"	0.180"	0.046"	7400.0lbs	83.30lbs
9/16	9L89	0.579"	1.188"	0.091"	0.114"	0.023"	4000.0lbs	21.80lbs
9/16	9M98	0.579"	1.313"	0.101"	0.129"	0.028"	4700.0lbs	31.00lbs
9/16	9H112	0.579"	1.500"	0.115"	0.150"	0.035"	6000.0lbs	48.90lbs

Belleville Washers (continued)

Bolt Size	Part #	ID	OD	Thickness	Overall Height	Deflection	Load (100%)	APW per 1000 PCS
5/8	101860	0.625"	1.125"	0.063"	0.090"	0.025"	1200.0lbs	11.30lbs
5/8	10L98	0.644"	1.313"	0.101"	0.127"	0.026"	4800.0lbs	29.20lbs
5/8	10M112	0.644"	1.500"	0.115"	0.147"	0.032"	6100.0lbs	44.33lbs
5/8	10H131	0.644"	1.750"	0.134"	0.176"	0.042"	8100.0lbs	78.90lbs
5/8	10EH150	0.644"	2.000"	0.154"	0.205"	0.051"	10200.0lbs	122.30lbs
3/4	12L60	0.773"	1.500"	0.063"	0.105"	0.043"	1100.0lbs	22.77lbs
3/4	12L72	0.773"	1.500"	0.072"	0.111"	0.039"	1600.0lbs	26.40lbs
3/4	12L112	0.773"	1.500"	0.115"	0.143"	0.028"	6200.0lbs	39.03lbs
3/4	12M131	0.773"	1.750"	0.134"	0.171"	0.037"	8300.0lbs	73.40lbs
3/4	12H150	0.773"	2.000"	0.154"	0.200"	0.046"	10800.0lbs	116.00lbs
3/4	12EH168	0.773"	2.250"	0.172"	0.228"	0.056"	13000.0lbs	170.70lbs
7/8	14L131	0.901"	1.750"	0.134"	0.167"	0.033"	8500.0lbs	67.00lbs
7/8	14M150	0.901"	2.000"	0.154"	0.196"	0.042"	11100.0lbs	108.80lbs
7/8	14H168	0.901"	2.250"	0.172"	0.223"	0.051"	13600.0lbs	162.50lbs
1	163284	1.005"	2.005"	0.082"	0.141"	0.059"	2600.0lbs	54.90lbs
1	1632131	1.020"	2.000"	0.134"	0.175"	0.041"	8200.0lbs	87.50lbs
1	16L150	1.030"	2.000"	0.154"	0.191"	0.037"	11200.0lbs	100.30lbs
1	16M168	1.030"	2.250"	0.172"	0.219"	0.047"	13800.0lbs	153.00lbs
1	16H187	1.030"	2.500"	0.192"	0.248"	0.056"	17000.0lbs	220.90lbs
1 1/8	18L168	1.155"	2.250"	0.172"	0.214"	0.042"	14000.0lbs	142.50lbs
1 1/8	18M187	1.155"	2.500"	0.192"	0.243"	0.051"	17300.0lbs	209.30lbs
1 1/8	18H206	1.155"	2.750"	0.211"	0.271"	0.060"	20600.0lbs	273.49lbs
1 1/4	204098	1.245"	2.505"	0.101"	0.174"	0.076"	3600.0lbs	101.00lbs
1 1/4	20L187	1.280"	2.500"	0.192"	0.239"	0.047"	17400.0lbs	182.50lbs
1 1/4	20M206	1.280"	2.750"	0.211"	0.267"	0.056"	20900.0lbs	279.00lbs
1 1/4	20H225	1.280"	3.000"	0.231"	0.296"	0.065"	24800.0lbs	378.00lbs
1 3/8	22L206	1.405"	2.750"	0.211"	0.263"	0.052"	21000.0lbs	263.00lbs
1 3/8	22M225	1.405"	3.000"	0.231"	0.292"	0.061"	25000.0lbs	360.00lbs
1 3/8	22H244	1.405"	3.250"	0.250"	0.320"	0.070"	29000.0lbs	479.00lbs
1 1/2	24L225	1.530"	3.000"	0.231"	0.287"	0.056"	25200.0lbs	310.00lbs
1 1/2	24M244	1.530"	3.250"	0.250"	0.315"	0.065"	29400.0lbs	458.00lbs
1 1/2	24H262	1.530"	3.500"	0.262"	0.338"	0.076"	32000.0lbs	591.00lbs
1 5/8	26L244	1.650"	3.250"	0.250"	0.311"	0.061"	29500.0lbs	415.40lbs
1 5/8	26M262	1.650"	3.500"	0.262"	0.334"	0.072"	32100.0lbs	516.10lbs
1 5/8	26H281	1.650"	3.750"	0.281"	0.362"	0.081"	36700.0lbs	697.10lbs
1 3/4	28L262	1.780"	3.500"	0.262"	0.329"	0.067"	32200.0lbs	516.00lbs
1 3/4	28M281	1.780"	3.750"	0.281"	0.358"	0.077"	37000.0lbs	-
1 3/4	28H300	1.780"	4.000"	0.300"	0.386"	0.086"	41900.0lbs	834.60lbs
1 7/8	30L281	1.910"	3.750"	0.281"	0.353"	0.072"	37100.0lbs	-
1 7/8	30M300	1.910"	4.000"	0.300"	0.381"	0.081"	42100.0lbs	-
1 7/8	30H318	1.910"	4.250"	0.318"	0.409"	0.091"	47100.0lbs	471.50lbs
2	32L300	2.063"	4.000"	0.300"	0.376"	0.076"	42300.0lbs	715.00lbs
2 1/4	36L318	2.281"	4.250"	0.318"	0.400"	0.077"	48000.0lbs	846.00lbs
2 1/4	36M356	2.281"	4.750"	0.356"	0.462"	0.096"	59000.0lbs	0.00lbs
2 1/2	40L356	2.531"	4.750"	0.356"	0.452"	0.087"	59600.0lbs	0.00lbs

DESCRIPTION	PAGE
Locknuts	
ESNA® Light Hex Nuts	8-1 to 8-2
FLEXLOC® Self-Locking Nuts	8-3 to 8-4
Prevailing-Torque Type Steel Hex and Hex Flange Nuts	8-5 to 8-6
ANCO Self-Locking Nuts	8-7

ESNA® LIGHT HEX NUTS



AN365, MS51922, MS17830, MS20365, MS21044, NAS1021

THREAD SIZE	ESNA PART NUMBER	MATERIAL & FINISH	ULTIMATE TENSILE STRENGTH LB MIN	APPROX WEIGHT LB/100	THREAD	A	B	C REF	L REF
#10	22NM-02	STEEL-CADMIUM		.50	.1900-24UNJF-3B	.249 - .229	.376 - .367	.410	.140
	29NM-02	STEEL-UNPLATED							
	68NM-02	ALUMINUM-ANODIZED	1,220	.18	.1900-32UNF-2B				
	79NM-02	STAINLESS-UNPLATED	2,460	.50	.1900-32UNJF-3B				
	▲ 92NM-02	BRASS-CADMIUM							
	97NM-02	BRASS-BRIGHT NICKEL		.55					
	99NM-02	BRASS-UNPLATED							
	22NM-04	STEEL-CADMIUM		.50	.1900-24UNJC-3B				
	29NM-04	STEEL-UNPLATED	2,100		.1900-24UNC-2B				
	68NM-04	ALUMINUM-ANODIZED	1,000	.18					
	79NM-04	STAINLESS-UNPLATED	2,010	.50	.1900-24UNJC-3B				
	99NM-04	BRASS-UNPLATED		.55					
#12	▲ 22NM-124	STEEL-CADMIUM	2,900	.92	.2160-24UNJC-3B	.328 - .298	.439 - .430	.482	.225
	▲ 79NM-124	STAINLESS-UNPLATED							
	▲ 22NM-128	STEEL-CADMIUM	3,100		.2160-28UNJF-3B				
	21NE-040	STEEL-ZINC			.2500-20UNJC-3B				
1/4	29NE-040	STEEL-UNPLATED		.90	.2500-20UNC-2B	.328 - .298	.439 - .430	.482	.225
	42NE-040	STEEL-CADMIUM	3,760						
	68NE-040	ALUMINUM-ANODIZED	1,880	.32					
	79NE-040	STAINLESS-UNPLATED	3,760	.90	.2500-20UNJC-3B				
	▲ 92NE-040	BRASS-CADMIUM							
	▲ 99NE-040	BRASS-UNPLATED		.98					
	21NE-048	STEEL-ZINC			.2500-28UNJF-3B				
	29NE-048	STEEL-UNPLATED		.90	.2500-28UNF-2B				
	42NE-048	STEEL-CADMIUM	4,590						
	68NE-048	ALUMINUM-ANODIZED	2,270	.32					
	79NE-048	STAINLESS-UNPLATED	4,580	.90	.2500-28UNJF-3B				
	▲ 99NE-048	BRASS-UNPLATED		.98					
	21NE-054	STEEL-ZINC			.3125-24UNJF-3B				
	29NE-054	STEEL-UNPLATED		1.20	.3125-24UNF-2B				
	42NE-054	STEEL-CADMIUM	7,390						
5/16	79NE-054	STAINLESS-UNPLATED	7,390	1.20	.3125-24UNJF-3B	.359 - .329	.502 - .492	.552	.250
	▲ 99NE-054	BRASS-UNPLATED		1.30					
	21NE-058	STEEL-ZINC			.3125-18UNJC-3B				
	29NE-058	STEEL-UNPLATED		1.20	.3125-18UNC-2B				
	42NE-058	STEEL-CADMIUM	6,360						
	68NE-058	ALUMINUM-ANODIZED	3,150	.43					
	79NE-058	STAINLESS-UNPLATED	6,360	1.20	.3125-18UNJC-3B				
	▲ 99NE-058	BRASS-UNPLATED		1.30					
	21NE-064	STEEL-ZINC			.3750-24UNJF-3B				
	29NE-064	STEEL-UNPLATED		1.80	.3750-24UNF-2B				
	52NE-064	STEEL-CADMIUM	11,450						
	68NE-064	ALUMINUM-ANODIZED	5,680	.65	.3750-24UNJF-3B				
	▲ 79NE-064	STAINLESS-UNPLATED	11,450	1.80					
	▲ 99NE-064	BRASS-UNPLATED		2.00					
3/8	21NE-066	STEEL-ZINC			.3750-16UNJC-3B	.468 - .438	.564 - .553	.622	.335
	29NE-066	STEEL-UNPLATED		1.80	.3750-16UNC-2B				
	52NE-066	STEEL-CADMIUM	9,540						
	68NE-066	ALUMINUM-ANODIZED	4,730	.65					
	79NE-066	STAINLESS-UNPLATED	9,540	1.80	.3750-16UNJC-3B				
	▲ 99NE-066	BRASS-UNPLATED		2.00					
	21NE-070	STEEL-ZINC			.4375-20UNJF-3B				
	29NE-070	STEEL-UNPLATED		2.30	.4375-20UNF-2B				
	▲ 52NE-070	STEEL-CADMIUM	15,450			.468 - .438	.627 - .616	.698	.324
7/16	79NE-070	STAINLESS-UNPLATED		2.30	.4375-20UNJF-3B				

TOLERANCES: UNLESS OTHERWISE SPECIFIED: DECIMALS, .015 ANGLES, 2° (DO NOT SCALE)

▲ INDICATES ITEMS SUBJECT TO MINIMUM ORDER QUANTITIES IF NOT AVAILABLE FROM STOCK.

ESNA DIVISION
Amerace Corporation
Union, New Jersey 07083

NUT-HEX, LIGHT

PI 2400 & 2515
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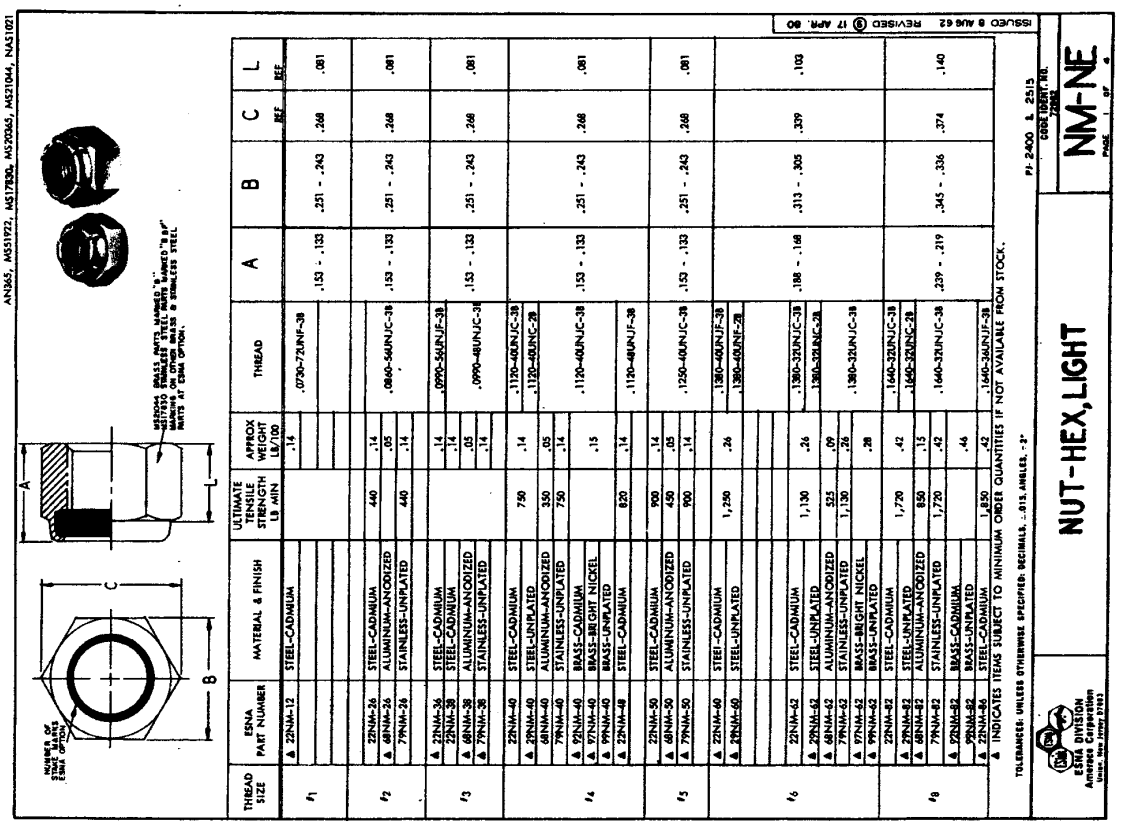
ISSUED 8 AUG 62 REVISED ⑨ 17 APR. 80



AN365, MS51922, MS17830, MS20365, MS21044, NAS1021

THREAD SIZE	ESNA PART NUMBER	MATERIAL & FINISH	ULTIMATE TENSILE STRENGTH LB MIN	APPROX WEIGHT LB/100	THREAD	A	B	C REF	L REF
#1	▲ 22NM-12	STEEL-CADMIUM		.14	.0730-72UNF-3B	.153 - .133	.251 - .243	.268	.081
#2	22NM-26	STEEL-CADMIUM	440	.14	.0860-56UNJC-3B	.153 - .133	.251 - .243	.268	.081
	▲ 68NM-26	ALUMINUM-ANODIZED		.05					
	79NM-26	STAINLESS-UNPLATED	440	.14					
#3	▲ 22NM-36	STEEL-CADMIUM		.14	.0995-56UNJF-3B	.153 - .133	.251 - .243	.268	.081
	68NM-36	STEEL-CADMIUM		.14					
	▲ 68NM-36	ALUMINUM-ANODIZED		.05	.0990-48UNJC-3B				
	▲ 79NM-36	STAINLESS-UNPLATED		.14					
#4	22NM-40	STEEL-CADMIUM	750	.14	.1120-40UNJC-3B	.153 - .133	.251 - .243	.268	.081
	▲ 29NM-40	STEEL-UNPLATED			.1120-40UNC-2B				
	68NM-40	ALUMINUM-ANODIZED	350	.05					
	79NM-40	STAINLESS-UNPLATED	750	.14					
	▲ 92NM-40	BRASS-CADMIUM			.1120-40UNJC-3B				
	▲ 97NM-40	BRASS-BRIGHT NICKEL		.15					
	▲ 99NM-40	BRASS-UNPLATED							
	▲ 22NM-48	STEEL-CADMIUM	820	.14	.1120-48UNJF-3B				
#5	22NM-50	STEEL-CADMIUM	900	.14	.1250-40UNJC-3B	.153 - .133	.251 - .243	.268	.081
	68NM-50	ALUMINUM-ANODIZED	450	.05					
	▲ 79NM-50	STAINLESS-UNPLATED	900	.14					
#6	22NM-60	STEEL-CADMIUM	1,250	.26	.1380-40UNJF-3B	.188 - .168	.313 - .305	.339	.103
	▲ 29NM-60	STEEL-UNPLATED			.1380-40UNF-2B				
	22NM-62	STEEL-CADMIUM	1,130	.26	.1380-32UNJC-3B				
	▲ 29NM-62	STEEL-UNPLATED			.1380-32UNC-2B				
	▲ 68NM-62	ALUMINUM-ANODIZED	525	.09					
	79NM-62	STAINLESS-UNPLATED	1,130	.26	.1380-32UNJC-3B				
	▲ 97NM-62	BRASS-BRIGHT NICKEL		.28					
	▲ 99NM-62	BRASS-UNPLATED							
#8	22NM-82	STEEL-CADMIUM	1,720	.42	.1640-32UNJC-3B	.239 - .219	.345 - .336	.374	.140
	▲ 29NM-82	STEEL-UNPLATED			.1640-32UNC-2B				
	▲ 68NM-82	ALUMINUM-ANODIZED	850	.15					
	79NM-82	STAINLESS-UNPLATED	1,720	.42	.1640-32UNJC-3B				
	▲ 92NM-82	BRASS-CADMIUM		.46					
	99NM-82	BRASS-UNPLATED							
	▲ 22NM-84	STEEL-CADMIUM	1,850	.42	.1640-24UNJF-3B				

TOLERANCES: UNLESS OTHERWISE SPECIFIED: DECIMALS, .015 ANGLES, 2°

▲ INDICATES ITEMS SUBJECT TO MINIMUM ORDER QUANTITIES IF NOT AVAILABLE FROM STOCK.

ESNA DIVISION
Amerace Corporation
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NUT-HEX, LIGHT

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© Sigma Fasteners, Inc.

