

LOCKWASHERS

HELICAL SPLIT & TOOTH TYPE

LOCKING TERMINALS

SHAFT RETAINERS



WCL - One Of The Few True Fastening Specialists

WCL has one of the broadest, most diversified offerings of fastening components available from any single source.

We know what each fastener is designed to do and what its limitations are.

Our engineers will recommend the fastener best suited to your specific needs. They are not limited to justifying a certain product line.

WCL performance and integrity are confirmed by the leading fasteners makers who have chosen us to represent them. We are master distributors for:

Alliance Plastics

ITW Fastex

ITW Shakeproof Assembly Components

ITW Shakeproof Industrial Threaded Products

Inserts International

Rolex National Disk Spring

Tyton Company

VIP - Volt Industrial Products















WCL assures product quality three ways:

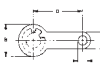

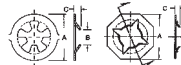

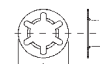





1. We work only with manufacturers having outstanding quality programs and reputations.
2. We have made a major investment in our Quality Inspection program to monitor the conformance of incoming parts to customer specifications and needs. We qualify parts from our manufacturers and processors to assure that all specifications are met.
3. We have developed a state-of-the-art control system to insure required lot traceability and certification on any part we sell.

**WCL - Competitively Priced
Quality Fastening Components
When You Want Them!**

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HELICAL SPRING LOCKWASHERS



FUNCTION OF THE HELICAL SPRING LOCKWASHER

Historically, helical spring lock washers have been among the most widely used anti-loosening assembly components on the market. They have been specified in thousands of assembly applications because they work—and work extremely well. They enhance the security of general industrial assemblies in the following ways:

1. Apply greater bolt tension per unit of applied torque.
2. Provide hardened bearing surfaces to create more uniform torque control.
3. Provide more uniform load distribution through controlled radii (section) cutoff.
4. Provide protection against looseness resulting from vibration and corrosion.
5. Optimum locking device for use in applications with hardened faying or bearing surfaces.

The “Split” in the helical spring lock washer absorbs initial driving torque and visually closes under nominal bolt loading. When tension in the assembly is reduced and loosening occurs, it provides resistance to the back-off rotation of the screw.

Independent tests show that this is just a small part of the helical spring lockwasher’s contribution to assembly integrity.

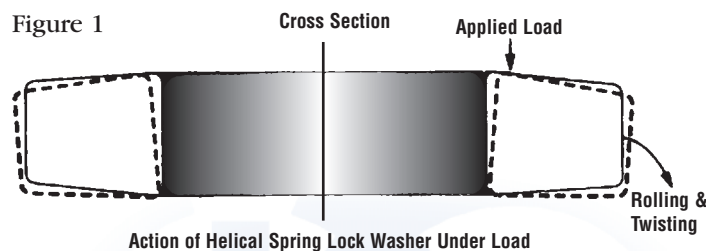
Helical washers are trapezoidal in section. After the single-coil spring closes to the flat condition, further loading results in additional deformation of the washer.

This further deformation is caused by a complex twisting of the trapezoidal section and a slight increase in the diameter of the washer under load. (See Figure 1.)

The spring rate which is developed by the final deformation is very high and provides a reactive load that is equivalent to a significant increase in effective bolt length.

Bolts stretch under load. The longer the effective length of the bolt, the more it can stretch. A hardened steel bolt, when stressed at 60,000 psi, will elongate approximately .002" per inch of effective length. A long bolt can, therefore, be a very effective spring and, like a spring when stretched, it attempts to return to its original length. This applies a clamping or tightening force to the assembly.

The clamped components are compressed and, in their inherent effort to expand to their original form, they set up an opposing force. It is these two forces that create the dynamics of a tight assembly.



SPRING RATE

Two terms are used to define and measure these described forces. One is Spring Rate. The other is equivalent bolt length.

Spring Rate is the ratio of load to deflection in the loaded part; it is deflection related to load and is expressed in terms of the amount of load required to achieve specific levels of deflection. The optimum joint performance is obtained when the spring elements in the fastening system have a spring rate which is low enough to assure that any yielding of the joint members in compression will not significantly reduce the designed tensile stress in the fastener. To obtain this optimal condition, the conventional solution is to utilize the spring characteristics of very long bolts. An auxiliary spring element, such as helical spring lock washer, is a very effective alternative.

Tests run by Lawrence Technological University have shown that the typical helical spring lock washer exhibits a spring rate after flattening which is approximately 70% more effective than a flat washer of the same thickness.

What this means to the design engineer is that the effective bolt length in the joint is increased by the thickness of the flattened helical spring lock washer, plus the equivalent length provided by the spring rate derived from the visually flattened washer. Tested at 75% of the hardened bolt proof load, the equivalent bolt length is as shown in figure 2.

