

## PILOT HOLE SIZES

Recommended Pilot Holes Sizes – Inch Screws						
Material Thickness Inch Nominal Screw Size Diameter - TPI	Inch Approx. US Gauge Material	.020 - .055 26 - 17 Diameter	.061 - .122 16 - 11 Diameter	.125 - .245 11 - 3 Diameter	.250 - .312 3 - 5/16" Diameter	.313 - .500 5/16" - 1/2" Diameter
4 - 40	Steel* Aluminum**	.098 .098	.102 .100	.104 .102	.	.
6 - 32	Steel Aluminum	.120 .120	.120 .120	.125 .125	.128 .125	.
8 - 32	Steel Aluminum	.	.147 .147	.150 .150	.154 .152	.
10 - 24	Steel Aluminum	.	.166 .166	.172 .166	.177 .170	.
10 - 32	Steel Aluminum	.	.173 .173	.177 .173	.180 .177	.
12 - 24	Steel Aluminum	.	.193 .191	.199 .196	.203 .199	.
1/4 - 20	Steel Aluminum	.	.219 .219	.224 .221	.228 .224	.234 .228
5/16 - 18	Steel Aluminum	.	.	.281 .278	.288 .284	.290 .286
3/8 - 16	Steel Aluminum	.	.	.342 .339	.348 .343	.350 .343
Recommended Pilot Holes Sizes – MetricScrews						
Material Thickness Nominal Screw Size Dia. Pitch	Millimeters Material	.05 - 1.2 Diameter	1.3 - 2.4 Diameter	2.5 - 4.0 Diameter	4.1 - 5.9 Diameter	6.0 - 8.1 Diameter
M3 x 0.5	Steel	2.72	2.74	2.77	.	.
M4 x .07	Steel	3.58	3.60	3.63	3.68	.
M5 x 0.8	Steel	.	4.55	4.57	4.60	4.65
M6 x 1.0	Steel	.	5.41	5.46	5.51	5.54
M7 x 1.0	Steel	.	.	6.45	6.51	6.58
M8 x 1.25	Steel	.	.	7.31	7.39	7.47
M10 x 1.50	Steel	.	.	9.10	9.17	9.27
* Steel: Low carbon sheet and bar; average Rockwell - "B" 55 - 75.						
** Aluminum: Aluminum sheet and bar (including aluminum and zinc die castings and all alloys in Rockwell "B" hardness range from 40 - 70) and other ductile materials of similar hardness, such as brass, bronze, etc.						
Note: Special materials and applications may warrant special hole sizes. Information available upon request.						

Recommended Pilot Hole Sizes in Steel Nut Members – Inch Sizes (in)					
Applica tion Duty	Light 0.3 Diameters of Material	Medium-Light 0.5 Diameters of Material	Medium-Heavy 0.75 Diameters of Material	Full Strength 1.0 Diameters of Material	Extended 1.25 Diameters of Material