THREAD SIZE	ESNA PART NUMBER	MATERIAL & FINISH	ULTIMATE TENSILE STRENGTH LB MIN	APPROX WEIGHT LB/100	THREAD ⑨	A	B	C REF	L REF
7/16	▲ 52NE-070U	STEEL-CADMIUM	13,450	3.10	.4375-20UNJF-3B	.468- .438	.690 - .679	.766	.324
	▲ 68NE-070U	ALUMINUM-ANODIZED	7,660	1.10					
	21NE-074	STEEL-ZINC		2.30	.4375-14UNJC-3B	.468 - .438	.627- .616	.698	.324
	29NE-074	STEEL-UNPLATED			.4375-14UNC-2B				
	▲ 52NE-074	STEEL-CADMIUM	13,140						
	▲ 79NE-074	STAINLESS-UNPLATED							
	▲ 52NE-074U	STEEL-CADMIUM		3.10	.4375-14UNJC-3B		.690- .679	.766	
	▲ 79NE-074U	STAINLESS-UNPLATED	13,140						
1/2	21NE-080	STEEL-ZINC		4.30	.5000-20UNJF-3B	.609- .579	.752- .741	.837	.464
	29NE-080	STEEL-UNPLATED			.5000-20UNF-2B				
	52NE-080	STEEL-CADMIUM	21,110		.5000-20UNJF-3B				
	79NE-080	STAINLESS-UNPLATED	21,110	4.30					
	▲ 99NE-080	BRASS-UNPLATED		4.70					
	21NE-083	STEEL-ZINC		4.30	.5000-13UNJC-3B				
	29NE-083	STEEL-UNPLATED			.5000-13UNC-2B				
	52NE-083	STEEL-CADMIUM	17,730		.5000-13UNJC-3B				
	79NE-083	STAINLESS-UNPLATED							
	▲ 99NE-083	BRASS-UNPLATED		4.70					
9/16	21NE-098	STEEL-ZINC		7.10	.5625-18UNJF-3B	.656- .626	.877- .865	.978	.469
	29NE-098	STEEL-UNPLATED			.5625-18UNF-2B				
	▲ 52NE-098	STEEL-CADMIUM	26,810						
	▲ 79NE-098	STAINLESS-UNPLATED			.5625-18UNJF-3B				
	▲ 21NE-092	STEEL-ZINC			.5625-12UNJC-3B				
5/8	21NE-101	STEEL-ZINC		8.30	.6250-11UNJC-3B	.765- .735	.940- .928	1.051	.593
	29NE-101	STEEL-UNPLATED			.6250-11UNC-2B				
	52NE-101	STEEL-CADMIUM	28,530		.6250-11UNJC-3B				
	79NE-101	STAINLESS-UNPLATED							
	▲ 99NE-101	BRASS-UNPLATED		9.00					
	21NE-108	STEEL-ZINC		8.30	.6250-18UNJF-3B				
	29NE-108	STEEL-UNPLATED			.6250-18UNF-2B				
	▲ 52NE-108	STEEL-CADMIUM	34,130		.6250-18UNJF-3B				
	▲ 79NE-108	STAINLESS-UNPLATED							
3/4	41NE-120	STEEL-ZINC		12.00	.7500-10UNJC-3B	.890- .860	1.064-1.052	1.191	.742
	49NE-120	STEEL-UNPLATED			.7500-10UNC-2B				
	79NE-120	STAINLESS-UNPLATED			.7500-10UNJC-3B				
	▲ 99NE-120	BRASS-UNPLATED		13.00					
	41NE-126	STEEL-ZINC		12.00	.7500-16UNJF-3B				
	49NE-126	STEEL-UNPLATED			.7500-16UNF-2B				
	▲ 59NE-126	STEEL-UNPLATED	50,020		.7500-16UNJF-3B				
7/8	41NE-144	STEEL-ZINC		19.00	.8750-14UNJF-3B	.999- .969	1.252-1.239	1.403	.790
	49NE-144	STEEL-UNPLATED			.8750-14UNF-2B				
	52NE-144	STEEL-CADMIUM	68,440		.8750-14UNJF-3B				
	41NE-149	STEEL-ZINC		19.00	.8750-9UNJC-3B				
	49NE-149	STEEL-UNPLATED			.8750-9UNC-2B				
1	41NE-164	STEEL-ZINC		27.00	1.0000-14UNJS-3B	1.078-1.016	1.440-1.427	1.615	.825
	49NE-164	STEEL-UNPLATED			1.0000-14UNS-2B				
	52NE-164	STEEL-CADMIUM	92,180		1.0000-14UNJS-3B				
	41NE-168	STEEL-ZINC		27.00	1.0000-8UNJC-3B				
	49NE-168	STEEL-UNPLATED			1.0000-8UNC-2B				
	52NE-168	STEEL-CADMIUM	79,280		1.0000-8UNJC-3B				

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TOLERANCES: UNLESS OTHERWISE SPECIFIED: DECIMALS, ±.015, ANGLES, ±2° (DO NOT SCALE)

FJ-2400 & 2515

ISSUED 8 AUG 62 REVISED ⑨ 17 APR. 80

ESNA DIVISION
Amerace Corporation
Union, New Jersey 07083

NUT-HEX, LIGHT

CODE IDENT. NO. 72962

NM-NE

THREAD SIZE	ESNA PART NUMBER	MATERIAL & FINISH	ULTIMATE TENSILE STRENGTH LB MIN	APPROX WEIGHT LB/100	THREAD ⑨	A	B	C REF	L REF
1 1/8	▲ 41NE-182	STEEL-ZINC		41.00	1.1250-12UNJF-3B	1.203 - 1.141	1.627 - 1.614	1.826	.930
	49NE-182	STEEL-UNPLATED			1.1250-12UNF-2B				
	▲ 52NE-182	STEEL-CADMIUM	116,700		1.1250-12UNJF-3B				
1 1/4	41NE-202	STEEL-ZINC		58.00	1.2500-12UNJF-3B	1.422 - 1.360	1.815 - 1.801	2.038	1.125
	49NE-202	STEEL-UNPLATED			1.2500-12UNF-2B				
	▲ 52NE-202	STEEL-CADMIUM	147,940		1.2500-12UNJF-3B				
1 3/8	49NE-222	STEEL-UNPLATED		77.00	1.3750-12UNF-2B	1.609 - 1.547	2.008 - 1.973	2.232	1.282
	▲ 49NE-226	STEEL-UNPLATED			1.3750-8UNC-2B				
1 1/2	▲ 41NE-242	STEEL-ZINC		100.00	1.5000-12UNJF-3B	1.640 - 1.578	2.197 - 2.159	2.444	1.313
	49NE-242	STEEL-UNPLATED			1.5000-12UNF-2B				
	52NE-242	STEEL-CADMIUM			1.5000-12UNJF-3B				
	▲ 59NE-242	STEEL-UNPLATED			1.5000-12UNF-2B				

▲ INDICATES ITEMS SUBJECT TO MINIMUM ORDER QUANTITIES IF NOT AVAILABLE FROM STOCK.

MATERIAL:

"2" } STEEL
"4" }
"5" }
"6" ALUMINUM ALLOY - 2017-T4 OR EQUIV.
"7" STAINLESS STEEL - AISI 303 OR EQUIV.
"9" BRASS - COMMERCIAL HALF HARD OR EQUIV.

FINISH:

"1" ZINC PLATE, QQ-Z-325, TYPE I, CLASS 3.
"2" CADMIUM PLATE, QQ-P-416, TYPE I, CLASS 3. (SEE PART CODING NOTE)
"7" BRIGHT NICKEL PLATE. (SEE NOTE 1)
"8" ANODIZED, MIL-A-8625.
"9" UNPLATED.

LOCKING INSERT: IED NYLON. (250°F MAX PERFORMANCE).

THREADS: MIL-S-8879 OR MIL-S-7742.

THREAD SQUARENESS: ESNA SPEC 405, GROUP I.

PERFORMANCE/APPROVAL STATUS: MIL-N-25027 AS APPLICABLE.

PART CODING:

F 52 NE-070

- THREAD SIZE.
- NUT TYPE.
- FINISH.
- MATERIAL.
- POST PLATE TREATMENT - CHROMATE FORTIFICATION ON CADMIUM PLATED PARTS ONLY. ESNA IS CONVERTING THIS DESIGN. FROM "TYPE I" CADMIUM PLATE TO "TYPE II" CADMIUM PLATE. PARTS ORDERED UNDER THE ESNA PART NUMBER WILL BE SUPPLIED WITH "TYPE I" PLATING UNTIL PRESENT INVENTORIES ARE EXHAUSTED, AFTER WHICH ALL SHIPMENTS WILL HAVE "TYPE II" PLATING ONLY. ON CADMIUM PLATED BRASS PARTS, THE LETTER "Y" IS USED TO DESIGNATE "TYPE II" PLATING IN LIEU OF THE LETTER "F". AN EXAMPLE WOULD BE: Y92NM-02.

NOTE: 1. ESNA IS CONVERTING ALL NICKEL PLATE PROCESSING TO BRIGHT ORNAMENTAL, WHEREAS PREVIOUSLY BOTH NON-ORNAMENTAL (DUCTILE) AND ORNAMENTAL WERE AVAILABLE. THE ESNA FINISH CODE FOR NON-ORNAMENTAL NICKEL WAS "6", SUCH AS 96NM-02. THE EQUIVALENT PART NUMBER FOR ORNAMENTAL NICKEL FINISH IS 97NM-02. AT SUCH TIME AS EXISTING STOCK OF NON-ORNAMENTAL "6" FINISH CODE PARTS IS EXHAUSTED, ESNA WILL AUTOMATICALLY SUBSTITUTE BRIGHT ORNAMENTAL NICKEL AT NO INCREASE IN PRICE. IN THESE INSTANCES OF SUBSTITUTION, ESNA WILL SHIP UNDER THE PREVIOUS "6" FINISH CODE NUMBER.

TOLERANCES: UNLESS OTHERWISE SPECIFIED: DECIMALS, ±.015, ANGLES, ±2° (DO NOT SCALE)

FJ-2400 & 2515

ISSUED 8 AUG 62 REVISED ⑨ 17 APR. 80

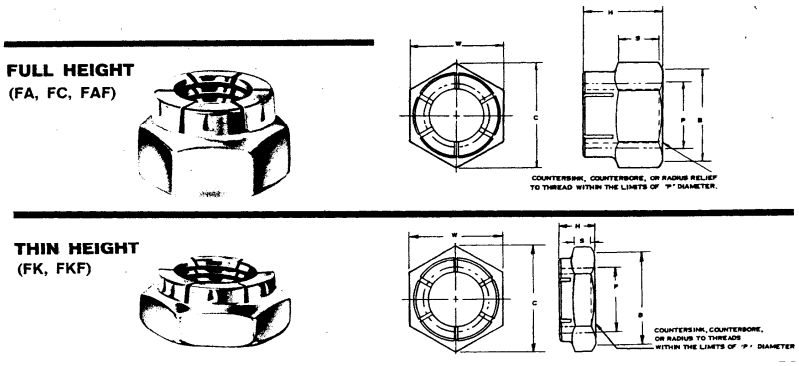
ESNA DIVISION
Amerace Corporation
Union, New Jersey 07083

NUT HEX, LIGHT

CODE IDENT. NO. 72962

NM-NE

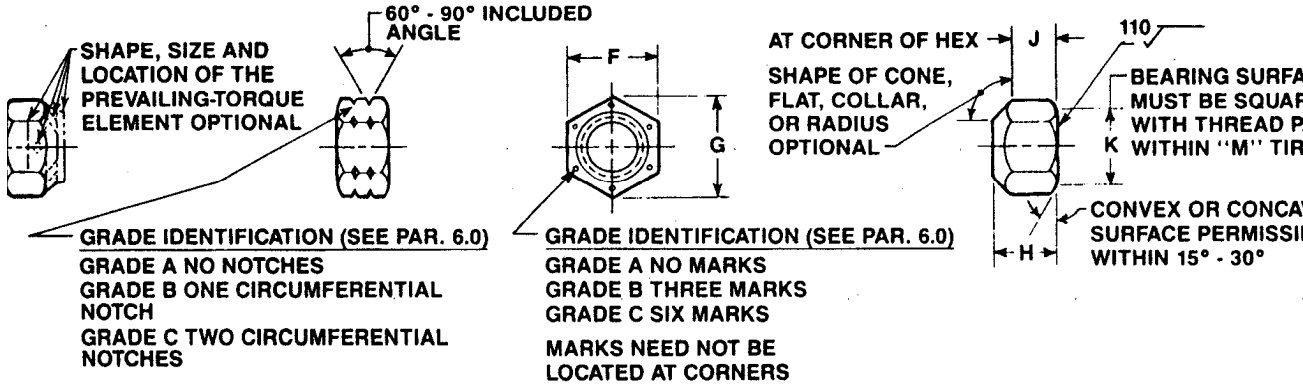
FLEXLOC® SELF-LOCKING NUTS



Size	Nut Diam	Thrds per in.	Type		Dash No.	Dimensions								
						B Diam	C	P Diam	H max		S min		W	
			Full Ht.	Thin Ht.		Min	Min	Max	Full Ht.	Thin Ht.	Full Ht.	Thin Ht.	Max	Min
#2	.086	56 UNC	FA		256	.243	.277	.129	.155	---	.050	---	.251	.243
#3	.099	48 UNC	FA		348	.243	.277	.142	.155	---	.050	---	.251	.243
#4	.112	40 UNC 48 UNF	FA FC	FK	440 448	.243	.277	.155	.155	---	.050	---	.251	.243
#5	.125	40 UNC 44 UNF	FA FC	FK FK	540 544	.243	.277	.168	.155	---	.052	---	.251	.243
#6	.138	32 UNC 40 UNF	FA FC	FK FK	632 640	.305	.347	.181	.180	.141	.075	.036	.313	.305
#8	.164	32 UNC 36 UNF	FA FC	FK FK	832 836	.336	.383	.208	.243	.188	.105	.070	.345	.336
#10	.190	24 UNC 32 UNF	FA FC	FK FK	1024 1032	.367	.419	.230	.243	.188	.085	.065	.376	.367
#12	.216	24 UNC 28 UNF	FA FC	FKF FK	1224 1228	.430	.491	.258	.290	.209	.122	.071	.439	.430
1/4	.250	20 UNC 28 UNF	FA FC	FKF FK	420 428	.430	.491	.293	.290 .320	.219	.122 .135	.075	.439	.430
5/16	.312	18 UNC 24 UNF	FAF FC	FKF FK	518 524	.492	.561	.356	.353	.266	.150	.097	.502	.492
3/8	.375	16 UNC 24 UNF	FAF FC	FKF FK	616 624	.553	.631	.418	.462	.282	.210	.108	.564	.553
7/16	.437	14 UNC 20 UNF 20 UNF	FAF FC FC	FKF FK FK	714 720 720 UN	.616 .679	.703 .775	.487 .487	.462 .462	.328 .328	.210 .210	.138 .120	.627 .690	.616 .679
½	.500	13	FAF	FKF	813	.741	.846	.551	.602	.328	.285	.121	.752	.741

Size	Nut Diam	Thrds per in.	Type		Dash No.	Dimensions								
						B Diam	C	P Diam	H max		S min		W	
			Full Ht.	Thin Ht.		Min	Min	Max	Full Ht.	Thin Ht.	Full Ht.	Thin Ht.	Max	Min
		UNC 20 UNF	FC	FK	820									
9/16	.562	12 UNC 18 UNF	FA FC	FKF FK	912 918	.865	.987	.614	.571 .696	.368	.260 .385	.135	.877	.865
5/8	.625	11 UNC 18 UNF	FAF FC	FKF FK	1011 1018	.928	1.059	.676	.759	.399	.410	.147	.940	.928
3/4	.750	10 UNC 16 UNF	FAF FC	FKF FK	1210 1216	1.052	1.200	.807	.884	.415	.505	.155	1.064	1.052
7/8	.875	9 UNC 14 UNF	FAF FC	FKF FK	1409 1414	1.239	1.414	.938	1.009	.477	.570	.166	1.252	1.239
1	1.000	8 UNC 12 UNF 14 NS	FAF FC FC	FKF FK FK	1608 1612 1614	1.427	1.628	1.064	1.134	.571	.635	.218	1.440	1.427
1-1/8	1.125	12 UNF	FC	FK	1812	1.614	1.842	1.191	1.259	.634	.710	.238	1.627	1.614
1-1/4	1.250	12 UNF	FC		2012	1.801	2.056	1.315	1.446	.759	.795	.311	1.814	1.801
1-3/8	1.375	12 UNF	FC		2212	1.988	2.269	1.440	1.509	.821	0.815	.325	2.002	1.988
1-1/2	1.500	12 UNF	FC		2412	2.176	2.484	1.565	1.759	.884	.970	.350	2.190	2.176
1-3/4	1.750	12 UN	FC		2812	2.787	2.980	1.815	2.010	---	1.124	---	2.752	2.737
2	2.000	12 UN	FC		3212	3.112	3.267	2.065	3.260	---	1.260	---	3.127	3.112

PREVAILING-TORQUE TYPE STEEL HEX AND HEX FLANGE NUTS

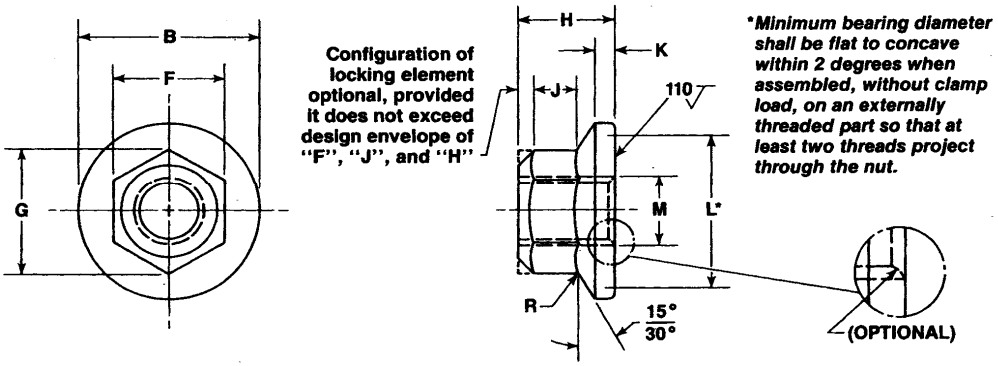


Dimensions of Prevailing-Torque Type Hex Nuts

Nominal Size or Basic Major Diam of Thread		Width Across Flats			Width Across Corners		Thickness			Height of Hex
		F			G		H	H	H	J
		Basic	Max	Min	Max	Min	Max	Max	Min	Min
No. 4	0.1120	1/4	0.251	0.241	0.289	0.275	0.163	0.163	0.087	0.066
No. 6	0.1380	5/16	.313	.302	.361	.344	.188	.171	.102	.075
No. 8	0.1640	11/32	.345	.332	.397	.378	.239	.191	.117	.083
No. 10	0.1900	3/8	.376	.362	.433	.413	.249	.241	.117	.083
No. 12	0.2160	7/16	.438	.423	.505	.482	.328	.241	.148	.103
1/4	0.2500	7/16	.4385	.428	.505	.488	.328	.288	.212	.145
5/16	0.3125	1/2	.5020	.489	.577	.557	.359	.336	.258	.166
3/8	0.3750	9/16	.5645	.551	.650	.628	.469	.415	.320	.198
7/16	0.4375	11/16	.6895	.675	.794	.768	.524	.463	.365	.223
1/2	0.5000	3/4	.7520	.736	.866	.840	.609	.573	.427	.262
9/16	0.5625	7/8	.8770	.861	1.010	.982	.656	.621	.473	.286
5/8	0.6250	15/16	.9395	.922	1.083	1.051	.765	.731	.535	.329
3/4	0.7500	1-1/8	1.1270	1.088	1.299	1.240	.890	.827	.617	.382
7/8	0.8750	1-5/16	1.3145	1.269	1.516	1.447	.999	.922	.724	.450
1	1.0000	1-1/2	1.5020	1.450	1.732	1.653	1.124	1.018	.831	.513
1-1/8	1.1250	1-11/16	1.6895	1.631	1.949	1.859	1.281	1.176	.939	.576
1-1/4	1.2500	1-7/8	1.8770	1.812	2.165	2.066	1.422	1.272	1.030	.628
1-3/8	1.3750	2-1/16	2.0645	1.994	2.382	2.273	1.609	1.399	1.138	.681
1-1/2	1.5000	2-1/4	2.2520	2.175	2.598	2.480	1.671	1.526	1.245	.757

© Sigma Fasteners, Inc.

PREVAILING-TORQUE TYPE STEEL
HEX AND HEX FLANGE NUTS



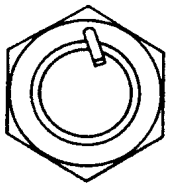
Dimensions of Prevailing-Torque Type Hex Flange Nuts

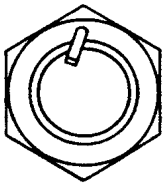
Nominal Size of Basic Major Diam of Thread		Width Across Flats			Width Across Corners		Height	Flange Diam	Bearing Diam	Flange Thick-ness	Corner Wrench-ing Length	Counter-sink Diam	Angu-larity of Brg. Surf. w/ Thrd PD FIM	Flange Top Radius
		F			G		H	B	L	K	J	M		R
		Basic	Max	Min	Max	Min	Max	Max	Min	Min	Min	Max	Max	Max
1/4	0.2500	7/16	0.4385	0.428	0.505	0.488	0.300	0.560	0.484	0.04	0.14	0.295	0.011	0.01
5/16	0.3125	1/2	0.5020	0.489	0.577	0.557	0.365	0.680	0.602	0.05	0.17	0.357	0.013	0.01
3/8	0.3750	9/16	0.5645	0.551	0.650	0.628	0.425	0.810	0.730	0.06	0.20	0.420	0.015	0.02
7/16	0.4375	11/16	0.6895	0.675	0.794	0.768	0.495	0.930	0.846	0.07	0.23	0.482	0.016	0.02
1/2	0.5000	3/4	0.7520	0.736	0.866	0.840	0.555	1.070	0.982	0.08	0.26	0.560	0.018	0.02
9/16	0.5625	7/8	0.8770	0.861	1.010	.982	0.625	1.190	0.101	0.09	0.29	0.622	0.019	0.03
5/8	.06250	15/16	0.9395	0.922	1.083	1.051	0.690	1.330	1.230	0.10	0.32	0.685	0.021	0.03
3/4	0.7500	1-1/8	1.1270	1.088	1.299	1.240	0.825	1.585	1.472	0.11	0.38	0.810	0.023	0.03

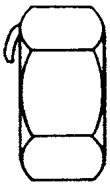
ANCO SELF LOCKING NUTS
ASTM A563 GRADE A

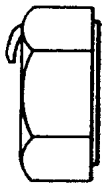
Washer Faced

Double Chamfered






Double Chamfered


Washer Faced

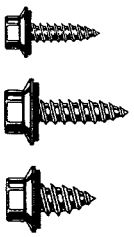
Hex				
Size	Net Price per 100 Pcs Plain Finish	Net Weight per 100 Pcs	Container Qty	Container Net Wt
In.	$	Lb	Pcs	Lb
1/4	12.60	.7	9000	66
5/16	12.80	1.0	6000	66
3/8	12.80	1.5	4000	64
1/2	15.05	3.6	1800	67
5/8	21.60	6.9	800	58
3/4	24.85	11.9	500	59
7/8	31.35	19.0	300	57
1	54.30	28.3	190	56

Heavy Hex					
Size	Net Price per 100 Pcs Plain Finish	Net Weight per 100 Pcs	Container Qty	Container Net Wt	Pitch Thrds per In.
In.	$	Lb	Pcs	Lb	Coarse
1/4	13.45	1.1	5500	64	20
5/16	13.75	1.6	3700	63	18
3/8	14.50	3.0	2000	63	16
1/2	16.95	6.5	1000	65	13
5/8	23.40	11.9	540	64	11
3/4	28.30	18.6	340	65	10
7/8	43.90	29.2	220	65	9
1	72.70	42.5	150	64	8
1-1/8	156.95	59.2	100	59	7
1-1/4	173.35	78.6	75	59	7
1-1/2	233.55	131.0	40	52	6