Figure 2

EQUIVALENT BOLT LENGTH		
Equivalent Bolt Length (Inches)		
Washer Size (Inches)	Helical Lock Washers	
	Regular	Heavy
3/8	0.656	0.741
7/16	0.686	0.722
1/2	0.730	0.803

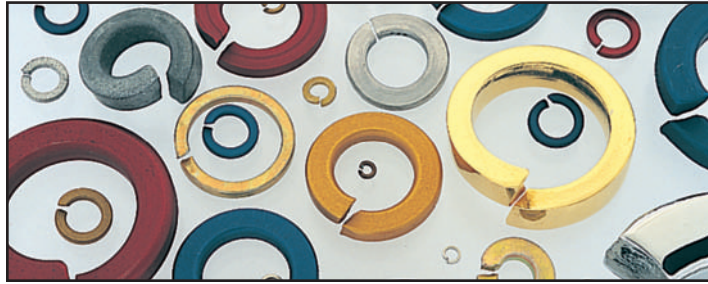
The total contribution of a helical spring lock washer to the integrity of an assembly, in addition to the commonly recognized frictional resistance to back-off rotation, includes the reactive length added to the bolt by the washer thickness and by the tension of Spring Rate generated by its compression.

The significant contribution of the helical spring lock washer to the overall tightness of an assembly is best shown in the test results for an assembly without a washer and an assembly that includes a helical spring washer.

Generated Spring Rates Expressed in Equivalent Bolt Lengths

Thickness of Assembled Components		Equivalent Bolt Length to Attain Comparable Spring Rate of Components Under Load	
JOINT WITHOUT WASHER			
Bolt head height	0.24"	Half of head height (deflected)	0.12"
2 Assembled 1/8" plates	0.25"	Total thickness of assembled plates	0.25"
Nut thickness	0.32"	Half of nut thickness (deflected)	0.16"
Total thickness	0.81"	Equivalent bolt length	0.53"
JOINT WITH 3/8" DIAMETER HELICAL SPRING LOCKWASHER			
Bolt head height	0.24"	Half of head height (deflected)	0.120"
2 Assembled 1/8" plates	0.25"	Total thickness of assembled plates	0.250"
Helical washer thickness	0.10"	Total thickness of washer	0.100"
		Additional spring rate contributed by compressed washer	0.656"
Nut thickness	0.32"	Half of nut thickness (deflected)	0.160"
Total thickness	0.91"	Equivalent bolt length	1.286"

GENERAL INFORMATION



STANDARDS

WCL helical spring lock washers qualify under the major standards requirements established by ASME (the American Society of Mechanical Engineers) and DOD (Department of Defense) for components of this type.

MILITARY SPECIFICATIONS

MS35338-, MS35340-, MS51416-, MS51415-, MS51848-, MS122029 thru MS122036, NAS1640, NAS1676
Also Ordnance series 12387272 - XX, 12387302 - XX

AMERICAN SOCIETY OF MECHANICAL ENGINEERS:

ASME B 18.13, ASME B 18.21.1, ASME B 18.21.2M

MATERIALS

Carbon Steel - SAE 1055 - 1065
Boron Steel - 10B55 - 10B65
Alloy Steel - SAE 4037
Stainless Steel - SAE 304, SAE 316, SAE 420
Aluminum Alloy - ASTM-B 211, 7075
Phosphor Bronze - ASTM-B 159, Copper Alloy NO.510
Silicon Bronze - ASTM-B 99, Copper Alloy NO.651 or 655
Monel K500 - QQ - N - 286

FINISHES

When carbon steel helical spring washers are required for galvanizing, this must be indicated on the order or inquiry. ASME standards call for such washers to be coiled to limits 0.020" in excess of conventional standards. Galvanizing is not recommended for washers under a 1/4" nominal size.

Helical washers are available in the following finishes:

Mechanical Zinc
Electro Zinc
Mechanical Galvanized
Hot Dip Galvanized,
Phosphate Coating
Black Oxide

Other materials and finishes are available on special request. Mechanical Finish will limit exposure to hydrogen embrittlement unless otherwise specified.

HARDNESS TESTING

In preparing a helical spring washer for hardness testing, it should first be twisted to remove the helix and form a near flat surface.

Due to the trapezoidal cross section of the washer, both sides must be filed or ground flat to assure accurate readings. This also removes decarburization and plating from the surface. Care must be taken to assure that surface temperature does not exceed 250°F during this operation. (See figure 3.)

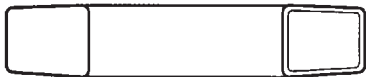
An essential requirement of the Rockwell test is that the penetrator be perpendicular to the surface of the test piece and that the test piece not move, in the slightest degree, as the test load is applied. One point of hardness represents a depth of only 0.00008". A movement of only .001" could cause an error of over 10 Rockwell numbers.

Penetration should be made in the center of the washer's flattened surface and readings should not be taken too close together. If the indentation is made too close to the edge of the test washer, the material will yield, giving incorrect low readings. Also, the area surrounding the indent will be cold worked. Subsequent indentations, if made in the cold worked area, will give incorrect readings-usually higher than the virgin material. Also, test penetrations should be made on only one side of the washer.

