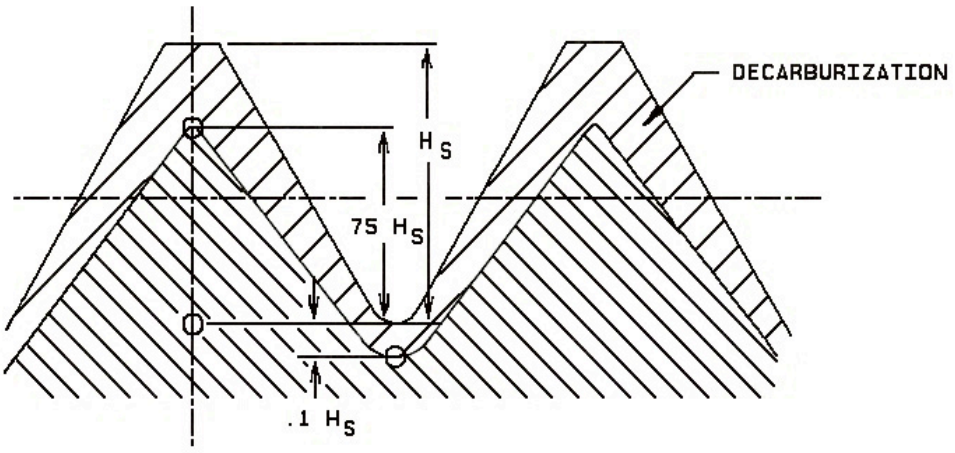
Threads and Materials

Section 3

Threads and Materials

Inch Series and Metric Threads

Decarburization Limits

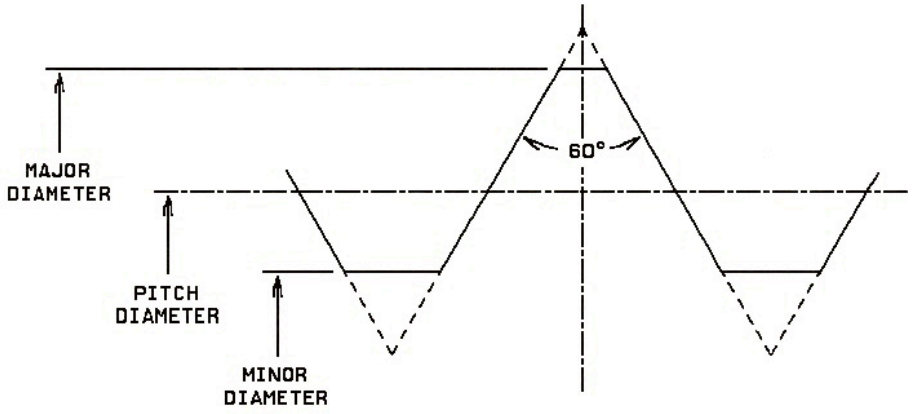


Threads Per Inch	H Thread Height	0.75 H From Root To Crest Min.	0.1 H At Root Max.	Thread Pitch mm	H Thread Height mm	0.75 H From Root To Crest Min. mm
80	0.008	0.006	0.001	0.35	0.215	0.161
72	0.009	0.007	0.001	0.4	0.245	0.184
64	0.010	0.008	0.001	0.45	0.276	0.207
56	0.011	0.008	0.001	0.5	0.307	0.230
48	0.013	0.010	0.001	0.7	0.429	0.322
44	0.014	0.011	0.001	0.8	0.491	0.368
40	0.015	0.011	0.002	1.0	0.613	0.460
36	0.017	0.013	0.002	1.25	0.767	0.575
32	0.019	0.014	0.002	1.5	0.920	0.690
28	0.022	0.017	0.002	1.75	1.074	0.806
24	0.026	0.020	0.003	2.0	1.227	0.920
20	0.031	0.023	0.003	2.5	1.534	1.151
18	0.034	0.026	0.003	3.0	1.840	1.380
16	0.038	0.029	0.004	3.5	2.147	1.610
14	0.044	0.033	0.004	4.0	2.454	1.841
13	0.047	0.035	0.005			
12	0.051	0.038	0.005			
11	0.056	0.042	0.006			
10	0.061	0.046	0.006			
9	0.068	0.051	0.007			
8	0.077	0.058	0.008			
7	0.088	0.066	0.009			
6	0.102	0.077	0.010			
5	0.123	0.092	0.012			
4.5	0.136	0.102	0.014			
4	0.153	0.115	0.015			