DESCRIPTION	PAGE
Self-Sealing Screws	
Plated Carbon Steel	9-1
Stainless Steel	9-2
Plated Steel Self-Drilling	9-3

SELF-SEALING SCREWS

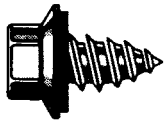
Plated Carbon Steel
No. 12, 14, 17 Diameters



Size (Inches)	Types Stocked	Ext. Wt/M	Pieces Carton
12 x 3/4	A-AB	10.1	2500
12 x 1	A	12.9	2500
12 x 1-1/2	A	17	2000
14 x 3/4	A-AB-B	14.7	2500
14 x 1	A-AB-B	17	2500
14 x 1-1/4	A-B	19	2000
14 x 1-1/2	A-AB-B	21.4	1500
14 x 1-3/4	A-B	23.4	1500
14 x 2	A-B	26	1000
14 x 2-1/2	A-B	30	1000
14 x 3	A-B	34	1000
14 x 3-1/2	A-B	38	500
14 x 4	A-B	44.6	500
14 x 5	A-B	53.5	300
14 x 6	A-B	61.5	250
17 x 7/8	AB	18	2000

SELF-SEALING SCREWS

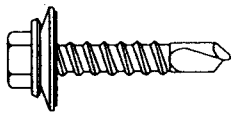
300 Series Stainless Steel
No. 12, 14, 17 Diameters



Size (Inches)	Types Stocked	Ext. Wt/M	Pieces Carton
12 x 3/4	A-AB	10.1	2500
12 x 1	A	12.9	2500
14 x 3/4	A-AB-B	14.7	2500
14 x 1	A-AB-B	17	2500
14 x 1-1/4	A-B	19	2000
14 x 1-1/2	A-B	21.4	1500
14 x 1-3/4	A-B	23.4	1500
14 x 2	A-B	26	1000
14 x 2-1/2	A-B	30	1000
14 x 3	A-B	34	1000
14 x 3-1/2	A-B	38	500
14 x 4	A-B	44.6	500
14 x 5	A-B	53.5	300
14 x 6	A-B	61.5	250
17 x 3/4	AB	17	2000
17 x 1	AB	21	1500
17 x 1-1/4	AB	24	1500
17 x 1-1/2	AB	27	1000
17 x 1-3/4	AB	29	1000

SELF-SEALING SCREWS

Plated Steel Self-Drilling
#3 Point (Hex Washer)



Size (Inches)	Est. Wt/M	Pieces Carton
#10 – 16 x 5/8	9.1	5000
#10 - 16 x 3/4	9.7	5000
#10 – 16 x 1	10.8	5000
#12 – 14 x 3/4	12.7	2500
#12 – 14 x 1	14.7	2500
#12 – 14 x 1-1/4	16.8	2500
#12 – 14 x 1-1/2	18.0	2000
#12 – 14 x 2	20.5	1500
#12 – 14 x 2-1/2	24.5	1000
#12 – 14 x 3	28.0	500
1/4 – 14 x 3/4	16.4	2500
1/4 – 14 x 1	18.6	2500
1/4 – 14 x 1-1/4	20.0	2000
1/4 – 12 x 1-1/2	22.4	2000
1/4 – 14 x 2	27.0	1500
1/4 – 14 x 2-1/2	32.6	1000
1/4 – 14 x 3	37.1	500
1/4 – 14 x 4	46.2	500

DESCRIPTION	PAGE
Self-Locking Fasteners	10-1 to 10-3

SELF-LOCKING FASTENERS

Features

Locking Pellet

The nylon pellet projects slightly beyond the crest of the thread – it must be compressed when the mating parts are engaged. When compressed, the resilient nylon pellet sets up a counter-force and creates a strong metal-to-metal engagement of the threads opposite the nylon pellet. This locking action takes place whether or not the fastener is seated. Moreover, the locking action is sustained; because nylon attempts to regain its original shape when deformed, it actually "grows" into the threads, providing still greater resistance to loosening**.**

Sealing

When an ordinary bolt is torqued down and seated properly, it is impossible for fluids to trickle down a zig-zag path parallel to the axis of the bolt because the load-bearing thread flanks are tightly engaged. But there is no way of preventing the fluid from entering the gap between the nonload-bearing thread flanks and following this gap in a spiral path around the bolt until leakage occurs.

With a self-locking bolt, however, the nylon pellet acts as a dam along the threads and stops all leakage. In all tests, even at elevated temperatures and pressures, the self-locking bolt has proved an effective seal against leakage**.**

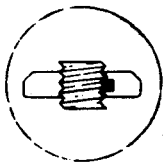
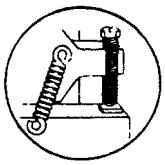
Adjusting

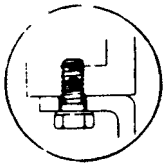
Since the nylon pellet that locks self-locking fasteners is effective regardless of whether the fastener is seated or not, self-locking fasteners make excellent adjustment screws. Fasteners stay just where you want them….cannot back off or be shaken out of position. In addition, the nature of self-locking fasteners makes it possible to change adjustments with ease and accuracy.

Locking Patch

The Locking Patch may be permanently bonded to any threaded fastener. Resilient patch provides you with superior locking torque on any threaded fastener, regardless of rockwell hardness.

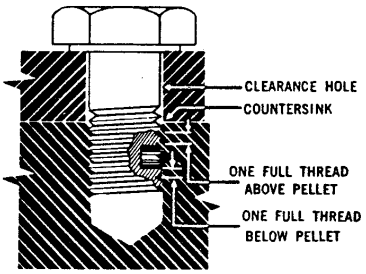
Fasteners with the Patch meet or exceed the requirements of Mil-F-18240 C and the Industrial Fastener Institute (IFI) requirements for 240°F self-locking fasteners**.**

How They Lock	How They Adjust
 A tough, resilient nylon pellet is permanently embedded in the threads, projecting slightly. When mating threads are engaged, the captive pellet is compressed. Its plastic memory creates a counterforce resulting in strong metal-to-metal contact of the threads. Locking action is sustained; fasteners may be used repeatedly.	 Self-locking fasteners lock whether seated or not. This positive locking action plus the natural resiliency of nylon prevents them from shaking loose or backing off. They can be adjusted easily, accurately, and repeatedly without altering their locking effectiveness.

How They Seal	Any Threaded Part Can Be Made Self-Locking
 The nylon pellet covers the crests of at least two full threads and acts as a jam between the load bearing and nonload-bearing flanks of the mating threads. Properly seated, the screw seats both liquids and gases, even at elevated temperatures and pressures.	Self-locking fasteners lock whether seated or not. This positive locking action plus the natural resiliency of nylon prevents them from shaking loose or backing off. They can be adjusted easily, accurately, and repeatedly without altering their locking effectiveness.

SELF-LOCKING FASTENERS

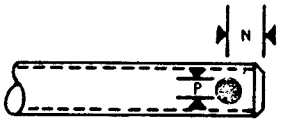
Application Data



1. For best locking torque it is recommended that the mating thread be countersunk 90° or 100° by 1/32" larger than the major thread diameter.
2. The clearance hole for average commercial applications should be a minimum of .015" larger than the major thread diameter in order to provide adequate clearance for the nylon pellet protrusion – for sizes No. 6 and smaller, .010" clearance will suffice.
3. Tensile strength equal to that of a comparable standard bolt or screw is developed when the self-locking bolt is engaged in a mating part two threads beyond the point at which the nylon pellet is completely covered.
4. Designed to have at least one full starting thread available even under the most extreme tolerance conditions. This gives sufficient thread engagement to withstand the axial load imposed by the engagement of the nylon pellet in most mating threads without distorting the first thread in the mating part.

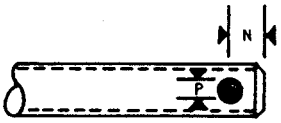
Pellet Data

Machine Screws, Cap Screws, Bolts



Thread Size	Diameter P	Location Nominal
6-32 6-40	5/64	1/8
8-32 8-36	3/32	1/8
10-24 10-32	3/32	5/32
1/4-20 1/4-28	7/64	3/16
5/16-18 5/16-24	9/64	13/64
3/8-16 3/8-24	5/32	7/32
7/16-14 7/16-20	5/32	15/64
1/2-13 1/2-20	5/32	1/4
9/16-12 9/16-18	3/16	9/32
5/8-11 5/8-18	3/16	5/16
3/4-10 3/4-16	7/32	23/64
7/8-9 7/8-14	7/32	13/32
1-8	7/32	13/32

Set Screws



Thread Size	Diameter P	Location Nominal
6-32 6-40	5/64	1/8 7/64
8-32 8-36	3/32	9/64
10-24 10-32	3/32	5/32
1/4-20 1/4-28	7/64	3/16 11/64
5/16-18 5/16-24	9-64	7/32 13/64
3/8-16 3/8-24	5/32	1/4 15/64
7/16-14 7/16-20	5/32	9/32 1/4
1/2-13 1/2-20	5/32	19/64 17/64
5/8-11 5/8-18	3/16	11/32 19/64
3/4-10 3/4-16	7/32	3/8 11/32
7/8-9 7/8-14	7/32	27/64 3/8
1-8 1-14	7/32	29/64 13/32

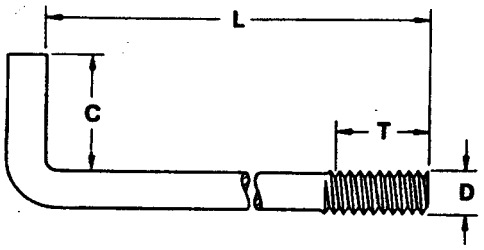
1-14		

DESCRIPTION	PAGE
U-Bolts And Eye Bolts	
Anchor Bolts & Bent Bolts	11-1
U-Bolts, Standard	11-2
U-Bolts, Long Tangent	11-3
Eyebolts-Regular Pattern	11-4
Eyebolts-Shoulder Pattern	11-5
Rod End Eyebolt Blanks	11-6

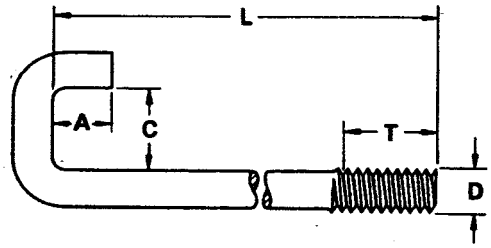
ANCHOR BOLTS, BENT BOLTS

Anchor Bolt

Hook Bolt, Right Angle Bend
(DxLxCxT)

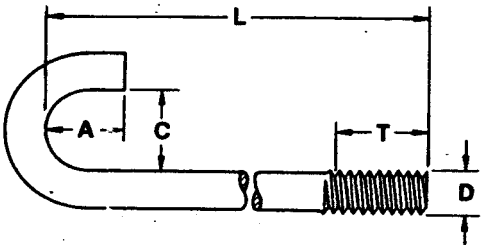


Hook Bolt, Square Bend
(DxLxCxAxT)



J-Bolt

Hook Bolt, Round Bend
(DxLxCxAxT)



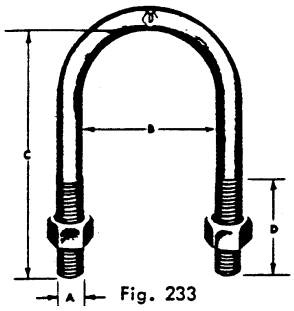
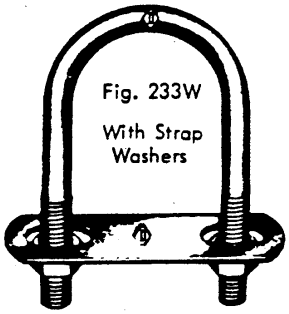


Fig. 233

U BOLTS

With Hex Nuts



Inside diameters shown are those of standard pipe. Outside diameters are of standard, extra strong and double extra strong pipe. These dimensions are published from standards by E.W. Daniel, a major manufacturer of this product, and are subject to change at any time.

Pipe and Conduit Sizes

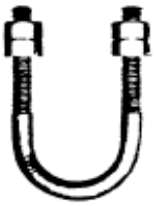
Inside Diam in Inches	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6
Outside Diam in Inches	9/16	11/16	7/8	1-1/16	1-5/16	1-11/16	1-15/16	2-3/8	2-7/8	3-1/2	4	4-1/2	5-9/16	6-5/8

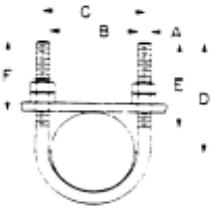
Fig. 233 Stock No.	A Thread Diam Inches	B Width Bet. Legs Inches	C Inside Length Inches	C Outside Length Inches	D Thread Length Inches	Pipe Size Inches	Wt per 100 Pcs Lbs	Figure 233W	
								Wt per 100 Pcs Lbs	Stock No.
400A	3/16	9/32	3/4	15/16	1/2		1.5		
400B	7/32	9/32	3/4	31/32	1/2		1.5		
400C	1/4	11/32	15/16	1-3/16	5/8		3/8		
401	1/4	3/4	1-1/4	1-1/2	3/4	3/8	4.4		
402	1/4	3/4	1-3/4	2	3/4	3/8	5.6		
403	1/4	3/4	2-1/4	2-1/2	1-1/2	3/8	6.9		
407	1/4	1	1-3/4	2	3/4	1/2	5.6	10	407W
408	1/4	1-1/8	2	2-1/4	3/4	3/4	6.3	10.6	408W
409	1/4	1-3/8	2-1/4	2-1/2	3/4	1	6.9	10.6	409W
410	1/4	1-3/4	2-3/4	3	1	1-1/4	8	13.8	410W
411	1/4	2	3-1/4	3-1/2	1-1/4	1-1/2	9.3	14.4	411W
412	1/4	1-1/2	3-1/2	3-3/4	2	1	9.4	15	412W
420	5/16	1-3/8	2-3/16	2-1/2	1	1	10.6	15.6	420W
420A	5/16	1-3/8	1-5/16	1-5/8	1		6.9		
421	5/16	1-3/8	3-11/16	4	1-1/2	1	15.6	20.6	421W
422	5/16	1-3/4	2-11/16	3	1	1-1/4	13	18	422W
423	5/16	1-3/4	4-3/16	4-1/2	1-1/2	1-1/4	18	22.5	423W
424	5/16	2	2-11/16	3	1	1-1/2	13	19.4	424W
425	5/16	2	3-11/16	4	1-1/2	1-1/2	16.2	20.9	425W
427	5/16	2-1/2	3-3/16	3-1/2	1-1/2	2	15	21.3	427W
428	3/8	7/16	1-1/2	1-13/16	1-1/8		11.3		
429	3/8	5/8	1-3/4	2-1/8	1-1/4		13.3		
430A	3/8	1-3/8	3-1/8	3-1/2	1-1/2	1	20.6	30	430A-W
430B	3/8	1-3/4	3-5/8	4	1-1/2	1-1/4	23		
430	3/8	2	3-1/8	3/1/2	1-1/4	1-1/2	21.2	30.6	430W
431	3/8	2-1/2	3-5/8	4	1-1/2	2	24.4		431W
432	3/8	3	4-1/8	4-1/2	1-1/2	2-1/2	27.5		432W
433	3/8	3-1/2	4-5/8	5	1-1/2	3	30.6		433W
437	7/16	11-16	2	2-7/16	1-3/8		18.8		
440	1/2	3	4-1/2	5	1-1/2	2-1/2	56.9		
440A	1/2	3/4	2-3/8	2-7/8	1-5/8		31.9		
441	1/2	3-1/2	5	5-1/2	1-1/2	3	63		
442	1/2	4	5-1/2	6	1-1/2	3-1/2	68		
443	1/2	4-1/2	6	6-1/2	1-1/2	4	73.7		
444	1/2	5-5/8	7	7-1/2	2	5	86.3		
445	1/2	6-3/4	8	8-1/2	2	6	98		
446	9/16	7/8	2-3/4	3-5/16	1-3/4		47.5		
447A	5/8	1	3-1/4	3-7/8	2-1/4		68.6		
447B	5/8	1-1/8	3-5/8	4-1/4	2-1/2		75		
448	3/4	1-1/4	4-1/8	4-7/8	3		157.5		

LONG TANGENT U-BOLTS, GRINNELL FIGURE 137

U-bolts

standard U-bolt
fig. 137
special U-bolt (non-standard dimensions)
fig. 137S





plastic coated: fig. 137C

SIZE RANGE: ½ to 30 inch pipe.

MATERIAL: Carbon steel U-bolt and four finished hex nuts.

FINISH: Black or galvanized; furnished black unless otherwise specified.

SERVICE: Recommended for support, anchor or guide of heavy loads; often employed in power and process plant service.

MAXIMUM TEMPERATURE: 750°F.

APPROVALS: Complies with Federal Specification WW-H-171D (Type 24) and Manufacturers Standardization Society SP-69 (Type 24).

ORDERING FIG. 137: Specify rod size x pipe size (as ⅝ x 6), figure number, name. U-bolt will be furnished with longer tangents D or with longer threads E if so required and ordered. If hex nuts are not required, specify "without hex nuts."

ORDERING FIG. 137S: Specify figure number, name, material specification, dimensions A, B, C, D and E, and "with hex nuts" or "without hex nuts."

SPECIAL NOTE: When furnished hot-dip galvanized, oversize hex nuts must be used.

fig. 137C coated U-bolt

SIZE RANGE: ½ to 8 inch pipe.

MATERIAL: Carbon steel U-bolt and four finished hex nuts. Formed portion of the U-bolt is plastic coated.

SERVICE: Recommended for support, anchor or guide for glass, copper, brass and aluminum pipe.

MAXIMUM TEMPERATURE: 225°F.

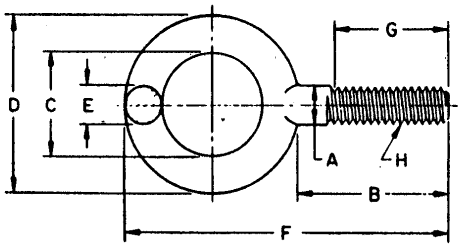
ORDERING: Specify rod size x pipe size (as ⅜ x 2), figure number, name. If hex nuts are not required, specify "without hex nuts."

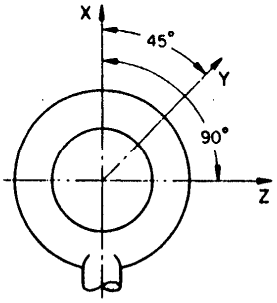
load • weights • packaging • dimensions (inches)

pipe size	rod size A	maximum recommended load, lbs 650°F	750°F	weight with nuts (approx) lb per 100	no of pieces per carton fig. 137	fig. 137C	B	C	D	E	F
½	¼	485	435	11	50	50	15/16	1 3/16	2¾	2⅜	2 5/16
¾	¼	485	435	12	50	50	1⅛	1⅜	2¾	2⅜	2 7/32
1	¼	485	435	12	50	50	1⅜	1⅝	2¾	2⅜	2 3/32
1¼	⅜	1220	1090	28	50	50	1 11/16	2 1/16	2⅞	2⅜	2 1/32
1½	⅜	1220	1090	30	50	50	2	2⅜	3	2½	2 1/16
2	⅜	1220	1090	33	50	50	2 7/16	2 13/16	3¼	2½	2 1/16
2½	½	2260	2020	73	50	50	2 15/16	3 7/16	3¾	3	2 5/16
3	½	2260	2020	78	50	50	3 9/16	4 1/16	4	3	2¼
3½	½	2260	2020	84	50	50	4 1/16	4 9/16	4¼	3	2¼
4	½	2260	2020	90	50	50	4 9/16	5 1/16	4½	3	2¼
5	½	2260	2020	101	...	15	5⅝	6⅛	5	3	2 7/32
6	⅝	3620	3230	197	...	15	6¾	7⅜	6⅛	3¾	2 13/16
8	⅝	3620	3230	233	...	...	8¾	9⅜	7⅛	3¾	2 13/16
10	¾	5420	4830	491	...	...	10⅞	11⅝	8⅛	4	3
12	⅞	7540	6730	773	...	...	12⅞	13¾	9⅝	4¼	3¼
14	⅞	7540	6730	828	...	...	14⅛	15	10¼	4¼	3¼
16	⅞	7540	6730	915	...	...	16⅛	17	11¼	4¼	3¼
18	1	9920	8850	1348	...	...	18⅛	19⅛	12⅛	4¾	3⅝
20	1	9920	8850	1457	...	...	20⅛	21⅛	13⅝	4¾	3⅝
24	1	9920	8850	1687	...	...	24⅛	25⅛	15⅝	4¾	3⅝
30	1	9920	8850	1917	...	...	30⅛	31⅛	18⅝	4¾	3⅝

▪ With minimum safety factor of 5.