Class	90%			80%			70%			65%			60%		
Percentage of Thread	90%			80%			70%			65%			60%		
Nominal Size	Material Thickness	Pilot Hole	Drill Size	Material Thickness	Pilot Hole	Drill Size	Material Thickness	Pilot Hole	Drill Size	Material Thickness	Pilot Hole	Drill Size	Material Thickness	Pilot Hole	Drill Size
2-56	.017-.034	0.0756	1.9 mm 0.0748	.034-.052	0.0767	1.9 mm 0.0763	.052-.072	0.0779	5/64 0.0781	.073-.095	0.0756	1.9 mm 0.0748	.017-.034	0.0756	1.9 mm 0.0748
3-48	.020-.040	0.8680	2.2 mm 0.0866	.040-.059	0.0882	#43 0.089	.059-.084	0.0895	#43 0.089	.084-.110	0.0902	2.3 mm 0.0906	.110-.141	0.0909	2.3 mm 0.0906
4-40	.022-.045	0.0974	#40 0.098	.045-.067	0.0990	#39 0.0995	.067-.095	0.1006	#39 0.0995	.095-.126	0.1014	#38 0.1015	.126-.157	0.1023	2.6 mm 0.0906
5-40	.025-.051	0.1104	2.8 mm 0.1102	.051-.075	0.1120	#33 0.113	.075-.106	0.1136	#33 0.113	.106-.141	0.1104	2.9 mm 0.1142	.141-.175	0.1153	2.9 mm 0.1142
6-32	.028-.066	0.1197	#31 0.120	.066-.083	0.1218	3.1 mm 0.122	.083-.117	0.1238	1/8 0.125	.117-.152	0.1248	1/8 0.125	.152-.193	0.1258	3.2 mm 0.126
8-32	.033-.066	0.1457	3.7 mm 0.1457	.066-.098	0.1478	3.75 mm 0.1476	.098-.141	0.1498	3.8 mm 0.1496	.141-1.80	0.1508	3.8 mm 0.1491	.180-.230	0.1518	#24 0.152
10-24	.038-.079	0.1656	#19 0.166	.079-.114	0.1683	#18 0.1695	.114-.162	0.1710	11/64 0.1719	.162-.209	0.1724	11/64 0.1719	.209-.266	0.1738	4.4 mm 0.1732
10-32	.038-.079	0.1717	11/64 0.1719	.079-.114	0.1738	#17 0.173	.114-.162	0.1758	#16 0.177	.162-.209	0.1768	#16 0.177	.209-.266	0.1778	4.5 mm 0.1772
12-24	.043-.086	0.1916	#11 0.191	.086-.130	0.1943	#9 0.196	.130-.184	0.1970	5 mm 0.1969	.184-.238	0.1984	#8 0.199	.238-.302	0.1998	5.1 mm 0.2008
1/4-20	.050-.100	0.2208	#2 0.221	.100-.150	0.2240	5.7 mm 0.2244	.150-.213	0.2273	#1 0.228	.213-.275	0.2289	5.8 mm 0.2283	.275-.350	0.2309	5.8 mm 0.2283
5/16-18	.062-.126	0.2800	7.1 mm 0.2795	.126-.188	0.2836	7.2 mm 0.2835	.188-.266	0.2872	7.3 mm 0.2874	.266-.345	0.2890	L 0.29	.345-.438	0.2908	7.4 mm 0.2913
3/8-16	.075-.174	0.3384	8.6 mm 0.33	.150-.225	0.3425	8.7 mm 0.342	.225-.319	0.3466	8.8 mm 0.34	.319-.413	0.3486	Size 0.348	.413-.525	0.3506	8.9 mm 0.35

			84			5			65						04
7/16-14	.087- .174	0.39 57	X 0.39 7	.174- .262	0.40 04	X 0.397	.262- .371	.040 50	Y 0.40 4	.371- .481	0.40 73	13/3 2 0.40 63	.481- .612	0.40 96	13/3 2 0.40 63
1/2-13	.100- .200	0.45 50	29/6 4 0.45 31	.200- .300	0.46 00	29/64 0.453 1	.300- .425	0.46 50	15/3 2 0.46 88	.425- .550	0.46 75	15/3 2 0.46 88	.550- .700	0.47 00	15/3 2 0.46 8