Threads and Materials (continued)

Thread Limiting Dimensions – Inch threads

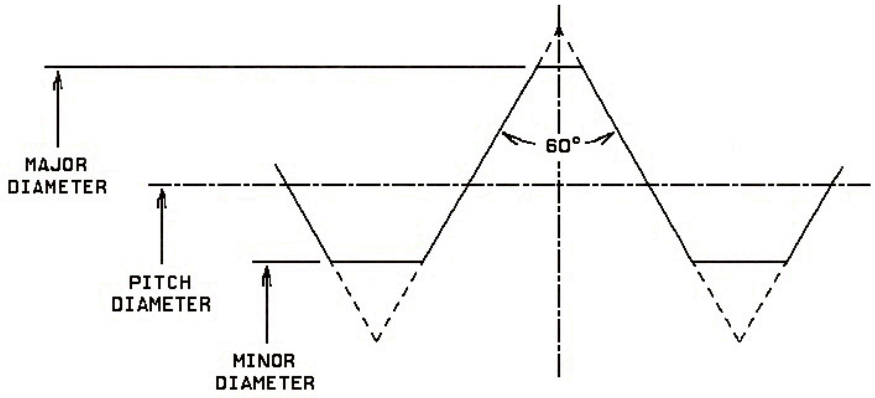
Class 3A through 1”, Class 2A 1 1/8 through 2” diameter



Coarse Series Threads

Nominal Screw Size	Threads Per Inch UNRC	Pitch Diameter Max.	Pitch Diameter Min.	Major Diameter Max.	Major Diameter Min.	Minor Diameter Min.
#2	56	0.0744	0.0728	0.0860	0.0819	0.0612
#3	48	0.0855	0.0838	0.0990	0.0945	0.0703
#4	40	0.0958	0.0939	0.1120	0.1069	0.0777
#5	40	0.1088	0.1069	0.1250	0.1199	0.0906
#6	32	0.1177	0.1156	0.1380	0.1320	0.0953
#8	32	0.1437	0.1415	0.1640	0.1580	0.1212
#10	24	0.1629	0.1604	0.1900	0.1828	0.1334
1/4	20	0.2175	0.2147	0.2500	0.2419	0.1823
5/16	18	0.2764	0.2734	0.3125	0.3038	0.2374
3/8	16	0.3344	0.3311	0.3750	0.3656	0.2906
7/16	14	0.3911	0.3876	0.4375	0.4272	0.3413
1/2	13	0.4500	0.4463	0.5000	0.4891	0.3964
5/8	11	0.5660	0.5619	0.6250	0.6129	0.5029
3/4	10	0.6850	0.6806	0.7500	0.7371	0.6157
7/8	9	0.8028	0.7981	0.8750	0.8611	0.7260
1	8	0.9188	0.9137	1.0000	0.9850	0.8325
1 1/8	7	1.0300	1.0228	1.1228	1.1064	0.9300
1 1/4	7	1.1550	1.1476	1.2478	1.2314	1.0548
1 1/2	6	1.3893	1.3812	1.4976	1.4794	1.2729
1 3/4	5	1.6174	1.6085	1.7473	1.7268	1.5092
2	4 1/2	1.8528	1.8423	1.9971	1.9751	1.6900

Threads and Materials (continued)
Thread Limiting Dimensions – Inch Series Threads