TYPE 1 REGULAR PATTERN EYEBOLTS, FORGED





Nominal Size		A	B	C	D	E	F	G	H	W_X	W_Y	W_Z
		Shank Diam	Shank Lngth	Eye ID	Nominal Eye OD	Eye Sect Diam	Overall Lngth	Min Lngth Full Thrd	Thrd Size UNC-2A	Safe Working Load Lb at 0 deg[1]	Safe Working Load Lb at 45 deg[1]	Safe Working Load Lb at 90 deg[1]
1/4*	0.25	0.25	1.00	0.69	1.19	0.19	2.06	0.75	1/4-20 or	400	80	60
		0.28	1.06	0.81		0.25	2.38		.250-20			
5/16	0.31	0.31	1.12	0.81	1.44	0.25	2.44	0.81	5/16-18 or	800	160	120
		0.34	1.19	0.94		0.31	2.75		.3125-18			
3/8*	0.38	.038	1.25	0.94	1.69	0.31	2.81	0.88	3/8-16 or	1400	280	210
		.041	1.38	1.06		0.38	3.19		.375-16			
7/16	0.44	0.44	1.38	1.00	1.81	0.34	3.06	1.00	7/16-14 or	2000	400	300
		0.47	1.50	1.12		0.41	3.44		.4375-14			
1/2*	0.50	0.50	1.50	1.12	2.12	0.44	3.50	1.12	1/2-13 or	2600	520	390
		0.53	1.62	1.25		0.50	3.88		.500-13			
9/16	0.56	0.56	1.62	1.19	2.25	0.47	3.75	1.25	9/16-12 or	3000	600	450
		0.59	1.75	1.31		0.53	4.12		.5625-12			
5/8*	0.62	0.62	1.75	1.31	2.56	0.56	4.19	1.38	5/8-11 or	4000	800	600
		0.66	1.88	1.44		0.62	4.56		.625-11			
3/4*	.075	0.75	2.00	1.44	2.81	0.62	4.69	1.62	3/4-10 or	6000	1200	900
		0.78	2.12	1.56		0.69	5.06		.750-10			
7/8*	0.88	0.88	2.25	1.56	3.19	0.75	5.31	1.81	7/8-9 or	6600	1300	1000
		0.91	2.38	1.69		0.81	5.69		.875-9			
1*	1.00	1.00	2.50	1.69	3.56	0.88	5.94	2.06	1-8 or	8000	1600	1200
		1.06	2.62	1.81		0.94	6.31		1.000-8			
1-1/8	1.12	1.12	2.75	1.94	4.06	1.00	6.69	2.31	1-1/8-7 or	10000	2000	1500
		1.19	2.88	2.06		1.06	7.06		1.125-7			
1-1/4*	1.25	1.25	3.00	212	4.44	1.09	7.31	2.50	1-1/4-7 or	15000	3000	2250
		1.34	3.12	2.25		1.16	7.69		1.250-7			
1-1/2*	1.50	1.50	3.50	2.44	5.19	1.31	8.56	3.00	1-1/2-6 or	18000	3600	2700
		1.59	3.62	2.56		1.38	8.94		1.500-6			
1-3/4*	1.75	1.75	3.75	2.75	6.00	1.50	9.50	3.19	1-3/4-5 or	22000	4400	3300
		1.84	3.88	3.00		1.62	10.12		1.750-5			
2	2.00	2.00	4.00	3.06	6.88	1.75	10.56	3.38	2-4-1/2 or	26000	5200	3900
		2.09	4.25	3.44		1.88	11.44		2.000 4.50			
2-1/2*	2.50	2.50	5.00	3.81	8.50	2.19	13.19	4.25	2-1/2-4 or	32000	6400	4800
		2.62	5.25	4.19		2.31	14.06		2.500-4			

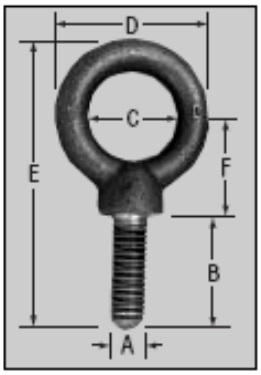
Shoulder Pattern Eye Bolts

Stock No.	Zinc Plated Stock No.	Thread Size UNC-2A A	Shank Length B	I.D. Eye C	O.D. Eye D	Overall Length E	Center of Eye to Shoulder F	Width of Shoulder G	Approx. Wt. Per 100 Pcs.	Rated Capacity	Blanks*
14611	14611ZP	1/4-20	1	¾	1⅜	2⅜	¾	17/32	5.0	500	R14611
14621	14621ZP	5/16-18	1⅛	⅞	1⅞	2 13/16	15/16	19/32	10.0	900	R14621
14631	14631ZP	3/8-16	1¼	1	1 11/16	3¼	1⅛	21/32	20.0	1,300	R14631
14638	14638ZP	7/16-14	1⅜	1 3/32	1 13/16	3 9/16	1¼	25/32	25.0	1,900	R14638
14641	14641ZP	1/2-13	1½	1 3/16	2⅛	3 31/32	1⅜	29/32	40.0	2,400	R14641
14650	14650ZP	9/16-12	1¾	1⅜	2 9/16	4¾	1 21/32	1 1/32	70.0	3,200	R14650
14661	14661ZP	5/8-11	1¾	1⅜	2 9/16	4¾	1 21/32	1 1/32	75.0	4,000	R14661
14672	14672ZP	3/4-10	2	1½	2 13/16	5¼	1 15/16	1 3/16	100.0	5,000	R14672
14682	14682ZP	7/8-9	2¼	1 11/16	3 3/16	6	2⅛	1⅜	160.0	7,000	R14682
14702	14702ZP	1-8	2½	1 15/16	3 9/16	6⅝	2 5/16	1 5/16	275.0	9,000	R14702
14712	14712ZP	1-1/8-7	2¾	2	4 1/16	7 17/32	2 11/16	1¾	340.0	12,000	R14712
14723	14723ZP	1-1/4-7	3	2 3/16	4 7/16	8 7/32	2 5/16	1 5/16	465.0	15,000	R14723
14753	14753ZP	1-1/2-6	3½	2½	5 3/16	9 15/32	3 5/16	2 3/16	765.0	21,000	R14753
14770	14770ZP	1-3/4-5	3¾	2⅞	6	10 5/16	4	2½	1145.0	28,000	R14770
14780	14780ZP	2-4½	4	3¼	6⅞	11⅞	4⅜	2⅞	1700.0	38,000	R14780

Part #14650 dimensions not in accordance with ANSI B18.15.
Shoulder style lifting eye meets MS51937 specification.

Machinery Style Shoulder Pattern

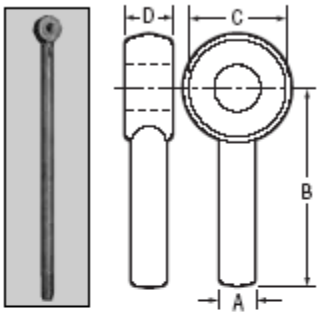
- Forged/ASTM A489
- 1030 Carbon Steel
- Self-Colored**



ROD END EYE BOLTS

Rod Ends

- Forged
- 1030 Carbon Steel & 4140 Alloy*
- Self-Colored



- Shank lengths can vary - ¼ + ½
- Standard forging tolerances ± ½

Self-colored will always be furnished unless otherwise specified.

INFORMATION REQUIRED:

(A) Shank diameter
(B) Length center of eye to end
(C) Head/Boss diameter
(D) Head thickness

4140 Heat treated to B7

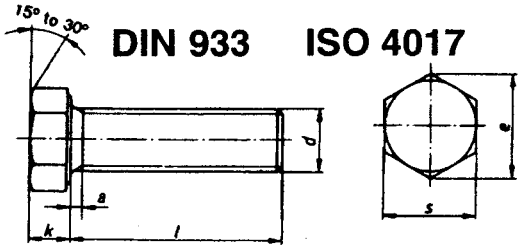
Blanks

1030 Stock No.	4140 Stock No.	Shank Diameter Inches A	Center of Eye to End B	Head Diameter Inches C	Head Thickness Inches D	Approx. Wt. Per 100 Pcs.
R-18004***	—	1/4	1¾	15/16	5/16	3.5
R-18010***	—	1/4	2	½	5/16	4.5
R-18008	—	1/4	2½	½	5/16	4.5
R-18022	—	5/16	1¾	5/8	11/32	14.0
R-18020	—	5/16	4	¾	5/16	13.0
R-18024***	—	5/16	2	15/16	7/16	15.0
R-18048	—	3/8	6	11/16	7/16	24.0
—	RA-18048	3/8	6	11/16	7/16	24.0
R-18044	—	3/8	12	11/16	7/16	—
R-18052***	—	7/16	4¾	15/16	½	45.0
R-18085	—	1/2	6	15/16	5/16	45.0
—	RA-18085	1/2	6	15/16	5/16	45.0
R-18055***	—	1/2	7	15/16	5/16	45.0
R-18070	—	1/2	12	15/16	5/16	90.0
—	RA-18070	1/2	12	15/16	5/16	90.0
R-18059	—	1/2	18	15/16	5/16	98.0
—	RA-18059	1/2	18	15/16	5/16	130.0
R-18058***	—	1/2	2¾	1 1/16	5/16	40.0
R-18075	—	1/2	6	1 1/16	½	36.0
R-18090	—	1/2	18	1 1/16	½	102.0
R-18105	—	5/8	6	1 3/16	11/32	73.0
—	RA-18105	5/8	6	1 3/16	11/32	73.0
R-18110	—	5/8	12	1 3/16	11/32	130.0
—	RA-18110	5/8	12	1 3/16	11/32	130.0
R-18117	—	5/8	18	1 3/16	11/32	172.0
—	RA-18117	5/8	18	1 3/16	11/32	185.0
R-18130	—	3/4	6	1 5/16	13/32	110.0
—	RA-18130	3/4	6	1 5/16	13/32	110.0
R-18135	—	3/4	12	1 5/16	13/32	200.0
—	RA-18135***	3/4	12	1 5/16	13/32	200.0
R-18137	—	3/4	18	1 5/16	13/32	243.0
—	RA-18137	3/4	18	1 5/16	13/32	315.0
R-18150	—	7/8	6	1 13/16	15/32	159.0
—	RA-18150***	7/8	6	1 13/16	15/32	159.0
R-18155	—	7/8	12	1 13/16	15/32	285.0
—	RA-18155	7/8	12	1 13/16	15/32	285.0
R-18162	—	7/8	18	1 13/16	15/32	298.0
R-18170	—	1	6	2	1	213.0
—	RA-18170***	1	6	2	1	213.0
R-18175	—	1	12	2	1	350.0
—	RA-18175	1	12	2	1	350.0
R-18181	—	1	18	2	1	403.0
R-18194	—	1-1/4	12	2½	1¼	575.0
R-18200	—	1-1/4	18	2½	1¼	625.0
R-18210	—	1-1/2	18	3	1½	650.0
R-18214	—	1-3/4	18	3½	1¾	675.0
R-18218	—	2	18	4	2	700.0

*Not heat treated. ***These products will be discontinued when stock is depleted.

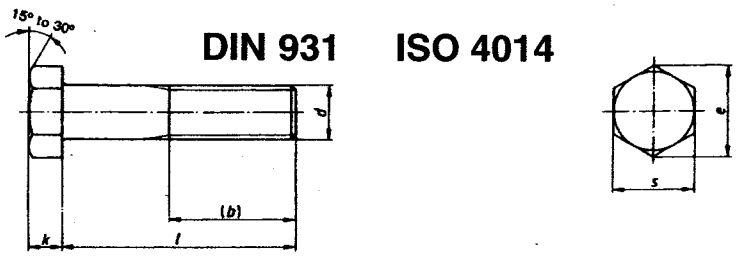
DESCRIPTION	PAGE
METRIC FASTENERS	
Hex Head Cap Screws	12-1
Weights of Hex Head Cap Screws	12-2
Socket Cap Screws & Flat Head Socket Caps	12-3
Socket Set Screws & Button Socket Caps	12-4
Hex Nuts	12-5
Flatwashers	12-6
Internal & External Tooth Washers	12-7 to 12-8
Lockwashers	12-9

HEX HEAD CAP SCREWS
FULL THREAD



Ø d	M 3	M 4	M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 24
A	1.5	2.1	2.4	3	3.75	4.5	5.25	6	6	7.5	7.5	9
e (min)	6.01	7.66	8.79	11.05	14.38	18.9	21.1	24.49	26.76	30.14	33.53	39.98
k (min)	1.88	2.68	3.35	3.85	5.15	6.22	7.32	8.62	9.82	11.28	12.28	14.78
S	5.5	7	8	10	13	17	19	22	24	27	30	36
Pitch	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5	3

HEX HEAD CAP SCREWS
PARTIAL THREAD



D	M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
b≤125 I	16	18	22	26	30	34	38	42	46	50	54
b>125	22	24	28	32	36	40	44	48	52	56	60
S	8	10	13	17	19	22	24	27	30	34	36
k (min)	3.35	3.85	5.15	6.22	7.32	8.62	9.82	11.28	12.28	13.78	14.78
Pitch	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5	2.5	3
E	8.79	11.05	14.38	18.9	21.1	24.49	26.75	30.14	33.53	35.72	39.98

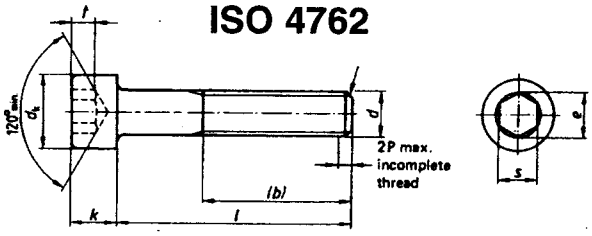
Weights of Standard Size Hex Caps in Kilograms per 1000 Pieces

		d = Diameter									
		5	6	8	10	12	14	16	18	20	24
L = LENGTH	30	5.64	8.06	16.1							
	35	6.42	9.13	18.2	32						
	40	7.2	10.2	20.3	35	49.1					
	45	7.98	11.3	22.2	38	53.6	75.9	99			
	50	8.76	12.3	24.2	41.1	58.1	82	107			
	55		13.4	25.8	43.8	62.6	88.1	115			
	60	10.30	4.4	27.8	46.9	67	94.1	123	161	207	
	65		15.5	29.8	50	70.3	98.8	131		219	
	70		16.5	31.8	53.1	74.7	105	139	181	231	356
	80		18.6	35.7	59.3	83.6	117	155	200	255	392
	90		20.8	39.6	65.5	92.4	127	171	220	279	428
	100		23	43.6	71.7	101	139	186	240	303	464
	110			47.5	83.9	109	151	202	260	327	500
	120			51.4	90	118	164	218	280	351	535
	130			55.3	96.2	127	174	230	296	374	560
	140			59.2	102	136	185	246	316	398	595
	150			63.1	108	145	199	262	336	422	630
	160							278		446	
	180							310		494	
	200							342		544	

1 Kilogram is approximately 2.2 Pounds.

HEX SOCKET HEAD CAP SCREWS

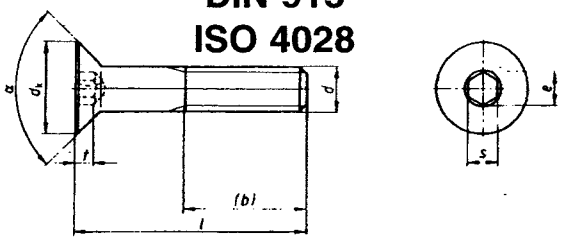
DIN 912
ISO 4762



Ø d	M 1.6	M 2	M 2.5	M 3	M 4	.M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 20
dk (min)	2.86	3.62	4.32	5.32	6.78	8.28	9.78	12.73	15.73	17.73	20.67	23.67	29.67
e	1.73	1.73	2.3	2.87	3.44	4.58	5.72	6.86	9.15	11.43	13.72	16	19.44
k (min)	1.46	1.86	2.36	2.86	3.82	4.82	5.7	7.64	9.64	11.57	13.57	15.57	19.48
s (nominal dimension)	1.5	1.5	2	2.5	3	4	5	6	8	10	12	14	17
b	15	16	17	18	20	22	24	28	32	36	40	44	52
t (min	0.7	1	1.1	1.3	2	2.5	3	4	5	6	7	8	10

FLAT SOCKET CAP SCREWS

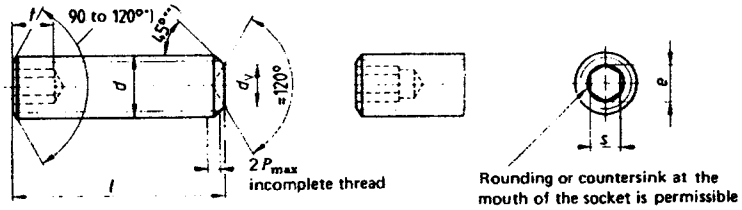
DIN 915
ISO 4028



d	M 3	M 4	M 5	M 6	M 8	M 10	M 12	M 16
e	2.3	2.9	3.5	4.7	5.8	7	9.4	11.7
t	1.7	2.3	2.8	3.3	4.4	5.5	6.5	7.5
s	2	2.5	3	4	5	6	8	10
Pitch	0.5	0.7	0.8	1	1.25	1.5	1.75	2
dk (nominal dimension)	6	8	10	12	16	20	24	30

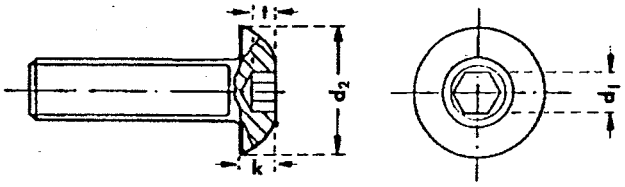
HEX SOCKET SET SCREWS
WITH CUP POINT

DIN 916
ISO 4029



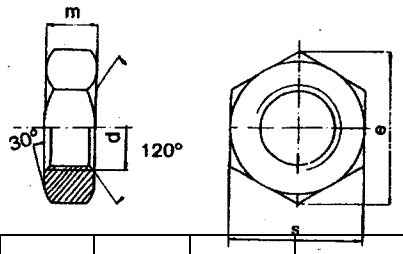
d	M 3	M 4	M 5	M 6	M 8	M 10	M 12
t	2	2.5	3	3.5	5	6	8
dv	1.4	2	2.5	3	5	6	8
s	1.5	2	2.5	3	4	5	6
e	1.73	2.3	2.87	3.44	4.58	5.72	6.86

BUTTON SOCKET HEAD SCREWS
ISO 8380



d1	M 3	M 4	M 5	M 6	M 8
d2 (max)t	5.7	7.6	9.5	10.5	14
k (max)	1.65	2.2	2.75	3.3	4.4
t	1.04	1.3	1.56	2.08	2.60

HEX NUTS
DIN 934
ISO 4032

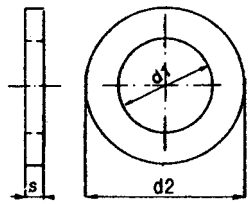


diameter	m	s	e	Box Quantity	Weight per 1000 Pcs in Kg
M 2	1.6	4	4.38	500	0.142
M 2.5	2	5	5.51	500	0.28
M 3	2.4	5.5	6.08	200	0.384
M 4	3.2	7	7.74	200	0.812
M 5	4	8	8.87	200	1.23
M 6	5	10	11.05	200	2.5
M 7	5.5	11	12.12	200	3.12
M 8	6.5	13	14.38	200	5.2
M 10	8	17	18.9	200	11.6
M 12	10	19	21.1	100	17.3
M 14	11	22	24.49	100	25
M 16	13	24	26.75	50	33.3
M 18	15	27	30.14	50	49.4
M 20	16	30	33.53	50	64.4
M 22	18	32	35.72	25	79
M 24	19	36	39.98	25	110
M 27	22	41	45.63	10	165
M 30	24	46	51.28	10	223
M 33	26	50	55.8	10	288
M 36	29	55	61.31	10	393
M 39	31	60	66.96	5	502

1 Kilogram is approximately 2.2 Pounds

REGULAR FLAT WASHERS
DIN 125
ISO 7089

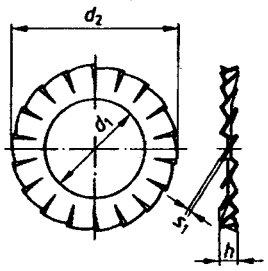
TYPE A



Diameter	Clearance Hole Diameter d1	Outside Diameter d2	S (nominal)	Box Quantity	Weight per 1000 Pcs in Kg
M 2	2.2	4.7	0.3	500	0.037
M 2.5	2.7	5.7	0.5	500	0.088
M 3	3.2	6.64	0.5	200	0.119
M 4	4.3	8.64	0.8	200	0.308
M 5	5.3	9.64	1	200	0.443
M 6	6.4	11.57	1.6	200	1.02
M 8	8.4	15.57	1.6	200	1.83
M 10	10.5	19.48	2	200	3.57
M 12	13	23.48	2.5	100	6.27
M 14	15	27.48	2.5	100	8.62
M 16	17	29.48	3	50	11.3
M 18	19	33.38	3	50	14.7
M 20	21	36.38	3	50	17.2
M 22	23	38.38	3	25	18.3
M 24	25	43.38	4	25	32.3
M 27	28	49.38	4	10	42.3
M 30	31	55.86	4	10	53.6

