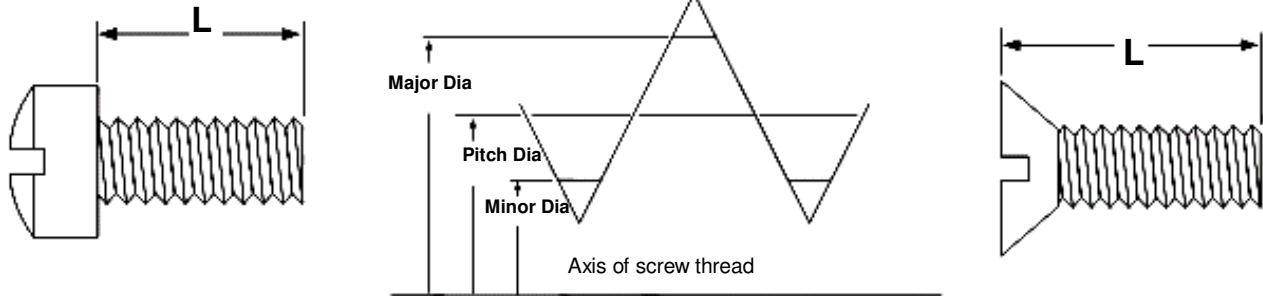


## Machine Screws - Thread Dimensions



2A External Threads for Machine Screws and SEMS									ASME B 1.1 (2002)	
Nominal Size / TPI	Thread Type	Allowance	Major Diameter		Pitch Diameter			Stress Area in <sup>2</sup>	Tensile Strength* lb min (Steel screws only)	
			Max	Min	Max	Min	Tolerance			
0-80 0.060	UNF	.0005	.0595	.0563	.0514	.0496	.001762	0.00180	-	
1-64 0.073	UNC	.0006	.0724	.0686	.0623	.0603	.001970	0.00263	-	
1-72 0.073	UNF	.0006	.0724	.0689	.0634	.0615	.001899	0.00278	-	
2-56 0.086	UNC	.0006	.0854	.0813	.0738	.0717	.002127	0.00370	-	
2-64 0.086	UNF	.0006	.0854	.0816	.0753	.0733	.002040	0.00394	-	
3-48 0.099	UNC	.0007	.0983	.0938	.0848	.0825	.002302	0.00487	-	
3-56 0.099	UNF	.0007	.0983	.0942	.0867	.0845	.002191	0.00523	-	
4-40 0.112	UNC	.0008	.1112	.1061	.0950	.0925	.002507	0.00604	360	
4-48 0.112	UNF	.0007	.1113	.1068	.0978	.0954	.002361	0.00661	396	
5-40 0.125	UNC	.0008	.1242	.1191	.1080	.1054	.002562	0.00796	470	
5-44 0.125	UNF	.0007	.1243	.1195	.1095	.1070	.002484	0.00830	498	
6-32 0.138	UNC	.0008	.1372	.1312	.1169	.1141	.002820	0.00909	550	
6-40 0.138	UNF	.0008	.1372	.1321	.1210	.1184	.002614	0.01015	609	
8-32 0.164	UNC	.0009	.1631	.1571	.1428	.1399	.002916	0.0140	850	
8-36 0.164	UNF	.0008	.1632	.1577	.1452	.1424	.002804	0.01474	884	
10-24 0.190	UNC	.0010	.1890	.1818	.1619	.1586	.003319	0.0175	1050	
10-32 0.190	UNF	.0009	.1891	.1831	.1688	.1658	.003004	0.0200	1200	
12-24 0.216	UNC	.0010	.2150	.2078	.1879	.1845	.003400	0.0242	1450	
12-28 0.216	UNF	.0010	.2150	.2085	.1918	.1886	.003224	0.0258	1548	
1/4-20 0.250	UNC	.0011	.2489	.2408	.2164	.2127	.003731	0.0318	1900	
1/4-28 0.250	UNF	.0010	.2490	.2425	.2258	.2225	.003322	0.0364	2200	
5/16-18 0.3125	UNC	.0012	.3113	.3026	.2752	.2712	.004041	0.0524	3150	
5/16-24 0.3125	UNF	.0011	.3114	.3042	.2843	.2806	.003660	0.0580	3480	
3/8-16 0.375	UNC	.0013	.3737	.3643	.3331	.3287	.004363	0.0775	4650	
3/8-24 0.375	UNF	.0011	.3739	.3667	.3468	.3430	.003804	0.0878	5268	
1/2-13 0.500	UNC	.0015	.4985	.4876	.4485	.4435	.004965	0.1419	8500	
1/2-20 0.500	UNF	.0013	.4987	.4906	.4662	.4619	.004288	0.1599	9594	

Tolerance on Length L	Nominal Screw Size	Nominal Screw Length			
		Up to 1/2"	Over 1/2" to 1"	Over 1 to 2"	Over 2"
		#0 thru #12	-0.02	-0.03	-0.06
1 1/4" thru 3/4"	-0.03	-0.03	-0.06	-0.09	

\*Tensile strength values are based on 60,000 psi. and apply to carbon steel screws and SEMS only. Hex and Hex Washer head machine screws of sufficient length may be wedge tensile tested. Other head styles may be axial tensile tested.