**Recommended Pilot Hole Sizes in Steel Nut Members – Metric Sizes (mm)**

Applica tion Duty Class	Light 0.3 Diameters of Material			Medium-Light 0.5 Diameters of Material			Medium-Heavy 0.75 Diameters of Material			Full Strength 1.0 Diameters of Material			Extended 1.25 Diameters of Material		
	90%			80%			70%			65%			60%		
Nomin al Size	Materi al Thickn ess	Pilo t Hol e	Drill Size	Materi al Thickn ess	Pilo t Hol e	Drill Size	Materi al Thickn ess	Pilo t Hol e	Drill Size	Materi al Thickn ess	Pilo t Hol e	Drill Size	Materi al Thickn ess	Pilo t Hol e	Drill Size
M2.5 x 0.45	0.5-0.9	2.24	2.25	0.9-1.5	2.27	#43 2.26	1.5-2.1	2.3	2.3	2.1-2.7	2.31	2.3	2.7-3.5	2.32	2.3
M3 x 0.5	0.5-1.1	2.71	#36 2.71	1.1-1.7	2.74	2.75	1.7-2.7	2.77	7/64 2.78	2.7-3.3	2.79	7/64 2.78	3.3-4.0	2.8	2.8
M3.5 x 0.6	0.6-1.4	3.15	1/8 3.18	1.4-2.0	3.19	3.2	2.0-2.9	3.23	3.25	2.9-3.8	3.25	3.25	3.8-4.5	3.27	#30 3.27
M4 x 0.7	0.8-1.4	3.59	3.6	1.4-2.4	3.64	#27 3.66	2.4-3.3	3.68	3.7	3.3-4.4	3.7	3.7	4.4-5.5	3.73	#26 3.73
M4.5 x 0.75	0.9-1.7	4.06	#21 4.04	1.7-2.7	4.11	4.1	2.7-3.9	4.16	4.2	3.9-4.9	4.18	4.2	4.9-6.4	4.21	4.2
M5 x 0.8	1.0-2.1	4.53	4.5	2.1-2.9	4.58	4.57	2.9-4.4	4.64	#14 4.62	4.4-5.9	4.66	4.65	5.9-7.1	4.69	4.7
M6 x 1.0	1.2-2.4	5.42	#3 5.41	2.4-3.6	5.48	5.5	3.6-4.9	5.55	7/32 5.56	4.9-6.9	5.58	5.6	6.9-8.1	5.61	5.6
M7 x 1.0	1.4-2.4	6.42	6.4	2.4-4.4	6.48	6.5	4.4-6.5	6.55	F 6.53	6.5-7.7	6.58	6.6	7.7-9.5	6.61	6.6
M8 x 1.25	1.6-3.1	7.27	7.25	3.1-4.9	7.35	L 7.37	4.6-6.9	7.43	7.4	6.9-8.9	7.47	M 7.49	8.9- 10.9	7.51	7.5
M10 x 1.5	1.9-3.9	9.12	23/6 4 9.1	3.9-5.9	9.22	9.25	5.9-8.3	9.32	9.25	8.3- 10.9	9.37	U 9.35	10.9- 12.9	9.41	9.4
M12 x 1.75	2.4-4.9	10.9 8	11.0	4.9-7.4	11.0 9	7/16 11.11	7.4- 10.5	11.2	7/16 11.1 1	10.5- 14.5	11.2 6	11.3	14.5- 17.0	11.3 1	11.3

Application Duty Class – A general term used here to group material thickness in terms of screw diameters. For example, the average material thickness listed under “medium-heavy” equals 75% of the screw diameter.

**Recommended Extruded Pilot Hole Sizes in Light-Gage Steel**

Extruding holes for fasteners in light-gage steel nearly doubles the length of thread engagement over the original material thickness.

Fasteners develop almost twice the failure torque in extruded holes, providing maximum joint integrity.

Example: The chart shows that for a M4 x 0.7 screw in a material thickness of 0.75 mm, the suggested hole diameter is 3.59 mm. The corresponding "H" dimension is the 1.35 mm minimum, making the total length of engagement 2.1 mm minimum.

**Hole Size Diameter (D) per Material Thickness – Metric Sizes (mm)**

Screw Size	Material Thickness				
	0.50–0.69	0.70–0.99	1.00–1.49	1.50–2.49	2.50–3.00
M2.5 x 0.45	2.22	2.23	2.24	—	—
M3 x 0.5	2.70	2.71	2.72	—	—
M4 x 0.7	3.57	3.59	3.61	3.64	—
M5 x 0.8	—	4.53	4.56	4.59	—
M6 x 1.0	—	5.42	5.45	5.48	5.51
M8 x 1.25	—	—	7.27	7.31	7.35