1 Kilogram is approximately 2.2 Pounds.

EXTERNAL TOOTH LOCK WASHERS
DIN 6798
TYPE A

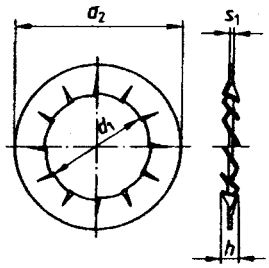


$h \approx 3s_1$

Diameter d1	d2 (nominal size)	S1	Number of Teeth	Box Quantity	Weight per 1000 Pcs in Kg
M 2	4.5	0.3	9	500	0.03
M 2.5	5.5	0.4	9	500	0.045
M 3	6	0.4	9	200	0.06
M 4	8	0.5	11	200	0.14
M 5	10	0.6	11	200	0.28
M 6	11	0.7	12	200	0.36
M 8	15	0.8	14	200	0.8
M 10	18	0.9	16	200	1.25
M 12	20.5	1	16	100	1.6
M 14	24	1	18	100	2.3
M 16	26	1.2	18	50	2.9
M 18	30	1.4	18	50	5
M 20	33	1.4	20	50	6
M 22	36	1.5	20	25	7.5
M 24	38	1.5	20	25	8

1 Kilogram is approximately 2.2 Pounds.

INTERNAL TOOTH LOCK WASHERS
DIN 6798
TYPE J

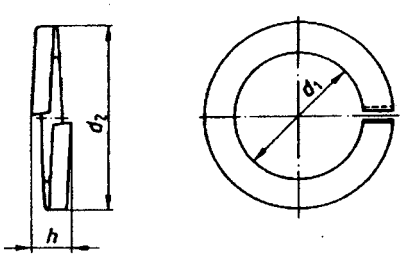


$h \approx 3s_1$

Diameter d1	d2 (nominal size)	S1	Number of Teeth	Box Quantity	Weight per 1000 Pcs in Kg
M 2.5	5.5	0.4	7	500	0.045
M 3	6	0.4	7	200	0.06
M 4	8	0.5	8	200	0.14
M 5	10	0.6	8	200	0.28
M 6	11	0.7	9	200	0.36
M 8	15	0.8	10	200	0.8
M 10	18	0.9	12	200	1.25
M 12	20.5	1	12	100	1.6
M 14	24	1	14	100	2.3
M 16	26	1.2	14	50	2.9
M 18	30	1.4	14	50	5
M 20	33	1.4	16	50	6

1 Kilogram is approximately 2.2 Pounds.

REGULAR SPLIT LOCK WASHERS
DIN 127



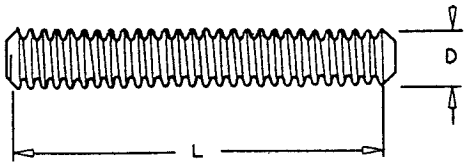
Diameter	d1 (min)	D2 (max)	h (min)	Box Quantity	Weight per 1000 Pcs in Kg
M 3	3.1	6.2	1.6	200	0.11
M 4	4.1	7.6	1.8	200	0.18
M 5	5.1	9.2	2.4	200	0.36
M 6	6.1	11.8	3.2	200	0.83
M 8	8.1	14.8	4	200	1.6
M 10	10.2	18.1	4.4	200	2.53
M 12	12.2	24.1	5	100	3.82
M 14	14.2	21.1	6	100	6.01
M 16	16.2	27.4	7	50	8.91
M 18	18.2	29.4	7	50	8.91
M 20	20.2	33.6	8	50	15.2
M 22	22.5	35.9	8	25	16.5
M 24	24.5	40	10	25	26.2
M 27	27.5	43	10	10	27.8
M 30	30.5	48.2	12	10	44.3

1 Kilogram is approximately 2.2 Pounds.

DESCRIPTION	PAGE
Thread Length Measurement and Suggested Lengths & Torques for Common Flange Applications	13-1
Bolting & Ring Gasket Requirements for ANSI and API Flanges	13-2

SUGGESTED LENGTHS AND TORQUE FOR COMMON FLANGE APPLICATIONS

Calculating Stud Bolt Lengths (from first thread to first thread)



Stud Bolts for Pressure-Temperature Piping

The length of stud bolt, measured parallel to the axis, is the distance from first thread to first thread. First thread is defined as the intersection of the major diameter of the thread with the base of the point.

Recommended Flange Bolt Torque

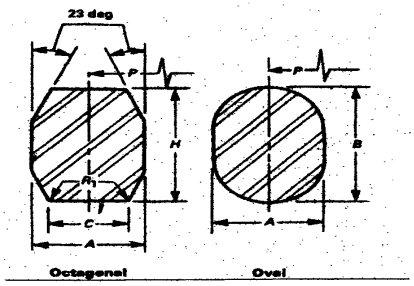
Bolt Size	40,000 PSI Stress Bolt Tension lbf	40,000 PSI Stress Make-up Torque ft-lbs		52,500 PSI Stress Bolt Tension lbf	52,500 PSI Stress Make-up Torqueft-lbs
1/2 – 13	5674	45		7448	59
5/8 – 11	9026	86		11846	113
3/4 – 10	13355	150		17528	196
7/8 – 9	18482	239		24258	313
1 – 8	24229	361		31800	474
1-1/8 – 8	31617	522		41497	686
1-1/4 – 8	39987	726		52483	953
1-3/8 – 8	49339	976		64757	1281
1-1/2 – 8	59672	1277		78320	1676
1-5/8 – 8	70988	1635		93171	2146
1-3/4 - 8	83284	2054		109311	2695
1-7/8 – 8	96563	2538		126739	3331
2 – 8	110824	3093		145456	4060
2-1/4 – 8	142290	4435		186755	5821
2-1/2 – 8	177683	6116		233209	8028
2-5/8 – 8	196852	7097		258368	9314
2-3/4 - 8	217003	8176		284817	10731
3 – 8	260250	10653		341578	13982
3-1/4 – 8	307424	13585		403495	17830
3-3/4 – 8	413554	20967		542790	27519
3-7/8 - 8	442541	23157		580834	30393
4 – 8	472509	25494		620168	33461
4-1/2 – 8	602200	36412		790388	47790
4-3/4-8	672936	42879		883229	56289

BOLTING AND RING GASKET REQUIREMENTS
for API AND ANSI FLANGES

Primary Source Pressure Rating	Bolting	Nominal Pipe Size																				
		Flange Facing	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6	8	10	12	14	16	18	20	24
150 Pound	Number		4	4	4	4	4	4	4	4	8	8	8	8	8	12	12	12	16	16	20	20
	Diameter		1/2	1/2	½	1/2	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	7/8	7/8	1	1	1-1/8	1-1/8	1-1/4
	Length of Stud Bolts	1/16 1RF	2-1/2	2-1/2	2-3/4	2-3/4	3	3-1/4	3-1/2	3-3/4	3-3/4	3-3/4	4	4	4-1/4	4-3/4	4-3/4	5-1/4	5-1/2	6	6-1/4	7
		RTJ	-	-	3-1/4	3-1/4	3-1/2	3-3/4	4	4-1/4	4-1/4	4-1/4	4-1/2	4-1/2	4-1/2	5-1/4	5-1/4	5-3/4	6	6-1/2	6-3/4	7-1/2
	Ring Size	R	-	-	15	17	19	22	25	29	33	36	40	43	48	52	56	59	64	88	72	76
300 Pound	Number		4	4	4	4	4	8	8	8	8	8	8	12	12	16	16	20	20	24	24	24
	Diameter		1/2	5/8	5/8	5/8	3/4	5/8	¾	3/4	3/4	3/4	3/4	3/4	7/8	1	1-1/8	1-1/8	1-1/4	1-1/4	1-1/4	1-1/2
	Length of Stud Bolts	1/16 1RF	2-3/4	3	3-1/4	3-1/4	3-3/4	3-1/2	4	4-1/4	4-1/2	4-1/2	4-3/4	5	5-1/2	6-1/4	6-3/4	7	7-1/4	7-3/4	8-1/4	9-1/4
		RTJ	3-1/4	3-1/2	3-3/4	3-3/4	4-1/4	4-1/4	4-3/4	5	5-1/4	5-1/4	5-1/2	5-3/4	6-1/4	7	7-1/2	7-3/4	8-1/4	8-1/2	9	10-1/4
	Ring Size	R	11	13	16	18	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
		RX	-	-	-	-	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
400 Pound	Number		4	4	4	4	4	8	8	8	8	8	8	12	12	16	16	20	20	24	24	24
	Diameter		1/2	5/8	5/8	5/8	3/4	5/8	¾	3/4	7/8	7/8	7/8	7/8	1	1-1/8	1-1/4	1-1/4	1-3/8	1-3/8	1-1/2	1-3/4
	Length of Stud Bolts	1/4 1RF	3-1/4	3-1/2	3-3/4	4	4-1/4	4-1/4	4-3/4	5	5-1/2	5-1/2	5-3/4	6	6-3/4	7-1/2	8	8-1/4	8-3/4	9	9-3/4	10-3/4
		RTJ	3-1/4	3-1/2	3-3/4	4	4-1/4	4-1/2	5	5-1/4	5-3/4	5-3/4	6	6-1/4	7	7-3/4	8-1/4	8-1/2	9	9-1/4	10	11-1/4
	Ring Size	R	11	13	16	18	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
		RX	-	-	-	-	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
600 Pound	Number		4	4	4	4	4	8	8	8	8	8	8	12	12	16	20	20	20	20	24	24
	Diameter		1/2	5/8	5/8	5/8	3/4	5/8	¾	3/4	7/8	7/8	1	1	1-1/8	1-1/4	1-1/4	1-3/8	1-1/2	1-5/8	1-5/8	1-7/8
	Length of Stud Bolts	1/4 1RF	3-1/4	3-1/2	3-3/4	4	4-1/4	4-1/4	4-3/4	5	5-1/2	5-3/7	6-1/2	6-3/4	7-3/4	8-1/2	8-3/4	9-1/4	10	10-3/4	11-1/2	13
		RTJ	3-1/4	3-1/2	3-3/4	4	4-1/4	4-1/2	5	5-1/4	5-3/4	6	6-3/4	7	8	8-3/4	9	9-1/2	10-1/4	11	11-3/4	13-1/2
	Ring Size	R	11	13	16	18	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
		RX	-	-	-	-	20	23	26	31	34	37	41	45	49	53	57	61	65	69	73	77
900 Pound	Number		4	4	4	4	4	8	8	8	-	8	8	12	12	16	20	20	20	20	20	20
	Diameter		3/4	3/4	7/8	7/8	1	7/8	1	7/8	-	1-1/8	1-1/4	1-1/8	1-3/8	1-3/8	1-3/8	1-1/2	1-5/8	1-7/8	2	2-1/2
	Length of Stud Bolts	1/4 1RF	4-1/4	4-1/2	5	5	5-1/2	5-3/4	6-1/4	5-3/4	-	6-3/4	7-1/2	7-3/4	8-3/4	9-1/4	10	10-3/4	11-1/4	13	13-3/4	17-1/4
		RTJ	4-1/4	4-1/2	5	5	5-1/2	6	6-1/2	6	-	7	7-3/4	7-3/4	9	9-1/2	10-1/4	11-1/4	11-3/4	13-1/2	14-1/4	18
	Ring Size	R	12	14	16	18	20	24	27	31	-	37	41	45	49	53	57	62	66	70	74	78
		RX	-	-	-	-	20	24	27	31	-	37	41	45	49	53	57	62	66	70	74	78
1500 Pound	Number		4	4	4	4	4	8	8	8	-	8	8	12	12	12	12	16	16	16	16	16
	Diameter		3/4	3/4	7/8	-	1	7/8	1	1-1/8	-	1-1/4	1-1/2	1-3/8	1-5/8	1-7/8	2	2-1/4	2-1/2	2-3/4	3	3-1/2
	Length of Stud Bolts	1/4 1RF	4-1/4	4-1/2	5	5	5-1/2	5-3/4	6-1/4	7	-	7-3/4	9-3/4	10-1/4	11-1/2	13-1/2	15	16-1/4	17-3/4	19-1/2	21-1/4	24-1/4
		RTJ	4-1/4	4-1/2	5	5	5-1/2	6	6-1/2	7-1/4	-	8	10	10/1/2	12	13-3/4	15-1/2	17	18-3/4	20-1/2	22-1/2	25-1/2
	Ring Size	R	12	14	16	18	20	24	27	35	-	39	44	46	50	54	58	63	67	71	75	79
		RX	-	-	-	-	20	24	27	35	-	39	44	46	50	54	58	63	67	71	75	79
2500 Pound	Number		4	4	4	4	4	8	8	8	-	8	8	8	12	12	12	-	-	-	-	-
	Diameter		3/4	3/4	7/8	1	1-1/8	1	1-1/8	1-1/4	-	1-1/2	1-3/4	2	2	2-1/2	2-3/4	-	-	-	-	-
	Length of Stud Bolts	1/4 1RF	5	5	5-1/2	6	6-3/4	7	7-3/4	8-3/4	-	10	11-3/4	13-3/4	15-1/4	19-1/4	21-1/4	-	-	-	-	-
		RTJ	5	5	5-1/2	6-1/4	7	7-1/4	8	9	-	10-1/2	12-1/2	14-1/4	15-3/4	20-1/4	22-1/4	-	-	-	-	-
	Ring Size	R	13	16	18	21	23	26	28	32	-	38	42	47	51	55	60	-	-	-	-	-
		RX	-	-	-	21	23	26	28	32	-	38	42	47	51	55	60	-	-	-	-	-

DESCRIPTION	PAGE
Type R Ring Gaskets	14-1 to 14-3
Type RX Ring Gaskets	14-4

TYPE R RING GASKETS



Metallic Gaskets for Pipe Flanges
Ring-Joint, Spiral Wound and Jacketed

TYPE R RING GASKET DIMENSIONS & TOLERANCES

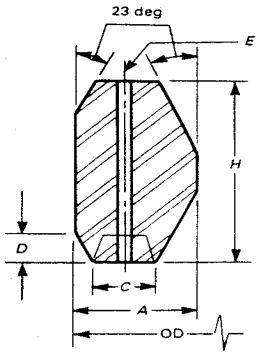
Ring Number	Pitch Dia. of Ring *P*	Width of Ring *A*	Height of Ring		Width of Flat on Octagonal Ring *C*	Radius in Octagonal Ring R_1
			Oval *B*	Octagonal *H*		
R-11	1.344	0.250	0.44	0.38	0.170	0.06
R-12	1.563	0.313	0.56	0.50	0.206	0.06
R-13	1.688	0.313	0.56	0.50	0.206	0.06
R-14	1.750	0.313	0.56	0.50	0.206	0.06
R-15	1.875	0.313	0.56	0.50	0.206	0.06
R-16	2.000	0.313	0.56	0.50	0.206	0.06
R-17	2.250	0.313	0.56	0.50	0.206	0.06
R-18	2.375	0.313	0.56	0.50	0.206	0.06
R-19	2.563	0.313	0.56	0.50	0.206	0.06
R-20	2.688	0.313	0.56	0.50	0.206	0.06
R-21	2.844	0.438	0.69	0.63	0.305	0.06
R-22	3.250	0.313	0.56	0.50	0.206	0.06
R-23	3.250	0.438	0.69	0.63	0.305	0.06
R-24	3.750	0.438	0.69	0.63	0.305	0.06
R-25	4.000	0.313	0.56	0.50	0.206	0.06
R-26	4.000	0.438	0.69	0.63	0.305	0.06
R-27	4.250	0.438	0.69	0.63	0.305	0.06
R-28	4.375	0.500	0.75	0.69	0.341	0.06
R-29	4.500	0.313	0.56	0.50	0.206	0.06
R-30	4.625	0.438	0.69	0.63	0.305	0.06
R-31	4.875	0.438	0.69	0.63	0.305	0.06
R-32	5.000	0.500	0.75	0.69	0.341	0.06
R-33	5.188	0.313	0.56	0.50	0.206	0.06
R-34	5.188	0.438	0.69	0.63	0.305	0.06
R-35	5.375	0.438	0.69	0.63	0.305	0.06
R-36	5.875	0.313	0.56	0.50	0.206	0.06
R-37	5.875	0.438	0.69	0.63	0.305	0.06
R-38	6.188	0.625	0.88	0.81	0.413	0.06
R-39	6.375	0.438	0.69	0.63	0.305	0.06
R-40	6.750	0.313	0.56	0.50	0.206	0.06

Ring Number	Pitch Dia. of Ring *P*	Width of Ring *A*	Height of Ring		Width of Flat on Octagonal Ring *C*	Radius in Octagonal Ring R_1
			Oval *B*	Octagonal *H*		
R-41	7.125	0.438	0.69	0.63	0.305	0.06
R-42	7.500	0.750	1.00	0.94	0.485	0.06
R-43	7.625	0.313	0.56	0.50	0.206	0.06
R-44	7.625	0.438	0.69	0.63	0.305	0.06
R-45	8.313	0.438	0.69	0.63	0.305	0.06
R-46	8.313	0.500	0.75	0.69	0.341	0.06
R-47	9.000	0.750	1.00	0.94	0.485	0.06
R-48	9.750	0.313	0.56	0.50	0.206	0.06
R-49	10.625	0.438	0.69	0.63	0.305	0.06
R-50	10.625	0.625	0.88	0.81	0.413	0.06
R-51	11.000	0.875	1.13	1.06	0.583	0.06
R-52	12.000	0.313	0.56	0.50	0.206	0.06
R-53	12.750	0.438	0.69	0.63	0.305	0.06
R-54	12.750	0.625	0.88	0.81	0.413	0.06
R-55	13.500	1.125	1.44	1.38	0.780	0.09
R-56	15.000	0.313	0.56	0.50	0.206	0.06
R-57	15.000	0.438	0.69	0.63	0.305	0.06
R-58	15.000	0.875	1.13	1.06	0.583	0.06
R-59	15.625	0.313	0.56	0.50	0.206	0.06
R-60	16.000	1.250	1.56	1.50	0.879	0.09
R-61	16.500	0.438	0.69	0.63	0.305	0.06
R-62	16.500	0.625	0.88	0.81	0.413	0.06
R-63	16.500	1.000	1.31	1.25	0.681	0.09
R-64	17.875	0.313	0.56	0.50	0.205	0.06
R-65	18.500	0.438	0.69	0.63	0.305	0.06
R-66	18.500	0.625	0.88	0.81	0.413	0.06
R-67	18.500	1.125	1.44	1.38	0.780	0.09
R-68	20.375	0.313	0.56	0.50	0.206	0.06
R-69	21.000	0.438	0.69	0.63	0.305	0.06
R-70	21.000	0.750	1.00	0.94	0.485	0.06
R-71	21.000	1.125	1.44	1.38	0.780	0.09
R-72	22.000	0.313	0.56	0.50	0.206	0.06
R-73	23.000	0.500	0.75	0.69	0.341	0.06
R-74	23.000	0.750	1.00	0.94	0.785	0.06
R-75	23.000	1.250	1.56	1.50	0.879	0.09
R-76	26.500	0.313	0.56	0.50	0.206	0.06
R-77	27.250	0.625	0.88	0.81	0.413	0.06
R-78	27.500	1.000	1.31	1.25	0.681	0.09
R-79	27.250	1.375	1.75	1.63	0.977	0.09
R-80	24.250	0.313	N/A	0.50	0.206	0.06
R-81	25.000	0.563	N/A	0.75	0.377	0.06
R-82	2.250	0.438	N/A	0.63	0.305	0.06
R-84	2.5	0.438	N/A	0.63	0.305	0.03
R-85	3.125	0.500	N/A	0.69	0.641	0.06

Ring Number	Pitch Dia. of Ring *P*	Width of Ring *A*	Height of Ring		Width of Flat on Octagonal Ring *C*	Radius in Octagonal Ring R_1
			Oval *B*	Octagonal *H*		
R-86	3-563	0.625	N/A	0.81	0.413	0.06
R-87	3-938	0.625	N/A	0.81	0.413	0.06
R-88	4.875	0.750	N/A	0.94	0.485	0.06
R-89	4.500	0.750	N/A	0.94	0.485	0.06
R-90	6.125	0.875	N/A	1.06	0.583	0.06
R-91	10.250	1.250	N/A	1.50	0.879	0.09
R-92	9.000	0.438	0.69	0.63	0.305	0.03
R-93	29.500	0.750	N/A	0.94	0.485	0.06
R-94	31.500	0.750	N/A	0.94	0.485	0.06
R-95	33.750	0.750	N/A	0.94	0.485	0.09
R-96	36.000	0.875	N/A	1.06	0.583	0.06
R-97	38.000	0.875	N/A	1.06	0.583	0.06
R-98	40.250	0.875	N/A	1.06	0.583	0.06
R-99	9.250	0.438	N/A	0.63	0.305	0.03
R-100	29.500	1.125	N/A	1.38	0.780	0.09
R-101	31.500	1.250	N/A	1.50	0.879	0.09
R-102	33.750	1.250	N/A	1.50	0.879	0.09
R-103	36.000	1.250	N/A	1.50	0.879	0.09
R-104	38.000	1.375	N/A	1.63	0.977	0.09
R-105	40.250	1.375	N/A	1.63	0.977	0.09