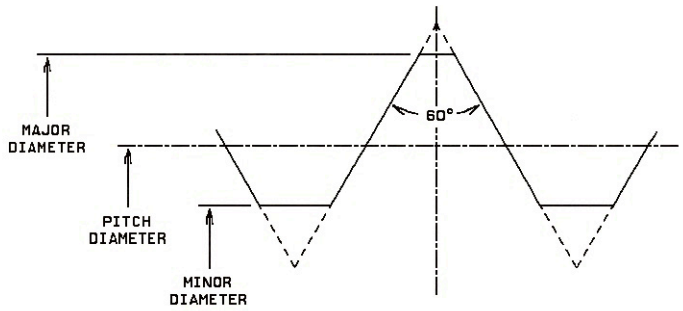


Fine Series Threads

Nominal Screw Size	Threads Per Inch UNRF	Pitch Diameter Max.	Pitch Diameter Min.	Major Diameter Max.	Major Diameter Min.	Minor Diameter Min.
#2	64	0.0759	0.0744	0.0860	0.0822	0.0643
#3	56	0.0874	0.0858	0.0990	0.0949	0.0742
#4	48	0.0985	0.0967	0.1120	0.1075	0.0832
#5	44	0.1102	0.1083	0.1250	0.1202	0.0936
#6	40	0.1218	0.1198	0.1380	0.1329	0.1036
#8	36	0.1460	0.1439	0.1640	0.1585	0.1259
#10	32	0.1697	0.1674	0.1900	0.1840	0.1471
1/4	28	0.2268	0.2243	0.2500	0.2435	0.2011
5/16	24	0.2854	0.2827	0.3125	0.3053	0.2557
3/8	24	0.3479	0.3450	0.3750	0.3678	0.3180
7/16	20	0.4050	0.4019	0.4375	0.4294	0.3695
1/2	20	0.4675	0.4643	0.5000	0.4919	0.4319
5/8	18	0.5889	0.5854	0.6250	0.6163	0.5494
3/4	16	0.7094	0.7056	0.7500	0.7406	0.6650
7/8	14	0.8286	0.8245	0.8750	0.8647	0.7781
1	12	0.9459	0.9415	1.0000	0.9886	0.8874
1 1/8	12	1.0691	0.0631	1.1232	1.1118	1.0090
1 1/4	12	1.1941	1.1879	1.2482	1.2368	1.1338
1 1/2	12	1.4440	1.4376	1.4981	1.4867	1.2586
1 3/4						
2						

Threads and Materials (continued)

Thread Limiting Dimensions – Class 4g6g Metric Threads

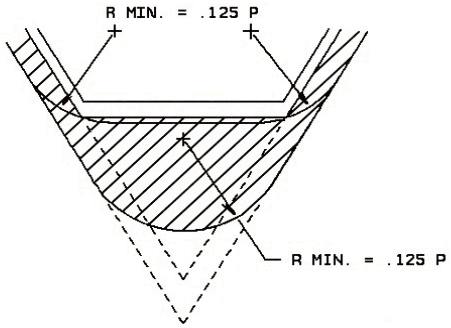


Nominal Diameter And Thread Pitch	Tolerance Class	Allowance ES	Major Diameter Max.	Major Diameter Min.	Pitch Diameter Max.	Pitch Diameter Min.	Minor Diameter (flat form) Max.	Minor Diameter (rounded form) Min. Ref.
M2x0.4	4g6g	0.019	1.981	1.886	1.721	1.679	1.548	1.433
M2.5x0.45	4g6g	0.020	2.480	2.380	2.188	2.143	1.993	1.866
M3x0.5	4g6g	0.020	2.980	2.874	2.655	2.607	2.439	2.299
M4x0.7	4g6g	0.022	3.978	3.838	3.523	3.467	3.220	3.036
M5x0.8	4g6g	0.024	4.976	4.826	4.456	4.396	4.110	3.904
M6x1.0	4g6g	0.026	5.974	5.794	5.324	5.253	4.891	4.637
M8x1.25	4g6g	0.028	7.972	7.760	7.160	7.085	6.619	6.315
M10x1.50	4g6g	0.032	9.968	9.732	8.994	8.909	8.344	7.985
M12x1.75	4g6g	0.034	11.966	11.701	10.829	10.734	10.072	9.656
M16x2.0	4g6g	0.038	15.962	15.682	14.663	14.563	13.797	13.331
M20x2.5	4g6g	0.042	19.958	19.623	18.334	18.228	17.252	16.688
M24x3.0	4g6g	0..048	23.952	23.577	22.003	21.878	20.704	20.030
M30x3.5	4g6g	0.053	29.947	29.522	27.674	27.542	26.158	25.386
M36x3.5	4g6g	0.060	35.940	35.465	33.342	33.202	31.610	30.738