**Extruded Hole Thickness – Metric Sizes (mm)**

Metric Hole Diameter "D"	Approximate Material Thickness "T"									
	0.6–1.0		1.0–1.2		1.2–2.0		2.0–2.5		2.5–3.0	
	H	R	H	R	H	R	H	R	H	R
2.00–2.55	1.00	0.13	1.00	0.13	1.00	0.15	1.10	0.25	—	
2.56–3.20	1.20	0.13	1.20	0.13	1.20	0.15	1.30	0.25	1.35	0.25
3.21–3.80	1.35	0.13	1.35	0.13	1.35	0.15	1.50	0.25	1.60	0.25
3.81–4.60	—		1.50	0.13	1.55	0.15	1.80	0.25	1.90	0.25
4.61–5.60	—		1.80	0.13	1.80	0.15	2.30	0.25	2.40	0.25
5.61–6.60	—		—		1.90	0.15	2.55	0.25	2.65	0.25
6.61–7.60	—		—		2.10	0.15	2.95	0.25	3.20	0.25

**Hole Size Diameter (D) per Material Thickness – Inch Sizes (in)**

Screw Size	Material Thickness				
	0.020–0.029	0.030–0.039	0.040–0.059	0.060–0.099	0.100–0.130
4-40	0.097	0.097	0.098	—	—
6-32	0.119	0.120	0.121	0.122	—
8-32	0.145	0.146	0.147	0.148	—
10-24	0.164	0.166	0.168	0.170	0.170
10-32	0.171	0.172	0.173	0.174	0.174
1/4-20	—	0.221	0.223	0.225	0.225
5/16-18	—	—	0.282	0.285	0.285

Extruded Hole Thickness – Inch Sizes (in)										
Hole Diameter “D”	Approximate Material Thickness “T”									
	0.020–0.035 H R		0.035–0.050 H R		0.050–0.075 H R		0.075–0.100 H R		0.100–0.125 H R	
0.081–0.100	0.040	0.005	0.040	0.005	0.040	0.006	0.043	0.010	—	
0.101–0.125	0.047	0.005	0.047	0.005	0.047	0.006	0.052	0.010	0.054 0.010	
0.126–0.150	0.053	0.005	0.053	0.005	0.053	0.006	0.060	0.010	0.063 0.010	
0.151–0.180	—		0.060	0.005	0.060	0.006	0.070	0.010	0.075 0.010	
0.181–0.220	—		0.070	0.005	0.070	0.006	0.090	0.010	0.095 0.010	
0.221–0.260	—		—		0.075	0.006	0.100	0.010	0.105 0.010	
0.261–0.300	—		—		0.083	0.006	0.116	0.010	0.125 0.010	

Hole Sizes per Percentage of Thread Engagement – Inch Sizes														
Nominal Screw Size	Percent Thread Enlargement													
	100	95	90*	85*	80	75	70	65	60	55	50	45	40	35
2-56	0.074 4	0.075 0	0.075 6	0.076 1	0.076 7	0.077 3	0.077 9	0.078 5	0.079 0	0.079 6	0.080 2	0.080 8	0.081 4	0.081 9
3-48	0.085 5	0.086 1	0.086 8	0.087 5	0.088 2	0.088 8	0.089 5	0.090 2	0.090 9	0.091 6	0.092 2	0.092 9	0.093 6	0.094 3
4-40	0.095 8	0.096 6	0.097 4	0.098 2	0.099 0	0.099 8	0.100 6	0.101 4	0.102 3	0.103 1	0.103 9	0.104 7	0.105 5	0.106 3
5-40	0.108 8	0.109 6	0.110 4	0.111 2	0.112 0	0.112 8	0.113 6	0.114 4	0.115 3	0.116 1	0.116 9	0.117 7	0.118 5	0.119 3
6-32	0.117 7	0.118 7	0.119 7	0.120 7	0.121 8	0.122 8	0.123 8	0.124 8	0.125 8	0.126 8	0.127 8	0.128 9	0.129 9	0.130 9
8-32	0.143 7	0.144 7	0.145 7	0.146 7	0.147 8	0.148 8	0.149 8	0.150 8	0.151 8	0.152 8	0.153 8	0.154 9	0.155 9	0.156 9
10-24	0.162 9	0.164 3	0.165 6	0.167 0	0.168 3	0.169 7	0.171 0	0.172 4	0.173 8	0.175 1	0.176 5	0.177 8	0.179 2	0.180 5
10-32	0.169 7	0.170 7	0.171 7	0.172 7	0.173 8	0.174 8	0.175 8	0.176 8	0.177 8	0.178 8	0.179 8	0.180 9	0.181 9	0.182 9
12-24	0.188 9	0.190 3	0.191 6	0.193 0	0.194 3	0.195 7	0.197 0	0.198 4	0.199 8	0.201 1	0.202 5	0.203 8	0.205 2	0.206 5
1/4-20	0.217 5	0.219 1	0.220 8	0.222 4	0.224 0	0.225 6	0.227 3	0.228 9	0.230 5	0.232 1	0.233 8	0.235 4	0.237 0	0.238 6
5/16-18	0.276 4	0.278 2	0.280 0	0.281 8	0.283 6	0.285 4	0.287 2	0.289 0	0.290 8	0.292 6	0.294 4	0.296 3	0.298 1	0.299 9
3/8-16	0.334	0.336	0.338	0.340	0.342	0.344	0.346	0.348	0.350	0.352	0.354	0.356	0.358	0.360