TYPE RX RING GASKETS

Dimensions & Tolerances



Ring Number	Outside Diam of Ring *OD*	Width of Ring *A*	Width of Flat *C*	Height of Outside Bevel *D*	Radius in Ring *H*	Radius in Ring *H*	Hole Size *E* (1)
RX-20	3.000	0.344	0.182	0.125	0.750	0.06	N/A
RX-23	3.672	0.469	0.254	0.167	1.000	0.06	N/A
RX-24	4.172	0.469	0.254	0.167	1.000	0.06	N/A
RX-25	4.313	0.344	0.182	0.125	0.750	0.06	N/A
RX-26	4.406	0.469	0.254	0.167	1.000	0.06	N/A
RX-27	5.797	0.469	0.254	0.167	1.000	0.06	N/A
RX-31	4.297	0.469	0.254	0.167	1.000	0.06	N/A
RX-35	5.797	0.469	0.254	0.167	1.000	0.06	N/A
RX-37	6.297	0.469	0.254	0.167	1.000	0.06	N/A
RX-39	6.797	0.469	0.254	0.167	1.000	0.06	N/A
RX-41	7.547	0.469	0.254	0.167	1.000	0.06	N/A
RX-44	8.047	0.469	0.254	0.167	1.000	0.06	N/A
RX-45	8.734	0.469	0.254	0.167	1.000	0.06	N/A
RX-46	8.750	0.531	0.263	0.188	1.125	0.06	N/A
RX-47	9.656	0.781	0.407	0.271	1.625	0.09	N/A
RX-49	11.047	0.469	0.254	0.167	1.000	0.06	N/A
RX-50	11.156	0.656	0.335	0208	1.250	0.06	N/A
RX-53	13.172	0.469	0.254	0.167	1.000	0.06	N/A
RX-54	13.281	0.656	0.335	0.208	1.250	0.06	N/A
RX-57	15.422	0.469	0.254	0.167	1.000	0.06	N/A
RX-63	17.391	1.063	0.582	0.333	2.000	0.09	N/A
RX-65	18.922	0.469	0.254	0.167	1.000	0.06	N/A
RX-66	18.031	0.656	0.335	0.208	1.250	0.06	N/A
RX-69	21.422	0.469	0.254	0.167	1.000	0.06	N/A
RX-70	21.656	0.781	0.407	0.271	1.625	0.09	N/A
RX-73	23.469	0.531	0.263	0.208	1.250	0.06	N/A
RX-74	23.656	0.781	0.407	0.271	1.625	0.09	N/A
RX-82	2.672	0.469	0.254	0.167	1.000	0.06	0.06
RX-84	2.922	0.469	0.254	0.167	1.000	0.06	0.06
RX-85	3.547	0.531	0.263	0.167	1.000	0.06	0.06
RX-86	4.078	0.594	0.335	0.188	1.125	0.06	0.09
RX-87	4.453	0.594	0.335	0.188	1.125	0.06	0.09
RX-88	5.484	0.688	0.407	0.208	1.250	0.06	0.12
RX-89	5.109	0.719	0.407	0.208	1.250	0.06	0.12
RX-90	6.875	0.781	0.479	0.292	1.750	0.09	0.12
RX-91	11.297	1.188	0.780	0.297	1.781	0.09	0.12
RX-99	9.672	0.469	0.254	0.167	1.000	0.06	N/A
RX-201	2.026	0.226	0.126	0.057	0.445	0.02 (3)	N/A
RX-205	2.453	0.219	0.120	0.072 (2)	0.437	0.02 (3)	N/A
RX-210	3.844	0.375	0.213	0.125 (2)	0.750	0.03 (3)	N/A
RX-215	5.547	0.469	0.210	0.167 (2)	1.000	0.06 (3)	N/A

DESCRIPTION	PAGE
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Material Selection Chart	15-14

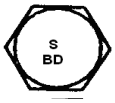
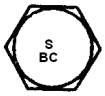
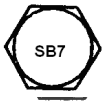
Nominal Size & Threads In.	Series[1] Desig-nation	External[4]										Internal[4]						
				Major Diameter			Pitch Diameter			UN[2] Minor Diam Max (Ref	UNR Minor Diam Max (Ref)		Minor Diameter		Pitch Diameter			Major Diameter
		Class	Allow-ance	Max[3]	Min	Min[5]	Max[3]	Min	Toler-ance			Class	Min	Max	Min	Max	Toler-ance	Min
0-80 or 0.060-80	UNF	2A 3A	0.0005 0.0000	0.0595 0.0600	0.0563 0.0568	--- ---	0.0514 0.0519	0.0496 0.0506	0.0018 0.0013	0.0460 0.0465	0.0446 0.0451	2B 3B	0.0465 0.0465	0.0514 0.0514	0.0519 0.0519	0.0542 0.0536	0.0023 0.0017	0.0600 0.0600
1.64 or 0.073-64	UNC	2A 3A	0.0006 0.0000	0.0724 0.0730	0.0686 0.0692	--- ---	0.0623 0.0629	0.0603 0.0614	0.0020 0.0015	0.0555 0.0561	0.0538 0.0544	2B 3B	0.0561 0.0561	0.0623 0.0623	0.0629 03.0629	0.0655 0.0648	0.0026 0.0019	0.0730 0.0730
1-72 or 0.073-72	UNF	2A 3A	0.0006 0.0000	0.0724 0.0730	0.0689 0.0695	--- ---	0.0634 0.0640	0.0615 0.0626	0.0019 0.0014	0.0574 0.0580	0.0559 0.0565	2B 3B	0.0580 0.0580	0.0635 0.0635	0.0640 0.0640	0.0665 0.0659	0.0025 0.0019	0.0730 0.0730
2-56 or 0.086-56	UNC	2A 3A	0.0006 0.0000	0.0854 0.0860	0.0813 0.0819	--- ---	0.0738 0.0744	0.0717 0.0728	0.0021 0.0016	0.0661 0.0667	0.0642 0.0648	2B 3B	0.0667 0.0667	0.0737 0.0737	0.0744 0.0744	0.0772 0.0765	0.0028 0.0021	0.0860 0.0860
2-64 or 0.086-64	UNF	2A 3A	0.0006 0.0000	0.0854 0.0860	0.0816 0.0822	--- ---	0.0753 0.0759	0.0733 0.0744	0.0020 0.0015	0.0685 0.0691	0.0668 0.0674	2B 3B	0.0691 0.0691	0.0753 0.0753	0.0759 0.0759	0.0786 0.0779	0.0027 0.0020	0.0860 0.0860
3-48 or 0.099-48	UNC	2A 3A	0.0007 0.0000	0.0983 0.0990	0.0938 0.0945	--- ---	0.0848 0.0855	0.0825 0.0838	0.0023 0.0017	0.0757 0.0764	0.0734 0.0741	2B 3B	0.0764 0.0764	0.0845 0.0845	0.0855 0.0855	0.0885 0.0877	0.0030 0.0022	0.0990 0.0990
3-56 or 0.099-56	UNF	2A 3A	0.0007 0.0000	0.0983 0.0990	0.0942 0.0949	--- ---	0.0867 0.0874	0.0845 0.0858	0.0022 0.0016	0.0790 0.0797	0.0771 0.0778	2B 3B	0.0797 0.0797	0.0865 0.0865	0.0874 0.0874	0.0902 0.0895	0.0028 0.0021	0.0990 0.0990
4-40 or 0.112-40	UNC	2A 3A	0.0008 0.0000	0.1112 0.1120	0.1061 0.1069	--- ---	0.0950 0.0958	0.0925 0.0939	0.0025 0.0019	0.0841 0.0849	0.0814 0.0822	2B 3B	0.0849 0.0849	0.0939 0.0939	0.0958 0.0958	0.0991 0.0982	0.0033 0.0024	0.1120 0.1120
4-48 or 0.112-48	UNF	2A 3A	0.0007 0.0000	0.1113 0.1120	0.1068 0.1075	--- ---	0.0978 0.0985	0.0954 0.0967	0.0024 0.0018	0.0887 0.0894	0.0864 0.0871	2B 3B	0.0894 0.0894	0.0968 0.0968	0.0985 0.0985	0.1016 0.1008	0.0031 0.0023	0.1120 0.1120
5-40 or 0.125-40	UNC	2A 3A	0.0008 0.0000	0.1242 0.1250	0.1191 0.1199	--- ---	0.1080 0.1088	0.1054 0.1069	0.0026 0.0019	0.0971 0.0979	0.0944 0.0952	2B 3B	0.0979 0.0979	0.1062 0.1062	0.1088 0.1088	0.1121 0.1113	0.0033 0.0025	0.1250 0.1250
5-44 or 0.125-44	UNF	2A 3A	0.0007 0.0000	0.1243 0.1250	0.1195 0.1202	--- ---	0.1095 0.1102	0.1070 0.1083	0.0025 0.0019	0.0997 0.1044	0.0972 0.0979	2B 3B	0.1004 0.1004	0.1079 0.1079	0.1102 0.1102	0.1134 0.1126	0.0032 0.0024	0.1250 0.1250
6-32 or 0.138-32	UNC	2A 3A	0.0008 0.0000	0.1372 0.1380	0.1312 0.1320	--- ---	0.1169 0.1177	0.1141 0.1156	0.0028 0.0021	0.1034 0.1042	0.1000 0.1008	2B 3B	0.104 0.1040	0.114 0.1140	0.1177 0.1177	0.1214 0.1204	0.0037 0.0027	0.1380 0.1380
6-40 or 0.138-40	UNF	2A 3A	0.0008 0.0000	0.1372 0.1380	0.1321 0.1329	--- ---	0.1210 0.1218	0.1184 0.1198	0.0026 0.0020	0.1101 0.1109	0.1074 0.1082	2B 3B	0.111 0.1110	0.119 0.1186	0.1218 0.1218	0.1252 0.1243	0.0034 0.0025	0.1380 0.1380
8-32 or 0.164-32	UNC	2A 3A	0.0009 0.0000	0.1631 0.1640	0.1571 0.1580	--- ---	0.1428 0.1437	0.1399 0.1415	0.0029 0.0022	0.1293 0.1302	0.0259 0.1268	2B 3B	0.130 0.1300	0.139 0.1389	10.1437 0.1437	0.1475 0.1465	0.0038 0.0028	0.1640 0.1640
8-36 or 0.164-36	UNF	2A 3A	0.0008 0.0000	0.1632 0.1640	0.1577 0.1585	--- ---	0.1452 0.1460	0.1424 0.1439	0.0028 0.0021	0.1331 0.1339	0.1301 0.1309	2B 3B	0.134 0.1340	0.142 0.1416	0.1460 0.1460	0.1496 0.1487	0.0036 0.0027	0.1640 0.1640
10-24 or 0.190-24	UNC	2A 3A	0.0010 0.0000	0.1890 0.1900	0.1818 0.1828	--- ---	0.1619 0.1629	0.1586 0.1604	0.0033 0.0025	0.1439 0.1449	0.1394 0.1404	2B 3B	0.145 0.1450	0.156 0.1555	0.1629 0.1629	0.1672 0.1661	0.0043 0.0032	0.1900 0.1900
10-32 or 0.190-32	UNF	2A 3A	0.0009 0.0000	0.1891 0.1900	0.1831 0.1840	--- ---	0.1688 0.1697	0.1658 0.1674	0.0030 0.0023	0.1553 0.1562	0.1519 0.1528	2B 3B	0.156 0.1560	0.164 0.1641	0.1697 0.1697	0.1736 0.1726	0.0039 0.0029	0.1900 0.1900
12-24 or 0.216-24	UNC	2A 3A	0.0010 0.0000	0.2150 0.2160	0.2078 0.2088	--- ---	0.1879 0.1889	0.1845 0.1863	0.0034 0.0026	0.1699 0.1709	0.1654 0.1664	2B 3B	0.171 0.1710	0.181 0.1807	0.1889 0.1889	0.1933 0.1922	0.0044 0.0033	0.2160 0.2160
12-28 or 0.216-28	UNF	2A 3A	0.0010 0.0000	0.2150 0.2160	0.2085 0.2095	--- ---	0.1918 0.1928	0.1886 0.1904	0.0032 0.0024	0.1763 0.1773	0.1724 0.1734	2B 3B	0.177 0.1770	0.186 0.1857	0.1928 0.1928	0.1970 0.1959	0.0042 0.0031	0.2160 0.2160
1/4-20 or 0.250-20	UNC	1A 2A 3A	0.0011 0.0011 0.0000	0.2489 0.2489 0.2500	0.2367 0.2408 0.2419	--- 0.2367 ---	0.2164 0.2164 0.2175	0.2108 0.2127 0.2147	0.0056 0.0037 0.0028	0.1948 0.1948 0.1959	0.1894 0.1894 0.1905	1B 2B 3B	0.196 0.196 0.1960	0.207 0.207 0.2067	0.2175 0.2175 0.2175	0.2248 0.2224 0.2211	0.0073 0.0049 0.0036	0.2500 0.2500 0.2500
¼-28 or 0.250-28	UNF	1A 2A 3A	0.0010 0.0010 0.0000	0.2490 0.2490 0.2500	0.2392 0.2425 0.2435	--- --- ---	0.2258 0.2258 0.2268	0.2208 0.2225 0.2243	0.0050 0.0033 0.0025	0.2103 0.2103 0.2113	0.2064 0.2064 0.2074	1B 2B 3B	0.211 0.211 0.2110	0.220 0.220 0.2190	0.2268 0.2268 0.2268	0.2333 0.2311 0.2300	0.0065 0.0043 0.0032	0.2500 0.2500 0.2500
5/16-18 or 0.312-18	UNC	1A 2A 3A	0.0012 0.0012 0.0000	0.3113 0.3113 0.3125	0.2982 0.3026 0.3038	--- 0.2982 ---	0.2752 0.2752 0.2764	0.2691 0.2712 0.2734	0.0061 0.0040 0.0030	0.2512 0.2512 0.2524	0.2452 0.2452 0.2464	1B 2B 3B	0.252 0.252 0.2520	0.265 0.265 0.2630	0.2764 0.2764 0.2764	0.2843 0.2817 0.2803	0.0079 0.0053 0.0039	0.3125 0.3125 0.3125

Nominal Size & Threads In.	Series[1] Designation	External[4]										Internal[4]						
				Major Diameter			Pitch Diameter			UN[2] Minor Diam Max (Ref	UNR Minor Diam Max (Ref)		Minor Diameter		Pitch Diameter			Major Diameter
		Class	Allowance	Max[3]	Min	Min[5]	Max[3]	Min	Tolerance			Class	Min	Max	Min	Max	Tolerance	Min
5/16-24 or 0.3125-24	UNF	1A	0.0011	0.3114	0.3006	---	0.2743	0.2788	0.0055	0.2663	0.2618	1B	0.267	0.277	0.2854	0.2925	0.0071	0.3125
		2A	0.0011	0.3114	0.3042	---	0.2843	0.2866	0.0037	0.2663	0.2618	2B	0.267	0.277	0.2854	0.2902	0.0048	0.3125
		3A	0.0000	0.3125	0.3053	---	0.2854	0.2827	0.0027	0.2674	0.2629	3B	0.2670	0.2754	0.2854	0.2890	0.0036	0.3125
3/8-16 or .0375-16	UNC	1A	0.0013	0.3737	0.3595	---	0.3331	0.3266	0.0065	0.3060	0.2992	1B	0.307	0.321	0.3344	0.3429	0.0085	0.3750
		2A	0.0013	0.3737	0.3643	0.3595	0.3331	0.3287	0.0044	0.3060	0.2992	2B	0.307	0.321	0.3344	0.3401	0.0057	0.3750
		3A	0.0000	0.3750	0.3656	---	0.3344	0.3331	0.0033	0.3073	0.3005	3B	0.3070	0.3182	0.3344	0.3387	0.0043	0.3750
3/8-24 or 0.375-24	UNF	1A	0.0011	0.3739	0.3631	---	0.3468	0.3411	0.0057	0.3288	0.3243	1B	0.330	0.340	0.3479	0.3553	0.0074	0.3750
		2A	0.0011	0.3739	0.3667	---	0.3468	0.3430	0.0038	0.3288	0.3243	2B	0.330	0.340	0.3479	0.3528	0.0049	0.3750
		3A	0.000	0.3750	0.3678	---	0.3479	0.3450	0.0029	0.3299	0.3254	3B	0.3300	0.3372	0.3479	0.3516	0.0037	0.3750
7/16-14 or 0.4375-14	UNC	1A	0.0014	0.4361	0.4206	---	0.3897	0.3826	0.0071	0.3588	0.3511	1B	0.360	0.376	0.3911	0.4003	0.0092	0.4375
		2A	0.0014	0.4361	0.4258	0.4206	0.3897	0.3850	0.0047	0.3588	0.3511	2B	0.360	0.376	0.3911	0.3972	0.0061	0.4375
		3A	0.0000	0.4375	0.4272	---	0.3911	0.3876	0.0035	0.3602	0.3525	3B	0.3600	0.3717	0.3911	0.3957	0.0046	0.4375
7/16-20 or 0.4375-20	UNF	1A	0.0013	0.4362	0.4240	---	0.4037	0.3975	0.0062	0.3821	0.3767	1B	0.383	0.395	0.4050	0.4131	0.0081	0.4375
		2A	0.0013	0.4362	0.4281	---	0.4037	0.3995	0.0042	0.3821	0.3767	2B	0.383	0.395	0.4050	0.4104	0.0054	0.4375
		3A	0.0000	0.4375	0.4294	---	0.4050	0.4019	0.0031	0.3834	0.3780	3B	0.3830	0.3916	0.4050	0.4091	0.0041	0.4375
½-13 or 0.500-13	UNC	1A	0.0015	0.4985	0.4822	---	0.4485	0.4411	0.0074	0.4152	0.4069	1B	0.417	0.434	0.4500	0.4597	0.0097	0.5000
		2A	0.0015	0.4985	0.4876	---	0.4485	0.4435	0.0050	0.4152	0.4069	2B	0.417	0.434	0.4500	0.4565	0.0065	0.5000
		3A	0.0000	0.5000	0.4891	---	0.4500	0.4463	0.0037	0.4167	0.4084	3B	0.4170	0.4284	0.4500	0.4548	0.0048	0.5000
½-20 or 0.500-20	UNF	1A	0.0013	0.4987	04865	---	0.4662	0.4598	0.0064	0.4446	0.4392	1B	0.446	0.457	0.4675	0.4759	0.0084	0.5000
		2A	0.0013	0.4987	0.4906	---	0.4662	0.4619	0.0043	0.4446	0.4392	2B	0.446	0.457	0.4675	0.4731	0.0056	0.5000
		3A	0.0000	0.5000	0.4919	---	0.4675	0.4643	0.0032	0.4459	0.4405	3B	0.4460	0.4537	04675	0.4717	0.0042	0.5000
9/16-12 or 0.5625-12	UNC	1A	0.0016	0.5609	0.5437	---	0.5068	0.4990	0.0078	0.4707	0.4617	1B	0.472	0.490	0.5084	0.5186	0.0102	0.5625
		2A	0.0016	0.5609	0.5495	0.5437	0.5068	0.5016	0.0054	0.4707	0.4617	2B	0.472	0.490	0.5084	0.5152	0.0068	0.5625
		3A	0.0000	0.5625	0.5511	---	0.5084	0.5045	0.0039	0.4723	0.4633	3B	0.4720	0.4843	0.5084	0.5135	0.0051	0.5625
9/16-18 or 0.5625-18	UNF	1A	0.0014	0.5611	0.5480	---	0.5250	0.5182	0.0068	0.5010	0.4950	1B	0.502	0.515	0.5264	0.5353	0.0089	0.5625
		2A	0.0014	0.5611	0.5524	---	0.5250	0.5205	0.0045	0.5010	0.4950	2B	0.502	0.515	0.5264	0.5323	0.0059	0.5625
		3A	0.0000	0.5625	0.5538	---	0.5264	0.5230	0.0034	0.5024	0.4964	3B	0.5020	0.5106	0.5264	0.5308	0.0044	0.5625
5/8-11 or 0.625-11	UNC	1A	0.0016	0.6234	0.6052	---	0.5644	0.5561	0.0083	0.5250	0.5152	1B	0.527	0.546	0.5660	0.5767	0.0107	0.6250
		2A	0.0016	0.6234	0.6113	0.6052	0.5589	1.5589	0.0055	0.5250	0.5152	2B	0.527	0.546	0.5660	0.5732	0.0072	0.6250
		3A	0.0000	0.6250	0.6129	---	0.5619	0.5619	0.0041	0.5266	0.5168	3B	0.5270	0.5391	0.5660	0.5714	0.0054	0.6250
5/8-18 or .0625-18	UNF	1A	0.0014	0.6236	0.6105	---	0.5875	0.5805	0.0070	0.5635	0.5575	1B	0.565	0.578	0.5889	0.5980	0.0091	0.6250
		2A	0.0014	0.6236	0.6149	---	0.5875	0.5828	0.0047	0.5635	0.5575	2B	0.565	0.578	0.5889	0.5949	0.0060	0.6250
		3A	0.0000	0.6250	0.6163	---	0.5889	0.5854	0.0035	0.5649	0.5589	3B	0.5650	0.5730	0.5889	0.5934	0.0045	0.6250
¾-10 or 0.750-10	UNC	1A	0.0018	0.7482	0.7288	---	0.6832	0.6744	0.0088	0.6399	0.6291	1B	0.642	0.663	0.6850	0.6965	0.0115	0.7500
		2A	0.0018	0.7482	0.7353	0.7288	0.6832	0.6773	0.0059	0.6399	0.6291	2B	0.642	0.663	0.6850	0.6927	0.0077	0.7500
		3A	0.0000	0.7500	0.7371	---	0.6850	0.6806	0.0044	0.6417	0.6309	3B	0.6420	0.6545	0.6850	0.6907	0.0057	0.7500
¾-16 or 0.750-16	UNF	1A	0.0015	0.7485	0.7343	---	0.7079	0.7004	0.0075	0.6808	0.6740	1B	0.682	0.696	0.7094	0.7192	0.0098	0.7500
		2A	0.0015	0.7485	0.7391	---	0.7079	0.7029	0.0050	0.6808	0.6740	2B	0.682	0.696	0.7094	0.7159	0.0065	0.7500
		3A	0.0000	0.7500	0.7406	---	0.7094	0.7056	0.0038	0.6823	0.6755	3B	0.6820	0.6908	0.7094	0.7143	0.0049	0.7500
7/8-9 or 0.875-9	UNC	1A	0.0019	0.8731	0.8523	---	0.8009	0.7914	0.0095	0.7528	0.7408	1B	0.755	0.778	0.8028	0.8151	0.0123	0.8750
		2A	0.0019	0.8731	0.8592	0.8523	0.8009	0.7946	0.0063	0.7528	0.7408	2B	0.755	0.778	0.8028	0.8110	0.0082	0.8750
		3A	0.0000	0.8750	0.8611	---	0.8028	0.7981	0.0047	0.7547	0.7427	3B	0.7550	0.7681	0.8028	0.8089	0.0061	0.8750
7/8-14 or 0.875-14	UNF	1A	0.0016	0.8734	0.8579	---	0.8270	0.8189	0.0081	0.7961	0.7884	1B	0.798	0.814	0.8286	0.8392	0.0106	0.8750
		2A	0.0016	0.8734	0.8631	---	0.8270	0.8216	0.0054	0.7961	0.7884	2B	0.798	0.814	0.8286	0.8356	0.0070	0.8750
		3A	0.0000	0.8750	0.8647	---	0.8286	0.8245	0.0041	0.7977	0.7900	3B	0.7980	0.8068	0.8286	0.8339	0.0053	0.8750
1-8 or 1.000-8	UNC	1A	0.0020	0.9980	0.9755	---	0.9168	0.9067	0.0101	0.8627	0.8492	1B	0.865	0.890	0.9188	0.9320	0.0132	1.0000
		2A	0.0020	0.9980	0.9830	0.9755	0.9168	0.9100	0.0068	0.8627	0.8492	2B	0.865	0.890	0.9188	0.9276	0.0088	1.0000
		3A	0.0000	1.0000	0.9850	----	0.9188	0.9137	0.0051	0.8647	0.8512	3B	0.8650	0.8797	0.9188	0.9254	0.0066	1.0000