Applicable Specifications: ASME B1.13M, B1.3M

Threads and Materials (continued)

Limits for M Profile Minimum Rounded Root Radius



Pitch Or Thread Spacing	Root Radius 0.125 P Min.
0.4	0.050
0.45	0.056
0.5	0.062
0.6	0.075
0.7	0.088
0.8	0.100
1.0	0.125
1.25	0.156
1.50	0.188
1.75	0.219
2.0	0.250
2.5	0.312
3.0	0.375
3.5	0.438
4.0	0.500

Applicable Specifications: ASME B1.13M, B1.3M.

Threads and Materials (continued)

Tolerance Grade and Position Symbols for Classes of ISO Metric Threads

	External Threads			Internal Threads		
Amount	Tolerance Grade			Tolerance Grade		
	Major Diameter	Pitch Diameter	Tolerance Position (allowance)	Minor Diameter	Pitch Diameter	Tolerance Position (allowance)
0	---	---	h	---	---	H
Small	---	3		---	---	
	4	4		4	4	
	---	5		5	5	
	6	6	g	6	6	G
	---	7		7	7	
	8	8		8	8	
	---	g		---	---	
Large			e			---

ISO metric internal threads are identified by the use of capital letters for the tolerance position. ISO metric external threads are identified by the use of lower case letters for the tolerance position.

As an example: M6 x 1.0 – 4g6g indicates a metric thread form "M", "6" mm nominal diameter. The fastener is externally threaded as noted by the lower case "g". The tolerance position and grade of the major diameter is listed first – "4g", followed by the tolerance position and grade of the pitch diameter-"6g".

Standard Property Class 12.9 socket screw products manufactured in the United States have 4g6g thread tolerances as the form most closely resembles the 3A thread form used on inch series socket products. When plating or coating of threads is desired, a thread form with greater allowance should be selected.

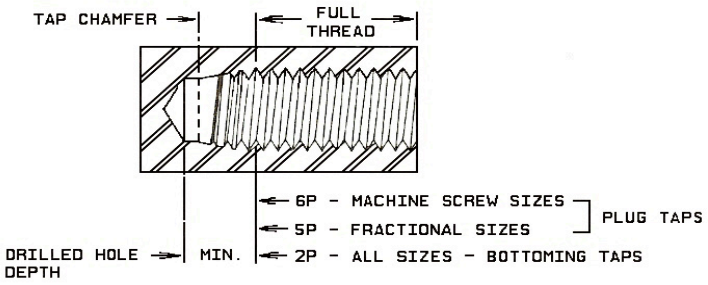
Threads and Materials (continued)
Diameter and Thread Pitch Comparison

Inch Series Size	Nom. Dia. In.	Threads Per Inch	Metric Size	Dia. In.	Pitch In mm	Equiv. TPI (app.)	Inch Series Size	Nom. Dia. In.	Threads Per Inch	Metric Size	Dia. In.	Pitch In mm	Equiv. TPI (app.)
			M1.4	0.055	0.3 0.2	85 127	**1/4**	0.250	20 28				
#0	0.060	80					**5/16**	0.3125	18 24				
			M1.6	0.063	0.35 0.2	74 127				**M8**	0.315	1.25 1.0	20 25
#1	0.073	64 72					**3/8**	0.375	16 24				
			M2	0.079	0.4 0.25	64 101				**M10**	0.393	1.5 1.25	17 20
#2	0.086	56 64					**7/16**	0.4375	14 20				
			M2.5	0.098	0.45 0.35	56 74				**M12**	0.472	1.75 1.25	14.5 20
#3	0.099	48 56					**1/2**	0.500	13 20				
#4	0.112	40 48								**M14**	0.551	2 1.5	12.5 17
			M3	0.118	0.5 0.35	51 74	**5/8**	0.625	11 18				
#5	0.125	40 44								**M16**	0.630	2 1.5	12.5 17
#6	0.138	32 40											
			M4	0.157	0.7 0.5	36 51	**3/4**	0.750	10 16				
#8	0.164	32 36								**M20**	0.787	2.5 1.5	10 17
#10	0.190	24 32											
			M5	0.196	0.8 0.5	32 51	**7/8**	0.875	9 14				
			M6	0.236	1.0 0.75	25 34				**M24**	0.945	3 2	8.5 12.5
							1	1.000	8 12				