	4	4	4	5	5	5	6	6	6	7	7	7	8	8
7/16-14	0.391 1	0.393 4	0.395 7	0.398 0	0.400 4	0.402 7	0.405 0	0.407 3	0.409 6	0.412 0	0.414 3	0.416 6	0.418 9	0.421 3
1/2-13	0.450 0	0.452 5	0.455 0	0.457 5	0.460 0	0.462 5	0.465 0	0.467 5	0.470 0	0.472 5	0.475 0	0.477 5	0.480 0	0.482 5

**Hole Sizes per Percentage of Thread Engagement – Metric Sizes**

Nominal Screw Size	Percent Thread Enlargement													
	100	95	90*	85*	80	75	70	65	60	55	50	45	40	35
M2.5 x 0.45	2.21	2.22	2.24	2.25	2.27	2.28	2.29	2.31	2.32	2.34	2.35	2.37	2.38	2.40
M3 x 0.5	2.67	2.69	2.71	2.72	2.74	2.76	2.77	2.79	2.80	2.82	2.84	2.85	2.87	2.90
M3.5 x 0.6	3.11	3.13	3.15	3.17	3.19	3.21	3.23	3.25	3.27	3.29	3.30	3.32	3.34	3.36
M4 x 0.7	3.54	3.57	3.59	3.61	3.64	3.66	3.68	3.70	3.73	3.75	3.77	3.79	3.80	3.84
M4.5 x 0.75	4.01	4.04	4.06	4.09	4.11	4.13	4.16	4.18	4.21	4.23	4.26	4.28	4.30	4.33
M5 x 0.8	4.48	4.51	4.53	4.56	4.58	4.61	4.64	4.66	4.69	4.71	4.74	4.77	4.79	4.82
M6 x 1.0	5.35	5.38	5.42	5.45	5.48	5.51	5.54	5.58	5.61	5.64	5.67	5.71	5.74	5.77
M7 x 1.0	6.35	6.38	6.42	6.45	6.48	6.51	6.54	6.58	6.61	6.64	6.67	6.71	6.74	6.77
M8 x 1.25	7.19	7.23	7.27	7.31	7.35	7.39	7.43	7.47	7.51	7.55	7.59	7.63	7.67	7.72
M10 x 1.5	9.03	9.07	9.12	9.17	9.22	9.27	9.32	9.37	9.41	9.46	9.51	9.56	9.61	9.66
M12 x 1.75	10.86	10.92	10.98	11.03	11.09	11.15	11.20	11.26	11.31	11.37	11.43	11.49	11.55	11.60

Note: Nominal screw diameters are used when calculating hole sizes and are based on the US basic thread depth of .6495 times the pitch. Hole data accuracy decreases for engagements less than 70%. This is because the data is based on a linear relation between hole size and percentage of thread engagement.

Hole Size =  $D - (0.6495 \times P \times \%)$ . In this equation, D is equal to the nominal screw diameter.

\* Pilot holes listed under the 90% and 85% thread engagement columns are recommended for single punch extruded holes.

Typical tolerance for the pilot hole range is -10% to +5% from the nominal percent thread engagement.