Nominal Size & Threads In.	Series[1] Desig-nation	External[4]										Internal[4]						
				Major Diameter			Pitch Diameter			UN[2] Minor Diam Max (Ref	UNR Minor Diam Max (Ref)		Minor Diameter		Pitch Diameter			Major Diameter
		Class	Allow-ance	Max[3]	Min	Min[5]	Max[3]	Min	Toler-ance			Class	Min	Max	Min	Max	Toler-ance	Min
1-12 or 1.000-12	UNF	1A 2A 3A	0.0018 0.0018 0.0000	0.9982 0.9982 1.0000	0.9810 0.9868 0.9886	--- --- ---	0.9441 0.9441 0.9459	0.9353 0.9382 0.9415	0.0088 0.0059 0.0044	0.09080 0.9080 0.9098	0.8990 0.8990 0.9008	1B 2B 3B	0.910 0.910 0.9100	0.928 0.928 0.9198	0.9459 0.9459 0.9459	0.9573 0.9535 0.9516	0.0114 0.0076 0.0057	1.0000 1.0000 1.0000
1-14 or 1.000-14	UNS	1A 2A 3A	0.0017 0.0017 0.0000	0.9983 0.9983 1.0000	0.9828 0.9880 0.9897	--- --- ---	0.9519 0.9519 0.9536	0.9435 0.9463 0.9494	0.0084 0.0056 0.0042	0.9210 0.9210 0.9227	0.9132 0.9132 0.9150	1B 2B 3B	03.923 0.923 0.9230	0.938 0.938 0.9315	0.9536 0.9536 0.9536	0.9645 0.9609 0.9590	0.0109 0.0073 0.0054	1.0000 1.0000 1.0000
1-1/8-7 or 1.125-7	UNC	1A 2A 3A	0.0022 0.0022 0.000	1.1228 1.1228 1.1250	1.0982 1.1064 1.1086	--- 1.0982 ---	1.0300 1.0300 1.0322	1.0191 1.0228 1.0268	0.0109 0.0072 0.0054	0.9682 0.9682 0.97049	0.9527 0.9527 0.9549	1B 2B 3B	0.970 0.970 0.9700	0.998 0.998 0.9875	1.0322 1.0322 1.0322	1.0463 1.0416 1.0393	0.0141 0.0094 0.0071	1.1250 1.1250 1.1250
1-1/8-8 or 1.125-8	UN	2A 3A	0.0021 0.0000	1.1229 1.1250	1.1079 1.1100	1.1004 ---	1.0417 1.0438	1.0348 1.0386	0.0069 0.0052	0.9876 0.9897	0.9741 0.9762	2B 3B	0.990 0.9900	1.015 1.0047	1.0438 1.0438	1.0528 0.0505	0.0090 0.0067	1.1250 1.1250
1-1/4-7 or 1.250-7	UNC	1A 2A 3A	0.0022 0.0022 0.0000	1.2478 1.2478 1.2500	0.2232 0.2314 1.2336	--- 1.2232 ---	1.1550 1.1550 1.1572	1.1439 1.1476 1.1517	0.0111 0.0074 0.0055	1.0932 1.0932 1.0954	1.0777 1.0777 1.0799	1B 2B 3B	1.095 1.095 1.0950	1.123 1.123 1.1125	1.1572 1.1572 1.1572	1.716 1.1668 1.1644	0.0144 0.0096 0.0072	1.2500 1.2500 1.2500
1-1/4-8 or 1.250-8	UN	2A 3A	0.0021 0.0000	1.2479 1.2500	1.2329 1.2350	1.2254 ---	1.1667 1.1688	1.1597 1.635	0.0070 0.0053	1.1126 1.1147	1.0991 1.1012	2B 3B	1.115 1.1150	1.140 1.1297	1.1688 1.1688	1.1780 1.1757	0.0092 0.0069	1.2500 1.2500
1-1/4-12 or 1.250-12	UNF	1A 2A 3A	0.0018 0.0018 0.0000	1.2482 1.2482 1.2500	1.2310 1.2368 1.2386	--- --- ---	1.1941 1.1941 1.1959	1.1849 1.1879 1.1913	0.0092 0.0062 0.0046	1.1580 1.1580 1.1598	1.1490 1.1490 1.1508	1B 2B 3B	1.160 1.160 1.1600	1.178 1.178 1.1698	1.1959 1.1959 1.1959	1.2079 .2039 1.2019	0.0120 0.0080 0.0060	1.2500 1.2500 1.2500
1-3/8-6 or 1.375-6	UNC	1A 2A 3A	0.0024 0.0024 0.0000	1.3726 1.3726 1.3750	1.3453 1.3544 1.3568	--- 1.3453 ---	1.2643 1.2643 1.2667	1.2523 1.2563 1.2607	0.0120 0.0080 0.0060	1.1922 0.1922 1.0946	1.1742 1.0742 1.1766	1B 2B 3B	1.195 1.195 1.1950	1.225 1.225 1.2146	1.2667 1.2667 1.2667	1.2822 1.2771 1.2745	0.0155 0.0104 0.0078	1.3750 1.3750 1.3750
1-3/8-8 or 1.375-8	UN	2A 3A	0.0022 0.0000	0.3728 1.3750	1.3578 1.3600	1.3503 ---	1.2916 1.2938	1.2844 1.2884	0.0072 0.0054	1.2375 1.2397	0.2240 1.2262	2B 3B	1.240 1.2400	1.265 1.2547	1.2938 1.2938	1.3031 1.3008	0.0093 0.0070	1.3750 1.3750
1-1/2-6 or 1.500-6	UNC	1A 2A 3A	0.0024 0.0024 0.0000	1.4976 1.4976 1.5000	1.4703 1.4794 1.4818	--- 1.4703 ---	1.3893 1.3893 1.3917	1.3772 1.3812 1.3856	0.0121 0.0081 0.0061	1.3172 1.3172 1.3196	1.2992 1.2992 1.3016	1B 2B 3B	1.320 1.320 1.3200	1.350 1.350 1.3396	1.3917 1.3917 1.3917	1.4075 1.4022 1.3996	0.0158 0.0105 0.0079	1.5000 1.5000 1.5000
1-1/2-8 or 1.500-8	UN	2A 3A	0.0022 0.0000	1.4978 1.5000	1.4828 1.4850	1.4753 ---	0.1466 1.4188	1.4093 1.4133	0.0073 0.0055	1.3625 1.3647	1.3490 1.3512	2B 3B	1.365 1.3650	1.390 1.3797	1.4188 1.4188	1.4283 1.4259	0.0095 0.0071	1.5000 1.5000
1-1/2-12 or 1.625-12	UNF	1A 2A 3A	0.0019 0.0019 0.0000	1.4981 1.4981 1.5000	1.4809 1.4867 1.4886	--- --- ---	1.4440 1.4440 1.4459	1.4344 1.4376 1.4411	0.0096 0.0064 0.0048	1.4079 1.4079 1.4098	1.3989 1.3989 1.4008	1B 2B 3B	1.410 1.410 1.4100	1.428 1.428 1.4198	1.4459 1.4459 1.4459	1.4584 1.4542 1.4522	0.0125 0.0083 0.0063	1.5000 1.5000 1.5000
1-5/8-8 or 1.625-8	UN	2A 3A	0.0022 0.0000	1.6228 1.6250	1.6078 1.6100	1.6003 ---	15416 1.5438	1.5342 1.5382	0.0074 0.0056	0.4875 1.4897	1.4784 1.4806	2B 3B	1.490 1.4900	1.515 1.5047	1.5438 1.5438	1.5535 1.5510	0.0097 0.0072	1.6250 1.6250
1-3/4-5 or 1.750-5	UNC	1A 2A 3A	0.0027 0.0027 0.0000	1.7473 1.7473 1.7500	1.7165 1.7268 1.7295	--- 1.7165 ---	1.6174 1.6174 1.6201	1.6040 1.6085 1.6134	0.0134 0.0089 0.0067	1.5308 1.5308 1.5335	1.5092 1.5092 1.5119	1B 2B 3B	1.534 1.534 1.5340	1.568 1.568 1.5575	1.6201 1.6201 1.6201	1.6375 1.6317 1.6288	0.0174 0.0116 0.0087	1.7500 1.7500 1.7500
1-3/4-8 or 1.750-8	UN	2A 3A	0.0023 0.0000	1.7477 1.7500	1.7327 1.7350	1.752 ---	1.6665 1.6688	1.6590 1.6632	0.0075 0.0056	1.6124 1.6147	1.5989 1.6012	2B 3B	1.615 1.6150	1.640 1.6297	1.6688 1.6688	1.6786 1.6762	0.0098 0.0074	1.7500 1.7500
1-7/8-8 or 1.875.8	UN	2A 3A	0.0023 0.0000	1.8727 1.8750	1.8577 1.8600	1.8502 ----	1.7915 1.7938	1.7838 1.7881	0.0077 0.0057	1.7374 1.7397	1.7239 1.7262	2B 3B	1.740 1.7400	1.765 1.7547	1.7938 1.7938	1.8038 1.8013	0.100 0.0075	1.8750 1.8750
2-4-1/2 or 2.000-4.5	UNC	1A 2A 3A	0.0029 0.0029 0.0000	1.9971 1.9971 2.0000	1.9641 1.9751 1.9780	--- 1.9641 ---	1.8528 1.8528 1.8557	1.8385 1.8433 1.8486	0.0143 0.0095 0.0071	1.7565 1.7565 1.7594	1.7324 1.7324 1.7353	1B 2B 3B	1.759 1.759 1.7590	1.795 1.795 1.7861	1.8557 1.8557 1.8557	1.8743 1.8681 1.8650	0.0186 0.0124 0.0093	2.0000 2.0000 2.0000
2-8 or 2.000-8	UN	2A 3A	0.0023 0.0000	19977 2.0000	1.9827 1.9850	1.9752 ---	1.9155 1.9188	1.9087 1.9030	0.0078 0.0058	1.8624 1.8647	1.8489 1.8512	2B 3B	1.865 1.8650	1.890 1.8797	1.9188 1.9188	1.9289 1.9264	0.0101 0.0076	2.0000 2.0000
2-1/4-4-1/2	UNC	1A	0.0029	2.2471	2.2141	---	2.1028	2.0882	0.0146	2.0065	1.9824	1B	2.009	2.045	2.1057	2.1247	0.0190	2.2500

Nominal Size & Threads In.	Series[1] Desig-nation	External[4]										Internal[4]						
				Major Diameter			Pitch Diameter			UN[2] Minor Diam Max (Ref	UNR Minor Diam Max (Ref)		Minor Diameter		Pitch Diameter			Major Diameter
		Class	Allow-ance	Max[3]	Min	Min[5]	Max[3]	Min	Toler-ance			Class	Min	Max	Min	Max	Toler-ance	Min
or 2.250-4.5		2A 3A	0.0029 0.000	2.2471 2.2500	2.2251 2.2280	2.2141 ---	2.1028 2.1057	2.0931 2.0984	0.0097 0.0073	2.0065 2.0094	1.39824 1.9853	2B 3B	2.009 2.0090	2.045 2.0361	2.1057 2.1057	2.1183 2.1152	0.0126 0.0095	2.2500 2.2500
2-1/4-8 or 2.250-8	UN	2A 3A	0.0024 0.0000	2.2476 2.250	2.2326 2.2350	2.2251 ---	2.1664 2.1688	2.1584 2.1628	0.0080 0.0060	2.1123 2.1147	2.0988 2.1012	2B 3B	2.115 2.1150	2.140 2.1297	2.1688 2.1688	2.1792 2.1766	0.0104 0.0078	2.2500 2.2500
2-1/2-4 or 2.500-4	UNC	1A 2A 3A	0.0031 0.0031 0.0000	2.4969 2.4969 2.5000	2.4612 2.4731 2.4762	--- 2.4612 ---	2.3345 2.3345 2.3376	2.3190 2.3241 2.3298	0.0155 0.0104 0.0078	2.2263 2.2263 2.2294	2.1992 2.1992 2.2023	1B 2B 3B	2.229 2.229 2.2290	2.267 2.267 2.594	2.3376 2.3376 2.3376	2.3578 2.3511 2.3477	0.0202 0.0135 0.0101	2.5000 2.5000 2.5000
2-1/2-8 or 2.500-8	UN	2A 3A	0.0024 0.0000	2.4976 2.5000	2.4826 2.4850	2.4751 ---	2.4164 2.4188	2.4082 2.4127	0.0082 0.0061	2.3623 2.3647	2.3488 2.3512	2B 3B	2.365 2.3650	2.390 2.3797	2.4188 2.4188	2.4294 2.4268	0.0106 0.0080	2.2500 2.2500
2-3/4-4 or 2.750-4	UNC	1A 2A 3A	0.0032 0.0032 0.0000	2.7468 2.7468 2.7500	2.7111 2.7230 2.7262	--- 2.7111 ---	2.5844 2.5844 2.5876	2.5686 2.5739 2.5797	0.0158 0.0105 0.0079	2.4762 2.4762 2.4794	2.4491 2.4491 2.4523	1B 2B 3B	2.479 2.479 2.4790	2.517 2.517 2.5094	2.5876 2.5876 2.5876	2.6082 2.6013 2.5979	0.0206 0.0137 0.0103	2.7500 2.7500 2.7500
2-3/4-8 or 2.750-8	UN	2A 3A	0.0025 0.0000	2.7475 2.7500	2.7325 2.7350	2.7250 ---	2.6663 2.6688	2.6580 2.6625	0.0083 0.0063	2.6122 2.6147	2.5987 2.6012	2B 3B	2.615 2.6150	2.640 2.6297	2.6688 2.6688	2.6796 2.6769	0.0108 0.0081	2.7500 2.7500
3-4 or 3.000-4	UNC	1A 2A 3A	0.0032 0.0032 0.0000	2.9968 2.9968 3.0000	2.9611 2.9730 2.9762	--- 2.9611 ---	2.8344 2.8344 2.8296	2.8183 2.8237 2.8376	0.0161 0.0107 0.0080	2.7262 2.7262 2.7294	2.6991 2.6991 2.7023	1B 2B 3B	2.729 2.729 2.7290	2.767 2.767 2.7594	2.8376 2.8376 2.8376	2.8585 2.8515 2.8480	0.0209 0.0139 0.0104	3.0000 3.0000 3.0000
3-8 or 3.000-8	UN	2A 3A	0.0026 0.0000	2.9974 3.0000	2.9824 2.9850	2.9749 ---	2.9162 2.9188	2.9077 2.9124	0.0085 0.0064	2.8621 2.8647	2.8486 2.8512	2B 3B	2.865 2.8650	2.890 2.8797	239188 2.9188	29299 2.9271	0.0111 2.9271	3.0000 3.0000
3-1/4-4 or 3.250-4	UNC	1A 2A 3A	0.0033 0.0033 0.0000	3.2467 3.2467 3.2500	3.2110 3.2229 3.2262	--- 3.2110 ---	3.0843 3.0843 3.0876	3.0680 3.0734 3.0794	0.0163 0.0109 0.0084	2.9761 2.9761 2.9794	2.9490 2.9490 2.9523	1B 2B 3B	2.979 2.979 2.9790	3.017 3.017 3.0094	3.0876 3.0876 3.0876	3.1088 3.1017 3.0982	0.0212 0.0141 0.0106	3.2500 3.2500 3.2500
3-1/4-8 or 3.250-8	UN	2A 3A	0.0026 0.0000	3.2474 3.2500	3.2324 3.2350	3.2249 ---	3.1662 3.1688	3.1575 3.1623	0.0087 0.0065	3.1121 3.1147	3.0986 3.1012	2B 3B	3.115 3.1150	3.140 3.1297	3.1688 3.1688	3.1801 3.1773	030113 0.0085	3.2500 3.2500
3-1/2-4 or 3.500-4	UNC	1A 2A 3A	0.0033 0.0033 0.0000	3.4967 3.4967 3.5000	3.4610 3.4729 3.4762	--- 3.4610 ---	3.3343 3.3343 3.3376	3.3177 3.3233 3.3293	0.0166 0.0110 0.0083	3.2261 3.2261 3.2294	3.1990 3.1990 3.2023	1B 2B 3B	3.229 3.229 3.2290	3.267 3.267 3.2594	3.3376 3.3376 3.3376	3.3591 3.3519 3.3484	0.0215 0.0143 0.0108	3.5000 3.5000 3.5000
3-1/2-8 or 3.500-8	UN	2A 3A	0.0026 0.0000	3.4974 3.5000	3.4824 3.4850	3.4749 ---	3.4162 3.4188	3.4074 3.4122	0.0088 0.0066	3.3621 3.3647	3.3621 3.3647	2B 3B	3.365 3.3650	3.390 3.3797	3.4188 3.4188	3.4303 3.4274	0.0115 0.0086	3.5000 3.5000
3-3/4-4 or 3.750-4	UNC	1A 2A 3A	0.0034 0.0034 0.0000	3.7466 3.7466 3.7500	3.7109 3.7228 3.7262	--- 3.7109 ---	3.5842 3.5842 3.5876	3.5674 3.5730 3.5792	0.0168 0.0112 0.0084	3.4760 3.4760 3.4794	3.4489 3.4489 3.4523	1B 2B 3B	3.479 3.479 3.4790	3.517 3.517 3.5094	3.5876 3.5876 3.5876	3.6094 3.6021 3.5985	0.0218 0.0145 0.0109	3.7500 3.7500 3.7500
3-3/4-8 or 3.750-8	UN	2A 3A	0.0027 0.0000	3.7473 3.7500	3.7323 3.7350	3.7248 ---	3.6661 3.6688	3.6571 3.6621	0.0090 0.0067	3.6120 3.6147	3.5985 3.6012	2B 3B	3.615 3.6150	3.640 3.6297	3.6688 3.6688	3.6805 3.6776	0.0117 0.0088	3.7500 3.7500
4-4 or 4.000-4	UNC	1A 2A 3A	0.0034 0.0034 0.0000	3.9966 3.9966 4.0000	3.9609 3.9728 3.9762	--- 3.9609 ---	3.8342 3.8342 3.8376	3.8172 3.8229 3.8291	0.0170 0.0113 0.0085	3.7260 3.7260 3.7294	3.6989 3.6989 3.7023	1B 2B 3B	3.729 3.729 3.7290	3.767 3.767 3.7594	3.8376 3.8376 3.8376	3.8597 3.8523 3.8487	0.0221 0.0147 0.0111	4.0000 4.0000 4.0000
4-8 or 4.000-8	UN	2A 3A	0.0027 0.0000	3.973 4.0000	3.9823 3.9850	3.9748 ---	3.9161 3.9188	3.9070 3.9120	0.0091 0.0068	3.8620 3.8647	3.8485 3.8512	2B 3B	3.865 3.8650	3.890 3.8797	3.9188 3.9188	3.9307 3.9277	0.0119 0.0089	4.0000 4.0000

ASTM AND SAE GRADE MARKINGS FOR STEEL BOLTS AND SCREWS

Grade Marking	Specification	Material	Bold & Screw Size (In.)	Yield PSI	Ult. Tensile Strength Min PSI
	SAE-Grade 1	Low Carbon Steel 1018-1022 Steel	1/4 thru 1-1/2	33,000	60,000
	Grade A ASTM-A307		1/4 thru 1-1/2 over 1-1/2 thru 4	33,000 ----	60,000 55,000
	SAE-Grade 2		1/4 thru 3/4 over 3/4 thru 1-1/2	55,000 33,000	74,000 60,000
	SAE-Grade 5	Medium Carbon Steel Quenched & Tempered 1038 Steel	1/4 thru 1-1/2 over 1-1/2 thru 4	85,000 74,000	120,000 105,000
	ASTM-A449		1/4 thru 1 over 1 thru 1-1/2 over 1-1/2 thru 3	85,000 74000 55,000	120,000 105,000 90,000
	ASTM-A325	Medium Carbon Steel Quenched & Tempered 1038 Steel	1/2, 5/8, 3/4 7/8, 1 1-1/8 thru 1-1/2	85,000 78,000 74,000	120,000 115,000 105,000
	ASTM-A354 Grade BD	Alloy Steel, Quenched & Tempered 4140/4340 Alloy Steel	1/4 thru 2-1/2 over 2-1/2 thru 4	130,000 115,000	150,000 140,000
	ASTM-A354 Grade BC	Alloy Steel, Quenched & Tempered 4140/4145 Alloy Steel	1/4 thru 2-1/2 over 2-1/2	109,000 99,000	125,000 115,000
	ASTM-A193 Grade B7	Alloy Steel, Quenched & Tempered	2-1/2 & under 2-1/2 thru 4	105,000 95,000	125,000 115,000
	SAE-Grade 8	Medium Carbon Alloy Steel Quenched & Tempered	1/4 thru 1-1/2	120,000	150,000
	ASTM-A490	Alloy Steel, Quenched & Tempered	1/2 thru 2-1/2 over 2-1/2 thru 4	120,000 105,000	150,000 140,000

PLATINGS AND COATINGS FOR FASTENERS

Cadmium Plating (ASTM B766)
An electrolytically deposited, silver-gray plating which provides exceptionally good protection against corrosion, particularly in a salt atmosphere. Chromate Clear Dip is a protective film dip applied after electroplating, and gives additional corrosion protection and a bright, shiny appearance which resists staining and finger marks. Cadmium is a known carcinogen, and has been banned in many countries. Commercial grades of cadmium plating are typically applied a minimum of 5 microns thick(.0002”). Cadmium plating with a chromate dip must not show white corrosion products at 96 hours of salt spray testing per ASTM B117.