Research has shown that there are over 100 possible inch/metric fastener mismatches possible among commonly used sizes. Care must be taken not to mix the types together.

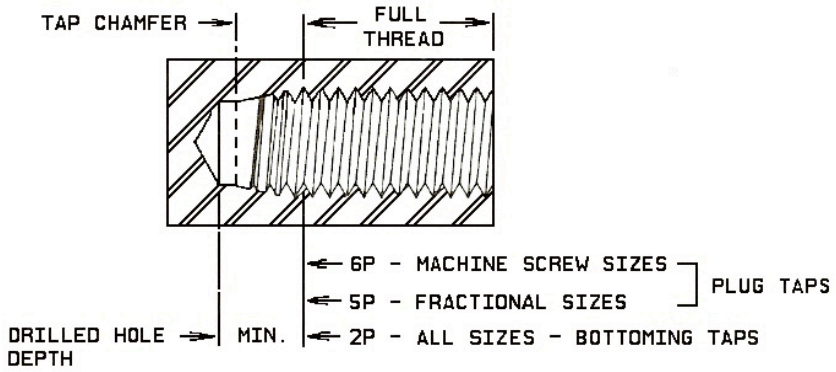
Inch and Metric Screw Threads (continued)

Common Tap Drill Sizes – Inch Series Threads



Diameter	Pitch (TPI) UNC	Pitch (TPI) UNF	Drill (in.) Decimal	Wire, Letter Fractional
#2	56		0.070	#50
		64	0.070	#50
#3	48		0.785	#53
		56	0.082	#53
#4	40		0.0890	#43
		48	0.0935	#42
#5	40		0.1015	#38
		44	0.1040	#37
#6	32		0.1065	#36
		40	0.1130	#33
#8	32		0.1360	#29
		36	0.1360	#29
#10	24		0.1495	#25
		32	0.1590	#21
1/4	20		0.2040	#6
		28	0.2187	7/32
5/16	18		0.261	G
		24	0.272	I
3/8	16		0.313	5/16
		24	0.332	Q
7/16	14		0.3680	U
		20	0.3906	25/64
1/2	13		0.4219	27/64
		20	0.4531	29/64
5/8	11		0.5469	35/64
		18	0.5781	37/64
3/4	10		0.6562	21/32
		16	0.6875	11/16
7/8	9		0.7656	49/64
		14	0.8125	13/16
1	8		0.875	7/8
		12	0.9129	59/64
1 1/4	7		1.1094	1 7/64
		12	1.1719	1 11/64
1 1/2	6		1.3437	1 11/32
		12	1.4219	1 27/64

Inch and Metric Screw Threads
Common Tap Drill Sizes-Metric Threads



Metric Diameter	Thread Spacing In mm	Drill mm
M2	0.4	1.6
M2.5	0.45	2.05
M3	0.5	2.5
M4	0.7	3.3
M5	0.8	4.2
M6	1.0	5.0
M8	1.25	6.7
M10	1.50	8.5
M12	1.75	10.2
M16	2.0	14.0
M20	2.5	17.5
M24	3.0	21.0
M30	3.5	26.5
M36	4.0	32.0
M42	4.5	37.5

Drilling Blind Holes: the minimum depth of a drilled hole suitable for tapping equals the full thread depth plus the number of turns, P, for each style and size of tap.

Generally, the following minimum length thread engagements are recommended:

Hardened Steel – 1 times diameter of the screw
Soft Steels or Cast Iron – 1 and 1/2 times diameter of screw
Aluminum – 2 times the diameter of the screw.