HARDNESS



1. WASHER TO BE TESTED



2. TWIST TO FLATTEN



3. GRIND OR FILE

Figure 3

The thickness of the test sample will determine the correct testing weight to use. Refer to Rockwell test charts to determine proper weight and scale use. To insure the most accurate readings, use the maximum weight possible. However, caution should be taken not to use a weight greater than the width and thickness will accommodate.

Applicable hardness requirements are:

Material	HRC	HV
Carbon Steel	38-46	372-458
Austenitic Stainless Steel	35-43	345-423
Monel K500	33-40	327-392
HRB	HV	
Aluminum alloy	75-97	137-222
Phosphor Bronze	90 Min	185 Min
Silicon Bronze	90 Min	185 Min

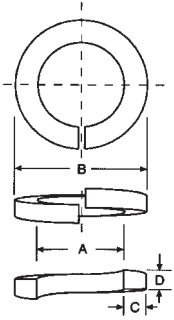
DECARBURIZATION

Carbon steel spring washers, tested in accordance with ASME B 18.21.1, 1994 revision, should meet the following limits for decarburization:

Diameters of Round Wire or Section of Equivalent Area	Maximum Depth of Free Ferrite	Maximum Total Affected Depth (Free Ferrite Plus Partial Decarburization)
Up to 0.140, incl.	0.002	0.006
0.140 to 0.250, incl.	0.003	0.008
0.250 to 0.375, incl.	0.004	0.010
0.375 to 0.500, incl.	0.006	0.015

All measurements in inches.

REGULAR HELICAL SPRING LOCKWASHERS



The tension generated by the deflection of the Regular helical spring lock washer meets the needs of most commercial applications. It is, therefore, the most popular type of helical spring lock washer in terms of usage and production.

T ₁ Material Code Table for 1st dash (-)	
C/S	= Carbon Steel
304 SS	= Type 304 Stainless Steel
316 SS	= Type 316 Stainless Steel
420 SS	= Type 420 Stainless Steel
PHO	= Phosphorus Bronze
KM	= K-Monel

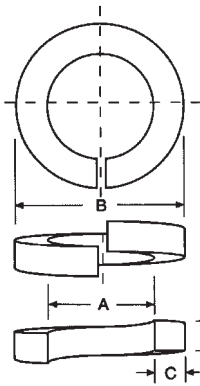
Ordering Example:
MS35338-41/ or #6 REG C/S MZ2 is a #6 Regular carbon Steel with a Mechanical Zinc & Yellow Iridite finish.

T ₂ Finish Code Table for 2nd dash (-)	
PLN	= Plain
CD1	= Cadmium & Clear Iridite
CD2	= Cadmium & Yellow Iridite
CD3	= Cadmium & Black chromate
MZ1	= Mechanical Zinc
MZ2	= Mechanical Zinc & Yellow Iridite
ZN1	= Zinc & Clear Iridite
ZN2	= Zinc & Yellow Iridite
BKO	= Black Oxide
PHO	= Phosphate