Zinc Electroplating (ASTM B633)
Zinc electroplating is also a protective coating against corrosion, blue gray in color, non-toxic, and can be used around food. Zinc plating performs better than cadmium in an industrial atmosphere, but not in a salt atmosphere. A clear Chromate dip is a protective film applied after electroplating, adding corrosion protection. At Sigma, we also use a “silicon dip,” to aid in assembly. Commercial grades of zinc electroplating are typically applied a minimum of 5 microns thick (.0002”). Zinc electroplating with a chromate dip must not show base metal corrosion products at 96 hours of salt spray testing per ASTM B117, but may show white corrosion at the edges.

Thickness conversion factors: microns x .0394=mils, mils x 25.4=microns, mils x .0254=millimeters, mils x .001=inches

Chromate Dips
Clear chromate dip as used by Sigma is applied to all zinc plated parts unless otherwise requested. We use an excellent product produced by MacDermid, which contains no hexavalent chrome.

Olive Drab Dichromate- Electroplated work is dipped in solution of chrome, nitric and acetic acids and a dye. This produces additional corrosion resistance, and is thicker than standard chromate dips.

Yellow Iridescent Dichromate – Electroplated work is dipped in solution of sodium dichromate, takes on surface film of basic chromium chromate which resists corrosion. Finish is yellow to brown in color.

Baking
Parts to be electroplated that are RC38 or higher in hardness, should be further processed to relieve hydrogen embrittlement. This process should include baking at 375 deg. F for 8 hours or more within 4 hours of the plating process. If the parts are over 40 RC, the baking should be for 24 hours minimum. The baking should be done before the chromate treatment. The parts are re-dipped in acid very briefly to reactivate the surface prior to chromating.

Phosphating
Supplementary Phosphate – Zinc-plated parts are dipped in a solution of acid phosphates, and catalytic agents at 200 degrees F. Adherent, porous coating makes an excellent bond for paint or oil, and is performed on all Sigma parts to be coated.

Several types of phosphate coatings are available: manganese, zinc, and iron. At Sigma, we prefer zinc phosphate as the best preparation for coating.

Black Oxide
Black oxide is a thin film of iron oxide formed on the metal. It will not chip, peel, crack, or crumble. The pleasing finish provides only mild rust protection.

Passivation
Passivation gives stainless steels added resistance to corrosion. The nitric acid or sodium dichromate dip removes any imbedded metal particles on the surface, and leaves a protective film of stainless only, to prevent rusting.

Hot Dip Galvanizing (ASTM A153):
Hot dip zinc galvanizing is available for many fasteners. Threads in the nuts must be tapped oversized after galvanizing, or the parts will not assemble. This coating is very effective in salt atmosphere because it is applied approximately 2 mils thick. Because of the need to tap the nuts after galvanizing, the inside of the nut forms corrosion that will not allow disassembly after a period of time.

Sigma does not recommend Hot Dip Galvanizing for medium to high strength alloy parts used in the production of oil and gas, because of the chance of hydrogen embrittlement, and the tendency for the thickness to vary, causing uneven torque readings upon application.

Molybdenum Disulfide
"Moly" coating is typically used as a bonded lubricant, and has some corrosion resistance. It is spray coated to a dry film thickness of .4 to .7 mil, and cured in ovens.

Sermagard 1105 (ASTM F1428)
Sigma Fasteners is a licensed applicator for Sermagard products. 1105 is a ceramic-metallic sprayed basecoat that at 1 mil of thickness or more affords 3000-4000 hours of ASTM B117 salt spray resistance, with an appropriate topcoat. It can be used at high temperatures. It is extremely effective in salt atmospheres. The Sermagard 1105 process involves curing at high temperatures (Minimum of 750 deg. F) and subsequent burnishing with appropriate blast media to achieve conductivity. Sermagard 1105 contains aluminum flake.

Sermagard 1280
Sermagard 1280 is a fluorocarbon topcoat, which when applied to Sermagard 1105 basecoat gives superior corrosion resistance and UV protection.

Xylan 1000 Series
Xylan is a fluoropolymer topcoat manufactured by Whitford Corporation, which in the 1014 and 1070 coatings afford high lubricity (co-efficient of friction as low as .02), and corrosion resistance of approximately 1000 hours(ASTM B117) when applied over phosphate, and up to 2000 hours when applied over electroplating. These are solvent based thin film topcoats. These Xylan products have a maximum operating temperature ranging up to 500 deg. F.

Xylan 1000 and 1400 series may also be applied over other basecoats, for added corrosion protection.

Xylan 1400 series:
The 1400 series coatings by Whitford (typically 1424), are low voc coatings. They have a coefficient of friction of .05 to .10, and a maximum constant operating temperature of 400 deg. F. The corrosion resistance of the 1400 series is approximately 1500 hours, when applied over a suitable basecoat such as zinc electroplating.

Sigma also applies coatings from other manufacturers, per customer specifications. Examples of other coating products we apply:
Everslik by EM Coatings
Inorganic Zinc
Magnigard

Other ASTM Specifications commonly used for fasteners

A 307 – Low Carbon Steel Externally and Internally Threaded Standard Fasteners
A 325 – High Strength Steel Bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers
A 449 – Quenched and Tempered Steel Bolts and Studs, Grade 5
A 453 – High Temperature Bolting Materials, Age hardened
A 354 – Quenched and Tempered Alloy Steel Bolts and Studs with Suitable Nuts Grades BC and BD
A 490 – High Strength Alloy Steel Bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers
A 540 – Alloy Bolting Material for Special Applications
A 563 -- Nuts of Carbon and Alloy Steel
A 564 – Age Hardening stainless steel (17-4, etc)
A 574 – Alloy Steel Socket Head Cap Screws
F 593 – Stainless Steel Bolts, Hex Cap Screws and Studs

SAE Specifications
J 429c – Mechanical and Quality Requirements for Threaded Fasteners

HEX CAP SCREWS – SAE J429

Mechanical & Quality Requirements for Externally Threaded Fasteners

Proof Load & Tensile Requirements[a]

Nominal Diam of Product & Threads per In.	Stress Area Sq. In.	Grade 2		Grade 5		Grade 8	
		Proof Load Lb.	Tensile Strength Min Lb.	Proof Load Lb	Tensile Strength Min Lb.	Proof Load Lb	Tensile Strength Min Lb.
Coarse Thread Series -- UNRC							
No. 1/4-20	0.0318	1.750	2.350	2.700	3.800	3.800	4.750
5/16-18	0.0524	2.900	3.900	4.450	6.300	6.300	7.850
3/8-16	0.0775	4.250	5.750	6.600	9.300	9.300	11.600
7/16-14	0.1063	5.850	7.850	9.050	12.800	12.800	15.900
1/2-13	0.1419	7.800	10.500	12.100	17.000	17.000	21.300
9/16-12	0.182	10.000	13.500	15.500	21.800	21.800	27.300
5/8-11	1.226	12.400	16.700	19.200	27.100	27.100	33.900
3/4-10	0.334	18.400	24.700	28.400	40.100	40.100	50.100
7/8-9	0.462	15.200	27.700	39.300	55.400	55.400	69.300
1-8	0.606	20.000	36.400	51.500	72.700	72.700	90.900
1-1/8-7	0.763	25.200	45.800	56.500	81.100	91.600	114.400
1-1/4-7	0.969	32.000	58.100	71.700	101.700	116.300	145.400
1-3/8-6	1.155	38.100	69.300	85.500	121.300	138.600	173.200
1-1/2-6	1.405	46.40	84.300	104.000	147.500	168.600	210.800
Fine Thread Series – UNRF							
No. 1/4-28	0.0364	2.000	2.700	3.100	4.350	4.350	5.450
5/16-24	0.0580	3.200	4.300	4.900	6.950	6.950	8.700
3/8-24	0.0878	4.800	6.500	7.450	10.500	10.500	13.200
7/16-20	0.1187	6.550	8.800	10.100	14.200	14.200	17.800
1/2-20	0.1599	8.800	11.800	13.600	19.200	19.200	24.000
9/16-18	0.203	11.200	15.000	17.300	24.400	24.400	30.400
5/8-19	0.256	14.100	18.900	21.800	30.700	30.700	38.400
3/4-16	0.373	20.500	27.600	31.700	44.800	44.800	56.000
7/8-14	0.509	16.800	30.500	43.300	61.100	61.100	76.400
1-12	0.663	21.900	39.800	56.400	79.600	79.600	99.400
1-14 uns	0.679	22.400	40.700	57.700	81.500	81.500	101.900
1-1/8-12	0.856	28.200	51.400	63.300	89.900	102.700	128.400
1-1/4-12	1.073	35.400	64.400	79.400	112.700	128.800	161.000
1-3/8-12	1.315	43.400	78.900	97.300	138.100	157.800	197.200
1-1/2-12	1.581	52.200	94.900	117.000	166.000	189.700	237.200

Suggested assembly torques for hex cap screws per SAE J429 CAUTION -- See notes below

Cap Screw Diam	Grade 2			Grade 5			Grade 8		
	Minimum Yield Strength	Torque (ft-lb)		Minimum Yield Strength	Torque (ft-lb)		Minimum Yield Strength	Torque (ft-lb)	
		UNRC	UNRF		UNRC	UNRF		UNRC	UNRF
¼	57,000	6	7	92,000	10	11	130,000	14	15
5/16	57,000	12	14	92,000	20	22	130,000	28	31
3/8	57,000	22	25	92,000	36	40	130,000	50	60
7/16	57,000	35	39	92,000	57	64	130,000	80	90
½	57,000	54	61	92,000	90	100	130,000	125	140
9/16	57,000	77	87	92,000	125	140	130,000	180	200
5/8	57,000	107	122	92,000	175	200	130,000	240	280
¾	57,000	190	212	92,000	310	340	130,000	430	480
7/8	36,000	193	216	92,000	500	550	130,000	700	770
1	36,000	290	320	92,000	740	810	130,000	1050	1150
1-1/8	36,000	410	470	81,000	930	1040	---	---	---
1-1/4	36,000	580	645	81,000	1300	1440	---	---	---
1-3/8	36,000	760	870	81,000	1700	1900	---	---	---
1-1/2	36,000	1010	1115	81,000	2270	2550	---	---	---

General formula for calculating torque. Torque (in.-lb) = 0.2 x nominal diameter meter of screw x load (b) where load is 80% of yield strength expressed in pounds. not psi. Torque for bolts with nuts may be slightly higher. Tension induced in a cap screw may be checked by measuring overall length before torquing and then under torque load. The crew stretches 0.001 in. per in. of screw length for each 30.000 psi. induced tension. Applies only to loads below the yield point. Torque suggestions in the above table are calculated in accordance with a standard formula for cap screws. It is based on the assumption that the screws and the internal threads into which they are rotated are free of excessive rust, dirt or lubricant. and that the threads have been properly formed within standard tolerances. Galvanizing or plating will upset the relationship between torque and tension upon which the table is based. Such variations of thread condition can cause the suggested torque values to vary by as much as 25%. Hot-galvanized zinc coatings may loosen and pack into the thread clearances causing galling of threads and the possibility of broken bolts. CAUTION: The information in this table is offered due to repeated requests by customers for such data. We suggest, in order to achieve adequate tightening and safe results, that personnel using the torque control technique should be carefully trained in the theory and methods of tightening. Bolts that have been overloaded too far beyond their proof load -- or if threads have been seriously distorted during tightening -- should be replaced.

STEEL BAR WEIGHTS

DIA	NOMINAL RD BAR		THREADED BAR		HEX BAR	
	INCH	FOOT	INCH	FOOT	INCH	FOOT
1/8"	0.0035	0.0420			0.0038	0.0456
3/16"	0.0078	0.0936			0.0087	0.1044
1/4"	0.0139	0.1668			0.0453	0.5436
5/16"	0.0218	0.2616			0.0240	0.2880
3/8"	0.0313	0.3756			0.0345	0.4140
7/16"	0.0425	0.5100			0.0470	0.5640
1/2"	0.0557	0.6684	0.0438	0.525	0.0613	0.7356
9/16"	0.0704	0.8448			0.0777	0.9324
5/8"	0.0869	1.0428	0.0695	0.834	0.0958	1.1496
11/16"	0.1052	1.2624			0.1161	1.3932
3/4"	0.1252	1.5024	0.0991	1.189	0.1380	1.6560
13/16"	0.1469	1.7628			0.1620	1.9440
7/8"	0.1703	2.0436	0.1405	1.686	0.1878	2.2536
15/16"	0.1956	2.3472			0.2157	2.5884
1"	0.2225	2.6700	0.1843	2.211	0.2454	2.9448
1 1/8"	0.2817	3.3804	0.2354	2.825	0.3106	3.7272
1 ¼"	0.3477	4.1724	0.2993	3.591	0.3834	4.6008
1 3/8"	0.4208	5.0496	0.3671	4.405	0.4639	5.5668
1 ½"	0.5007	6.0084	0.4419	5.303	0.5521	6.6252
1 5/8"	0.5876	7.0512	0.5238	6.285	0.6479	7.7748
1 ¾"	0.6815	8.1780	0.6124	7.349	0.7515	9.0180
1 7/8"	0.7823	9.3876	0.7080	8.496	0.8627	10.3524
2"	0.8901	10.6812	0.8106	9.727	0.9815	11.7780
2 ¼"	1.1266	13.5192	1.0367	12.44	1.2422	14.9064
2 ½"	1.3908	16.6896	1.2900	15.48	1.5336	18.4032
2 ¾"	1.6829	20.1948	1.5867	19.04	1.8557	22.2684
3"	2.0028	24.0336	1.8867	22.64	2.2084	26.5008
3 ¼"	2.3508	28.2096	2.2308	26.77	2.5918	31.1016
3 ½"	2.7251	32.7012	2.5967	31.16	3.0058	36.0696
3 ¾"	3.1292	37.5504			3.4506	41.4072
4"	3.5608	42.7296			3.9260	47.1120

WEIGHT MULTIPLIERS:

BRASS	0.364
HASTELLOY "B"	1.085
HASTELLOY "C"	1.187
HASTELLOY "G/G3"	1.139
HASTELLOY "X"	1.058
INCOLOY 800/800H	1.058
INCOLOY 825	1.012
INCONEL 600	1.037
INCONEL 625	1.074
INCONEL 718	1.082
INCONEL X-750	1.029
MONEL 400/405	1.053
MONEL K-500	1.078
NAVAL BRASS	1.074
NICKEL 200/201	1.134
SILICON BRONZE	1.110
TANTALUM	2.142
TITANIUM	0.582
TOOL STEEL	1.000
WASPALLOY	1.057
ZIRCONIUM	0.835
300 SERIES S/S	1.011
410 S/S	0.989
660 S/S	1.070
904-L	1.026

MATERIALS SELECTION

Suggested materials for use in various temperatures and atmospheres typically encountered in the energy industry

ASTM Design-tion	Grade	Service Temp-erature Range	Strength and Ductility						Suitable Nuts (ASTM/ Grade)
			Tensile Min. psi	Yield	Reduction of Area R/A	Elong-tion EL	Alloy Type	AISI	
ASTM A-193	B7	High Temp. from 0 – 480ºC	125,000	100,000	50	16	Cr-Mo	(4140)	A194 Gr 2H
ASTM A-193	B16	High Temp. from 0 – 550ºC	125,000	105,000	50	18	Cr-Mo V	(4140M)	A194 Gr 4
ASTM A-193	B7M	High Temp. from 0 – 450ºC	100,000	80,000	50	18	Cr-Mo	(4140)	A194 Gr 2HM
ASTM A-320	L7	Low Temp. -100ºC	125,000	105,000	50	16	Cr-Mo	(4140)	A194 Gr 4 or A194 Gr 7
ASTM A-193	B5	Up to 815ºC	100,000	80,000	50	16	5% Cr	(501)	A194 Gr 3
ASTM A-193	B6	Up to 450ºC	110,000	85,000	50	16	13% Cr	(410)	A194 Gr 6
ASTM A-193	B8	Low Temp. -200 – 650ºC	75,000	30,000	50	30	18% CR – 8% Ni	(304)	A194 B8
ASTM A-193	B8M	Low Temp. -200 – 750ºC	75,000	30,000	50	30	16%Cr – 10% Ni	(316)	A194 B8M
ASTM A-320	B8	Low Temp. -200 – 650ºC	75,000	30,000	50	30	18% Cr – 8% Ni	(304)	A194 B8
ASTM A-320	B8M	Low Temp. -200 – 750ºC	75,000	30,000	50	30	16% Cr – 10% Ni	(316)	A194 B8M
ASTM A-320	B8T	Low Temp. -200 – 650ºC	75,000	30,000	50	30	13% Cr	(321)	A194 B8T6
ASTM A-320	B8C	Low Temp. -200 – 650ºC	75,000	30,000	50	30	18% CR – 8% Ni	(347)	A194 B8C
ASTM A-193	B8M class 2	Low Temp. -200 – 650ºC	125,000	100,000	35	12	16% Cr – 10% Ni	(304)	A194 B8C
ASTM A-453	660	High Temp. up to 750ºC	130,000	85,000	18	15	High Iron Superalloy	660 (A286)	A453 600
ASTM A-564 (cond. 900) (cond. 1100)	630	Med Temp. up to 316ºC	190,000 140,000	170,000 115,000	40 45	10 14	Precipitation Hardening STST	630 (17-4)	A564 630
ASTM B-408	800 – 800H	High Temp. 540ºC – 815ºC	80,000	35,000		25	Incoloy	---	ASTM B408
ASTM B-164	405	High Temp. to 815ºC	85,000	50,000		15	Monel	---	---
ASTM B-164	K500	High Temp. 650ºC - 423ºC Low Temp. 650 ºC – 253ºC	100,000	70,000		35	Monel	---	---
600, 625, 718, x750	ASTM B446, B637	High Temp. from 850ºC – 1090ºC	100,000	80,000		30	Nickel Superalloy (Inconel)	---	---
B, C, X		High Temp. to 850ºC	170,000	115,000		30	Nickel Superalloy (Hastalloy)	---	---
Incoloy	925	High Temp. to - 1000ºC	176,000	120,000	40	24	Nickel Iron Chrome	---	---