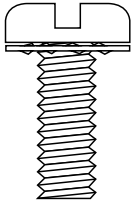
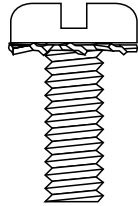


# Machine Screws *Mechanical & Performance Requirements* SEMS

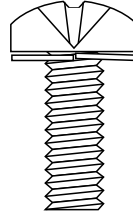
## MACHINE SCREWS WITH FREE-SPINNING LOCKWASHERS



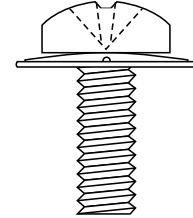
Internal Tooth



External Tooth



Split-Lock



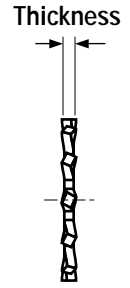
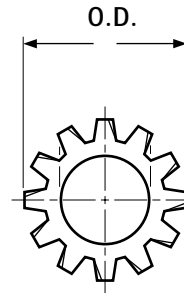
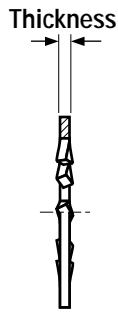
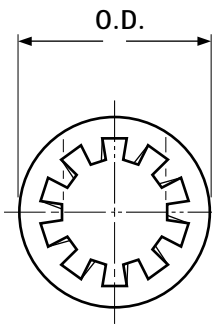
Square-Cone®

<b>Description</b>	A machine screw and free-spinning lock-washer manufactured as one assembly. Steel SEMS are available with the following types of washers: internal tooth, external tooth, split-lock and square-cone®. Stainless SEMS are offered with external tooth lock washers.
<b>Applications/ Advantages</b>	The washer/screw assembly makes this a locking screw with the washer providing the locking action. Machine pre-assembly provides cost savings to the end user. <i>Internal Tooth SEMS:</i> Recommended when it is desirable to hide the teeth for appearance or to prevent snagging. <i>External Tooth SEMS:</i> Preferred over the internal tooth style as the teeth provide greater torsional resistance being on the larger radius. <i>Split-Lock SEMS:</i> Preferred over tooth lockwasher SEMS for use with hardened bearing surfaces. <i>Square-Cone® SEMS:</i> Provides a higher retained clamp load & improved compensation for thermal cycling and vibration. Can accept a high tension load and maintain spring action. The washer design makes for better control during installation, and improved tool bit life. Ideal for clamping fragile materials and for spanning large clearance holes.
<b>Material</b>	<b>Steel Screws--</b> AISI 1022 or equivalent steel. <b>Steel Washers--</b> <u>Split-lock:</u> SAE 1055-1065 carbon steel; <u>Tooth-lock:</u> SAE 1050-1065; <u>Square-Cone®:</u> SAE 1050. <b>Stainless Screws--</b> SAE 18-8 stainless steel, passivated. <b>Stainless Washers--</b> <u>Tooth-lock:</u> SAE 410 stainless steel.
<b>Hardness</b>	<b>Steel Screws--</b> Rockwell B70 - B100. <b>Steel Washers--</b> <u>Split-lock:</u> Rockwell C38 - 46; <u>Tooth-lock:</u> Rockwell C40 - 50; <u>Square-Cone®:</u> Rockwell C42 - 46. <b>Stainless Washers--</b> <u>Tooth-lock:</u> Rockwell C40 - 50.
<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. Such SEMS screws of a size to be tested shall meet the tensile load requirements given on page 54. <b>Stainless:</b> No. 4: 99,000 psi. minimum; No. 6 & No. 8: 96,000 psi. minimum. <u>Note:</u> No. 4, No. 6 and No. 8 SEMS screws which are shorter than 1/2" are not subject to tensile testing.
<b>Plating</b>	See Appendix-A for information on the plating of steel SEMS.

### 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 fully 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.

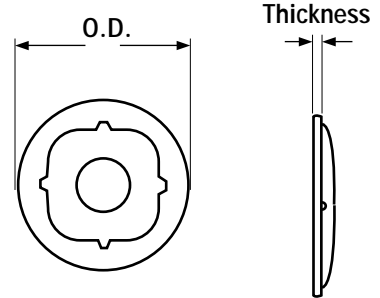
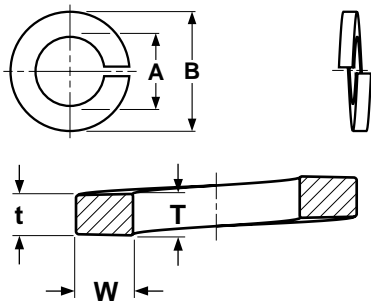
®Square-Cone is a registered trademark of Shakeproof division of Illinois Tool Works.



**TOOTH-LOCK WASHERS FOR PAN HEAD SEMS**

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
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



**WASHERS FOR SPLIT-LOCK & SQUARE-CONE PAN HEAD SEMS**

ASME B18.13,-1996  
Shakeproof\*

Nominal Size or Basic Screw Diameter		Split-Lock				Square Cone *				
		Washer Inside Diameter A		Washer Section Min		Washer Outside Diameter B		Washer Thickness	Washer Outside Diameter	
		Max	Min	Width W	Thickness $\frac{T+t}{2}$	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.



TOOTH LOCK WASHERS FOR HEX HEAD SEMS										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	
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	

TOOTH LOCK WASHERS FOR HEX WASHER HEAD SEMS										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	
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	