## SEMS Screws – Mechanical & Performance Specifications

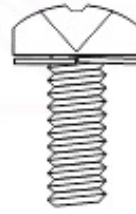
### MACHINE SCREWS WITH FREE-SPINNING LOCKWASHERS



**Internal Tooth**



**External Tooth**



**Split-Lock**

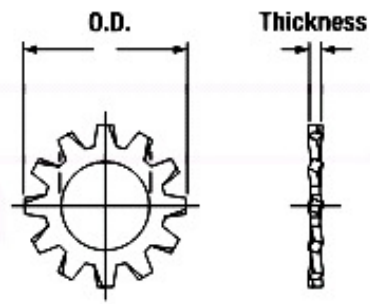
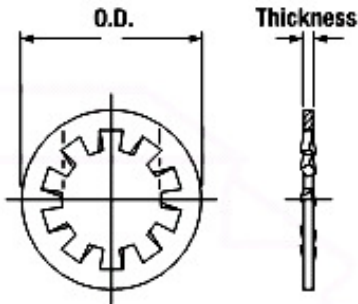


**Square-Cone®**

<b>Description</b>	A machine screw pre-assembled with a free-spinning lock-washer. A permanent assembly with the washer held in place by the major diameter of the screw thread being larger than the hole of the washer.
<b>Applications/ Advantages</b>	The washer/screw assembly acts as a self locking mechanism. Machine pre-assembly increases productivity and lowers cost for the end user: <b>Internal Tooth SEMS</b> : Recommended for smaller head screws, when teeth need to be hidden and to prevent snagging or scratching. <b>External Tooth SEMS</b> : Preferred over the internal tooth style for larger head screws and provides maximal torsional resistance due to larger radius. <b>Split-Lock SEMS</b> : Preferred over tooth lock-washer SEMS for use with hardened bearing surfaces. <b>Square-Cone® SEMS</b> : Provides a higher retained clamp load and improved compensation for thermal cycling and vibration. Can accept a high tension load and maintain spring action. Ideal for clamping fragile materials, preventing stress cracking around clearance holes and for spanning large clearance holes.
<b>Material</b>	<b>Steel Screws</b> -- AISI 1022 or equivalent steel. <b>Steel Washers</b> -- Split-lock: SAE 1055-1065 carbon steel; Tooth-lock: SAE 1050-1065. Square- Cone®: SAE 1050. <b>Stainless Screws</b> -- SAE 18-8 stainless steel or 410 martensitic stainless steel <b>Stainless Washers</b> -- Split-lock: SAE J405 302-305; Tooth-lock: SAE 410 stainless steel; Square-Cone®: 18-8 stainless steel Steel
<b>Hardness</b>	Screws-- Rockwell B70 - B100. Steel Washers-- <u>Split-lock</u> : Rockwell C38 - 46; <u>Tooth-lock</u> : Rockwell C40 - 50; <u>Square-Cone®</u> : Rockwell C42 - 46. Stainless Washers-- <u>Split-lock</u> : Rockwell C35 - 43; <u>Tooth-lock</u> : Rockwell C40 - 50; <u>Square-Cone®</u> : Rockwell B88 minimum.
<b>Tensile Strength</b>	<b>Steel</b> : 60,000 psi. minimum. No. 2 diameter SEMS screws are not subject to tensile testing. No. 4 SEMS screws shorter than 1/2" are not subject to tensile testing. SEMS screws of diameters No. 6 to 10 inclusive, which are shorter than 1/2" or 3D (where D is the nominal screw size in inches) are not subject to tensile testing. <b>18-8 Stainless</b> : No. 4: 99,000 psi. minimum; No. 6 & No. 8: 96,000 psi. minimum. <u>ote</u> : No. 4, No. 6 and No. 8 SEMS screws which are shorter than 1/2" are not subject to tensile testing. <b>410 Stainless</b> : No. 4, No. 6 and No. 8 SEMS screws which are shorter than 1/2" are not subject to tensile testing.

### HOW SEMS SPECIFICATIONS VARY FROM MACHINE SCREWS

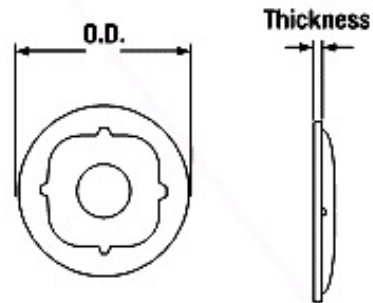
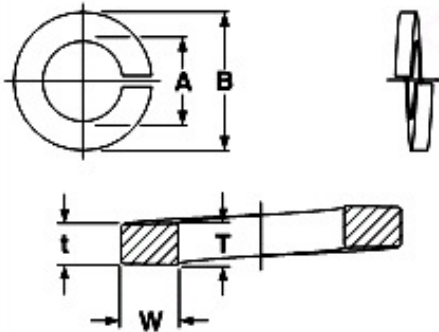
- The maximum diameter of the unthreaded shank shall be less than the maximum major diameter of the thread by an amount sufficient to prevent disassembly of the washer from the screw.
- The unthreaded length on full threaded screws is measured to the contacting face of the washer instead of to the bearing face of the screw.
- The minimum underhead fillet radius is equivalent to 5% of the basic screw diameter.



### Tooth-Lock Washer Specs for Pan Head SEMS

ASME B18.13-1996

Nominal Size / Basic Screw Dia		Internal Tooth				External Tooth			
		Washer Thickness		Washer OD		Washer Thickness		Washer OD	
		Max	Min	Max	Min	Max	Min	Max	Min
2	.0860	.016	.010	.185	.175	.016	.010	.180	.170
4	.1120	.018	.012	.268	.258	.018	.012	.230	.220
6	.1380	.022	.016	.288	.278	.022	.016	.285	.270
8	.1640	.023	.018	.338	.327	.023	.018	.320	.305
10	.1900	.024	.018	.383	.372	.024	.018	.381	.365
12	.2160	.027	.020	.408	.396	.027	.020	.410	.395
1/4	.2500	.028	.023	.478	.466	.028	.023	.510	.494



### Washer Specs for Split-Lock & Square-Cone® Pan Head SEMS

ASME B18.13-1996\*

Nominal Size / Basic Screw Dia		Split-Lock				Square Cone®*				
		Washer ID A		Washer Section Min		Washer OD B		Washer Thickness	Washer OD	
		Max	Min	Width W	Thickness (T+t) / 2	Max	Min	Ref	Max	Min
2	.0860	.080	.075	.035	.020	.156	.145	.015	.210	.200
4	.1120	.106	.101	.055	.034	.222	.211	.015	.250	.244
6	.1380	.129	.124	.062	.034	.261	.248	.025	.320	.307
8	.1640	.155	.149	.078	.040	.319	.305	.030	.383	.370
10	.1900	.179	.173	.093	.047	.373	.359	.032	.446	.433
1/4	.2500	.238	.230	.125	.062	.496	.480	.039	.508	.495

\*Dimensions of Square-Cone® washers are to Shakeproof specifications. Square-Cone® is a registered trademark of Shakeproof division of Illinois Tool Works.



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<b>Tooth Lock Washer Specs for Hex Head SEMS</b>										ASME B18.13-1996
Nominal Size or Basic Screw Diameter		Internal Tooth				External Tooth				
		Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter		
		Max	Min	Max	Min	Max	Min	Max	Min	
4	.1120	.018	.012	.268	.258	.018	.012	.230	.220	
6	.1380	.022	.016	.288	.278	.022	.016	.285	.278	
8	.1640	.023	.018	.338	.327	.023	.018	.320	.305	
10	.1900	.024	.018	.383	.372	.024	.018	.381	.365	
12	.2160	.027	.020	.408	.396	.027	.020	.410	.395	
1/4	.2500	.028	.023	.478	.466	.028	.023	.475	.460	
5/16	.3125	.034	.028	.610	.597	.034	.028	.580	.567	
3/8	.3750	.040	.032	.692	.678	.040	.032	.660	.640	

<b>Tooth Lock Washer Specs for Hex Washer Head SEMS</b>										ASME B18.13-1996
Nominal Size or Basic Screw Diameter		Internal Tooth				External Tooth				
		Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter		
		Max	Min	Max	Min	Max	Min	Max	Min	
4	.1120	-	-	-	-	.018	.012	.230	.220	
6	.1380	.022	.016	.288	.278	.022	.016	.317	.306	
8	.1640	.023	.018	.338	.327	.023	.018	.317	.306	
10	.1900	.024	.018	.383	.372	.024	.018	.406	.395	
12	.2160	.027	.020	.408	.396	.027	.020	.406	.395	
1/4	.2500	.028	.023	.478	.466	.028	.023	.580	.567	
5/16	.3125	.034	.028	.610	.597	.034	.028	.654	.640	
3/8	.3750	.040	.032	.692	.678	.040	.032	.760	.740	