Nominal Washer Size	Inside Diameter A		Outside Diameter B Max.	Width C Min.	Thickness D Min.	WCL ⁴ Product Number See Code Table	MS 35338 Dash Numbers ¹				NAS 1640 Dash No. ³		
	Min.	Max.					PHO	CD2	Stainless Type 300 ²	420		Bronze Finish CD8	K Monel
0	.062	.071	.123	.022	.022	#0 REG -T ₁ -T ₂							
1	.075	.084	.162	.035	.020	#1 REG -T ₁ -T ₂							
2	.088	.094	.172	.035	.020	#2 REG -T ₁ -T ₂	58	39	134	153	96	115	2
3	.101	.107	.195	.040	.025	#3 REG -T ₁ -T ₂							
4	.114	.120	.209	.040	.025	#4 REG -T ₁ -T ₂	59	40	135	154	97	116	4
5	.127	.133	.236	.047	.031	#5 REG -T ₁ -T ₂							
6	.141	.148	.250	.047	.031	#6 REG -T ₁ -T ₂	60	41	136	155	98	117	6
8	.167	.174	.293	.055	.040	#8 REG -T ₁ -T ₂	61	42	137	156	99	118	8
10	.193	.200	.334	.062	.047	#10 REG -T ₁ -T ₂	62	43	138	157	100	119	10
12	.220	.227	.377	.070	.056	#12 REG -T ₁ -T ₂							
1/4	.252	.260	.487	.109	.062	1/4 REG -T ₁ -T ₂	63	44	139	158	101	120	416
5/16	.314	.322	.583	.125	.078	5/16 REG -T ₁ -T ₂	64	45	140	159	102	121	516
3/8	.377	.385	.680	.141	.094	3/8 REG -T ₁ -T ₂	65	46	141	160	103	122	616
7/16	.440	.450	.776	.156	.109	7/16 REG -T ₁ -T ₂	66	47	142	161	104	123	716
1/2	.502	.512	.869	.171	.125	1/2 REG -T ₁ -T ₂	67	48	143	162	105	124	816
9/16	.564	.574	.965	.188	.141	9/16 REG -T ₁ -T ₂	68	49	144	163	106	125	916
5/8	.628	.641	1.073	.203	.156	5/8 REG -T ₁ -T ₂	69	50	145	164	107	126	1016
11/16	.691	.704	1.170	.219	.172	11/16 REG -T ₁ -T ₂							
3/4	.753	.766	1.265	.234	.188	3/4 REG -T ₁ -T ₂	70	51				127 ⁵	1216
7/8	.878	.894	1.459	.266	.219	7/8 REG -T ₁ -T ₂	71	52				128 ⁵	1416
1	1.003	1.024	1.656	.297	.250	1" REG -T ₁ -T ₂	72	53	148	167	110	129	1616
1-1/8	1.129	1.153	1.847	.328	.281	1 1/8 REG -T ₁ -T ₂		54	147	168	111	130	1816
1-1/4	1.254	1.280	2.036	.359	.312	1 1/4 REG -T ₁ -T ₂		55	150	169	112	131	2016
1-3/8	1.397	1.408	2.219	.391	.344	1 3/8 REG -T ₁ -T ₂		56	151	170	113	132	2216
1-7/16	1.442	1.472	2.324	.406	.359	1 7/16 REG -T ₁ -T ₂							
1-1/2	1.504	1.534	2.419	.422	.375	1 1/2 REG -T ₁ -T ₂		57	152	171	114	133	2416
1-5/8	1.633	1.663	2.553	.424	.389	1 5/8 REG -T ₁ -T ₂							
1-3/4	1.758	1.789	2.679	.424	.389	1 3/4 REG -T ₁ -T ₂							
1-7/8	1.883	1.914	2.811	.427	.422	1 7/8 REG -T ₁ -T ₂							
2	2.008	2.039	2.936	.427	.422	2" REG -T ₁ -T ₂							
2-1/4	2.262	2.293	3.221	.442	.440	2 1/4 REG -T ₁ -T ₂							
2-1/2	2.512	2.543	3.471	.442	.440	2 1/2 REG -T ₁ -T ₂							
2-3/4	2.762	2.793	3.824	.491	.458	2 3/4 REG -T ₁ -T ₂							
3	3.012	3.043	4.074	.491	.458	3" REG -T ₁ -T ₂							

Footnotes: 1 - MS35338 replaces MS16214, MS35337, AN935 and NAS1061
 2 - Series 300 - see referenced Mil Specifications or type requirements
 3 - NAS1640 - (Stainless Steel) add P for BKO and add C for CD2
 4 - Most sizes are stocked C/S PLN and C/S ZNI.
 5 - Not stocked 20,000 lb. minimum material buy.

HEAVY HELICAL SPRING LOCKWASHERS



With an increased O.D., thickness and bearing area, this washer is ideal for heavier duty applications involving the application of higher tightening torques. The Heavy Section helical spring lock washer contributes significantly to the maintenance of tightness or tension in applications involving screws, bolts and nuts under high loads.

T₁ Material Code Table for 1st dash (-)

- C/S = Carbon Steel
- 304 SS = Type 304 Stainless Steel
- 316 SS = Type 316 Stainless Steel
- 420 SS = Type 420 Stainless Steel
- PHO = Phosphorus Bronze
- KM = K-Monel

Ordering Example:
1/4 HVY 304 SS is a 1/4 Heavy type 304 Stainless Steel

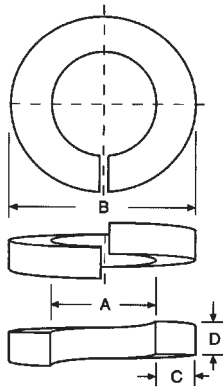
T₂ Finish Code Table for 2nd dash (-)

- PLN = Plain
- CD1 = Cadmium & Clear Iridite
- CD2 = Cadmium & Yellow Iridite
- CD3 = Cadmium & Black chromate
- MZ1 = Mechanical Zinc
- MZ2 = Mechanical Zinc & Yellow Iridite
- ZN1 = Zinc & Clear Iridite
- ZN2 = Zinc & Yellow Iridite
- BKO = Black Oxide
- PHO = Phosphate

Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number	MS 51416'
	Min.	Max.					
2	.088	.094	.182	.040	.025	#2 HVY -T ₁ -T ₂	
3	.101	.107	.209	.047	.031	#3 HVY -T ₁ -T ₂	
4	.114	.120	.223	.047	.031	#4 HVY -T ₁ -T ₂	
5	.127	.133	.252	.055	.040	#5 HVY -T ₁ -T ₂	
6	.141	.148	.266	.055	.040	#6 HVY -T ₁ -T ₂	
8	.167	.174	.307	.062	.047	#8 HVY -T ₁ -T ₂	
10	.193	.200	.350	.070	.056	#10 HVY -T ₁ -T ₂	
12	.220	.227	.391	.077	.063	#12 HVY -T ₁ -T ₂	
1/4	.252	.260	.489	.110	.077	1/4 HVY -T ₁ -T ₂	1
5/16	.314	.322	.583	.130	.097	5/16 HVY -T ₁ -T ₂	2
3/8	.377	.385	.688	.145	.115	3/8 HVY -T ₁ -T ₂	
7/16	.440	.450	.784	.160	.133	7/16 HVY -T ₁ -T ₂	
1/2	.502	.512	.879	.176	.151	1/2 HVY -T ₁ -T ₂	3
9/16	.564	.574	.975	.193	.170	9/16 HVY -T ₁ -T ₂	
5/8	.628	.641	1.087	.210	.189	5/8 HVY -T ₁ -T ₂	
3/4	.753	.766	1.285	.244	.226	3/4 HVY -T ₁ -T ₂	
7/8	.878	.894	1.489	.281	.266	7/8 HVY -T ₁ -T ₂	
1	1.003	1.024	1.700	.319	.306	1" HVY -T ₁ -T ₂	
1-1/8	1.129	1.153	1.903	.356	.345	1 1/8 HVY -T ₁ -T ₂	
1-1/4	1.254	1.280	2.104	.393	.384	1 1/4 HVY -T ₁ -T ₂	
1-3/8	1.397	1.408	2.301	.427	.422	1 3/8 HVY -T ₁ -T ₂	
1-1/2	1.504	1.534	2.491	.458	.458	1 1/2 HVY -T ₁ -T ₂	
1-5/8	1.633	1.663	2.694	.491	.458	1 5/8 HVY -T ₁ -T ₂	
1-3/4	1.758	1.789	2.820	.491	.458	1 3/4 HVY -T ₁ -T ₂	
1-7/8	1.883	1.914	2.945	.491	.458	1 7/8 HVY -T ₁ -T ₂	
2	2.008	2.039	3.144	.526	.496	2" HVY -T ₁ -T ₂	
2-1/4	2.262	2.293	3.398	.526	.496	2 1/4 HVY -T ₁ -T ₂	
2-1/2	2.512	2.543	3.648	.526	.496	2 1/2 HVY -T ₁ -T ₂	
2-3/4	2.762	2.793	3.910	.532	.526	2 3/4 HVY -T ₁ -T ₂	
3	3.012	3.043	4.160	.532	.526	3" HVY -T ₁ -T ₂	

Footnotes: 1 - MS51416 has only 3 dash numbers which are in steel (C/S) Zinc2 (ZN2)

EXTRA DUTY (EXTRA HEAVY) HELICAL SPRING LOCKWASHERS



With a further increase in O.D., thickness and bearing area, the Extra-Duty helical spring lock washer absorbs exceptionally high torques and retains tension under heavy loads. WCL also refers to these as Extra Heavy (EH).

T₁ Material Code Table for 1st dash (-)

C/S = Carbon Steel
 304 SS = Type 304 Stainless Steel
 316 SS = Type 316 Stainless Steel
 420 SS = Type 420 Stainless Steel
 PHO = Phosphorus Bronze
 KM = K-Monel

Ordering Example:

#10 EH C/S ZN1 is a #10 Extra duty Carbon Steel with a Zinc & Clear finish.
 See below for more stock examples.

T₂ Finish Code Table for 2nd dash (-)

PLN = Plain
 CD1 = Cadmium & Clear Irridite
 CD2 = Cadmium & Yellow Irridite
 CD3 = Cadmium & Black chromate
 MZ1 = Mechanical Zinc
 MZ2 = Mechanical Zinc & Yellow Irridite
 ZN1 = Zinc & Clear Irridite
 ZN2 = Zinc & Yellow Irridite
 BKO = Black Oxide
 PHO = Phosphate

Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number See Code Table	MS 35340 Dash Numbers ¹
	Min.	Max.					Steel Finish MZ2 or CD2
2	.088	.094	.208	.053	.027	#2 EH -T ₁ -T ₂	39
3	.101	.107	.239	.062	.034	#3 EH -T ₁ -T ₂	
4	.114	.120	.253	.062	.034	#4 EH -T ₁ -T ₂	40
5	.127	.133	.300	.079	.045	#5 EH -T ₁ -T ₂	
6	.141	.148	.314	.079	.045	#6 EH -T ₁ -T ₂	41
8	.167	.174	.375	.096	.057	#8 EH -T ₁ -T ₂	42
10	.193	.200	.434	.112	.068	#10 EH -T ₁ -T ₂	43
12	.220	.227	.497	.130	.080	#12 EH -T ₁ -T ₂	
1/4	.252	.260	.533	.132	.084	1/4 EH -T ₁ -T ₂	44
5/16	.314	.322	.619	.143	.108	5/16 EH -T ₁ -T ₂	45
3/8	.377	.385	.738	.170	.123	3/8 EH -T ₁ -T ₂	46
7/16	.440	.450	.836	.186	.143	7/16 EH -T ₁ -T ₂	47
1/2	.502	.512	.935	.204	.162	1/2 EH -T ₁ -T ₂	48
9/16	.564	.574	1.035	.223	.182	9/16 EH -T ₁ -T ₂	49
5/8	.628	.641	1.151	.242	.202	5/8 EH -T ₁ -T ₂	50
3/4	.753	.766	1.355	.279	.241	3/4 EH -T ₁ -T ₂	51
7/8	.878	.894	1.571	.322	.285	7/8 EH -T ₁ -T ₂	52
1	1.003	1.024	1.794	.366	.330	1" EH -T ₁ -T ₂	53
1-1/8	1.129	1.153	2.013	.411	.375	1 1/8 EH -T ₁ -T ₂	54
1-1/4	1.254	1.280	2.222	.452	.417	1 1/4 EH -T ₁ -T ₂	55
1-3/8	1.397	1.408	2.429	.491	.458	1 3/8 EH -T ₁ -T ₂	56
1-1/2	1.504	1.534	2.627	.526	.496	1 1/2 EH -T ₁ -T ₂	57
1-5/8	1.633	1.663	2.784	.526	.496	1 5/8 EH -T ₁ -T ₂	
1-3/4	1.758	1.789	2.902	.532	.526	1 3/4 EH -T ₁ -T ₂	
1-7/8	1.883	1.914	3.027	.532	.526	1 7/8 EH -T ₁ -T ₂	
2	2.008	2.039	3.156	.532	.526	2" EH -T ₁ -T ₂	

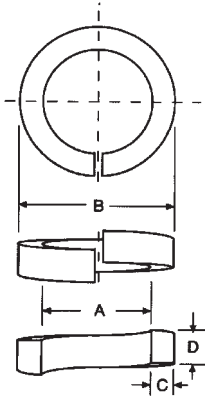
Footnotes: 1 - MS3540 replaces MS35339 Heavy Series.

Ordering Examples:

MS35340-42 is a #8 Extra Duty, Carbon Steel, with a Mechanical Zinc & Yellow Irridite finish

#1/4 EH C/S L/W MZ1 is a 1/4 Extra Duty Carbon Steel Lockwasher with a Mechanical Zinc finish.

HI-COLLAR HELICAL SPRING LOCKWASHERS



The smaller O.D. on the Hi-Collar helical spring lock washer accommodates confined areas. The increased thickness sustains the washer's overall locking effectiveness. The Hi-Collar is recommended for use with socket head cap screws and where there are clearance limitations.

T₁ Material Code Table for 1st dash (-)

C/S	= Carbon Steel
304 SS	= Type 304 Stainless Steel
316 SS	= Type 316 Stainless Steel
420 SS	= Type 420 Stainless Steel
PHO	= Phosphorus Bronze
KM	= K-Monel

Ordering Example:

- 1.) MS551848-50 or 1/4 HC 316 SS is a 1/4 Hi-Collar type 316 Stainless Steel
- 2.) 5/16 HC 304 SS is a 5/16 Hi Collar Type 304 Stainless Steel

T₂ Finish Code Table for 2nd dash (-)

PLN	= Plain
CD1	= Cadmium & Clear Irridite
CD2	= Cadmium & Yellow Irridite
CD3	= Cadmium & Black chromate
MZ1	= Mechanical Zinc
MZ2	= Mechanical Zinc & Yellow Irridite
ZN1	= Zinc & Clear Irridite
ZN2	= Zinc & Yellow Irridite
BKO	= Black Oxide
PHO	= Phosphate

Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number See Code Table	MS 51848 Dash Numbers ¹		NAS 1676 Dash Numbers		
	Min.	Max.					Steel Finish ZN2 or PHO	CD2	Stainless Type		Steel Finish CD2 ³
									300	300 ²	
0	.062	.068	.112	.018	.018	#0 HC -T ₁ -T ₂	21	1	41	C0	
1	.075	.081	.123	.022	.022	#1 HC -T ₁ -T ₂				C1	
2	.088	.094	.142	.020	.020	#2 HC -T ₁ -T ₂	23	3	43	C2	2
4	.114	.120	.173	.022	.022	#4 HC -T ₁ -T ₂	25	5	45	C4	4
5	.127	.133	.202	.030	.030	#5 HC -T ₁ -T ₂					
6	.141	.148	.216	.030	.030	#6 HC -T ₁ -T ₂	27	7	47	C6	6
8	.167	.174	.267	.042	.047	#8 HC -T ₁ -T ₂	28	8	48	C8	8
10	.193	.200	.294	.042	.047	#10 HC -T ₁ -T ₂	29	9	49	C10	10
12	.220	.227	.331	.047	.078	#12 HC -T ₁ -T ₂					
1/4	.252	.260	.363	.047	.078	1/4 HC -T ₁ -T ₂	30	10	50	C416	416
5/16	.314	.322	.457	.062	.093	5/16 HC -T ₁ -T ₂	31	11	51	C516	516
3/8	.377	.385	.550	.076	.125	3/8 HC -T ₁ -T ₂	32	12	52	C616	616
7/16	.440	.450	.644	.090	.140	7/16 HC -T ₁ -T ₂	33	13	53	C716	716
1/2	.502	.512	.733	.103	.172	1/2 HC -T ₁ -T ₂	34	14	54	C816	816
9/16	.564	.574	.819	.116	.187	9/16 HC -T ₁ -T ₂					
5/8	.628	.641	.917	.125	.203	5/8 HC -T ₁ -T ₂		15	55	C1016	1016
3/4	.753	.766	1.105	.154	.218	3/4 HC -T ₁ -T ₂		16		C1216	1216
7/8	.878	.894	1.291	.182	.234	7/8 HC -T ₁ -T ₂		17		C1416	1416
1	1.003	1.024	1.478	.208	.250	1" HC -T ₁ -T ₂		18		C1616	1616
1-1/8	1.129	1.153	1.663	.236	.313	1 1/8 HC -T ₁ -T ₂					
1-1/4	1.254	1.280	1.790	.236	.313	1 1/4 HC -T ₁ -T ₂					
1-3/8	1.397	1.408	2.031	.292	.375	1 3/8 HC -T ₁ -T ₂					
1-1/2	1.504	1.534	2.159	.292	.375	1 1/2 HC -T ₁ -T ₂					
1-3/4	1.758	1.789	2.596	.383	.469	1 3/4 HC -T ₁ -T ₂					
2	2.008	2.039	2.846	.383	.469	2" HC -T ₁ -T ₂					
2-1/4	2.262	2.293	3.345	.508	.508	2 1/4 HC -T ₁ -T ₂					
2-1/2	2.512	2.543	3.595	.508	.508	2 1/2 HC -T ₁ -T ₂					

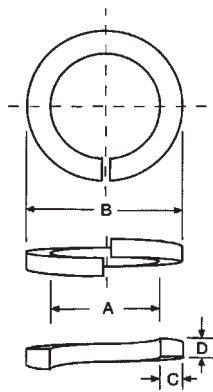
Footnotes: 1 MS51848-I indicates #0HC C/S CD1 or ZNI

MS51848 series was designated to supercede the NAS1676 specifications, however the NAS committee has not agreed yet.

2 NAS1676 add a P after dash # to indicate BKO finish on Stainless Steel.

3 NAS1676 steel dash numbers add a P to indicate Cad with a black Chromate finish (CD3).

LIGHT HELICAL SPRING LOCKWASHERS



With a significant reduction in washer thickness and a slight reduction in O.D., the Light Helical Spring washer is sometimes used in applications involving the reduced torques and lighter loads often associated with thin or fragile materials, or where head height clearance is limited.

T₁ Material Code Table for 1st dash (-)

- C/S = Carbon Steel
- 304 SS = Type 304 Stainless Steel
- 316 SS = Type 316 Stainless Steel
- 420 SS = Type 420 Stainless Steel
- PHO = Phosphorus Bronze
- KM = K-Monel

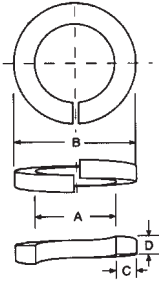
Ordering Example:
 1/2 Lt C/S Pln is a
 1/2 Light carbon Steel Plain

T₂ Finish Code Table for 2nd dash (-)

- PLN = Plain
- CD1 = Cadmium & Clear Iridite
- CD2 = Cadmium & Yellow Iridite
- CD3 = Cadmium & Black chromate
- MZ1= Mechanical Zinc
- MZ2= Mechanical Zinc & Yellow Iridite
- ZN1 = Zinc & Clear Iridite
- ZN2 = Zinc & Yellow Iridite
- BKO = Black Oxide
- PHO = Phosphate

Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
2	.088	.094	.162	.030	.015	#2 LT -T ₁ -T ₂
3	.101	.107	.185	.035	.020	#3 LT -T ₁ -T ₂
4	.114	.120	.199	.035	.020	#4 LT -T ₁ -T ₂
5	.127	.133	.222	.040	.025	#5 LT -T ₁ -T ₂
6	.141	.148	.236	.040	.025	#6 LT -T ₁ -T ₂
8	.167	.174	.277	.047	.031	#8 LT -T ₁ -T ₂
10	.193	.200	.320	.056	.040	#10 LT -T ₁ -T ₂
12	.220	.227	.361	.062	.047	#12 LT -T ₁ -T ₂
1/4	.252	.260	.483	.107	.047	1/4 LT -T ₁ -T ₂
5/16	.314	.322	.567	.117	.056	5/16 LT -T ₁ -T ₂
3/8	.377	.385	.670	.136	.070	3/8 LT -T ₁ -T ₂
7/16	.440	.450	.772	.154	.085	7/16 LT -T ₁ -T ₂
1/2	.502	.512	.867	.170	.099	1/2 LT -T ₁ -T ₂
9/16	.564	.574	.961	.186	.113	9/16 LT -T ₁ -T ₂
5/8	.628	.641	1.069	.201	.126	5/8 LT -T ₁ -T ₂
11/16	.691	.704	1.164	.216	.138	11/16 LT -T ₁ -T ₂
3/4	.753	.766	1.262	.233	.153	3/4 LT -T ₁ -T ₂
7/8	.878	.894	1.455	.264	.179	7/8 LT -T ₁ -T ₂
1	1.003	1.024	1.640	.289	.202	1" LT -T ₁ -T ₂
1-1/8	1.129	1.153	1.819	.314	.224	1 1/8 LT -T ₁ -T ₂
1-1/4	1.254	1.280	1.990	.336	.244	1 1/4 LT -T ₁ -T ₂
1-3/8	1.379	1.408	2.158	.456	.264	1 3/8 LT -T ₁ -T ₂
1-1/2	1.504	1.534	2.325	.375	.282	1 1/2 LT -T ₁ -T ₂
1-5/8	1.633	1.663	2.487	.391	.344	1 5/8 LT -T ₁ -T ₂
1-3/4	1.758	1.789	2.613	.391	.344	1 3/4 LT -T ₁ -T ₂
2	2.008	2.039	2.868	.393	.384	2" LT -T ₁ -T ₂
2-1/4	2.262	2.293	3.191	.427	.422	2 1/4 LT -T ₁ -T ₂
2-1/2	2.512	2.543	3.441	.427	.422	2 1/2 LT -T ₁ -T ₂
2-3/4	2.762	2.793	3.758	.458	.458	2 3/4 LT -T ₁ -T ₂
3	3.012	3.043	4.008	.458	.458	3" LT -T ₁ -T ₂

HIGH ALLOY HELICAL SPRING LOCKWASHERS



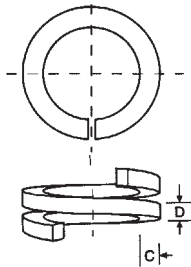
The High Alloy helical spring lock washers are manufactured from 4037 alloy steel. These washers are intended for use with Grade 5 and Grade 8 bolt and nut assembly applications.

T ₁ Table	
PLN	= Plain
MZ2	= Mechanical Zinc & Yellow Iridite

Ordering Example: 1/4 HA MZ2 is a 1/4 High Alloy Steel with a Mechanical Zinc & Yellow Iridite finish.

Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
1/4	.252	.260	.487	.109	.062	1/4 Reg Hi Alloy -T ₁
5/16	.314	.322	.583	.125	.078	5/16 Reg Hi Alloy -T ₁
3/8	.377	.385	.680	.141	.094	3/8 Reg Hi Alloy -T ₁
7/16	.440	.450	.776	.156	.109	7/16 Reg Hi Alloy -T ₁
1/2	.502	.512	.869	.171	.125	1/2 Reg Hi Alloy -T ₁
9/16	.564	.574	.965	.188	.141	9/16 Reg Hi Alloy -T ₁
5/8	.628	.641	1.073	.203	.156	5/8 Reg Hi Alloy -T ₁
3/4	.753	.766	1.265	.234	.188	3/4 Reg Hi Alloy -T ₁
7/8	.878	.894	.483	.107	.047	7/8 Reg Hi Alloy -T ₁
1	1.003	1.024	1.656	.297	.250	1 Reg Hi Alloy -T ₁

DOUBLE COIL HELICAL SPRING LOCKWASHERS



The Double Coil helical spring lock washer is used in soft joints, such as wooden pole line assemblies, that are subject to considerable expansion and contraction. The Double Coil

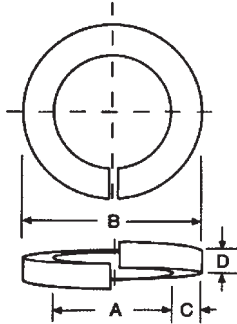
provides the travel necessary to maintain effective clamping force in such assemblies. Double Coil helical lock washers are manufactured with an oversized I.D. used with galvanized bolts.

T ₁ Table	
HDG	= Hot Dip Galvanized
MG	= Mechanical Galvanized

Nominal Washer Size	Width Min. C	Thickness Min. D	WCL Part Number
3/8	.141	.094	3/8 REG DBL COIL -T ₁
3/8	.170	.123	3/8 EH DBL COIL -T ₁
1/2	.171	.125	1/2 REG DBL COIL -T ₁
1/2	.203	.156	#1/2 203 DBL COIL -T ₁
1/2	.204	.162	#1/2 EH DBL COIL -T ₁
1/2	.233	.153	#1/2 233 DBL COIL -T ₁
5/8	.203	.156	5/8 REG DBL COIL -T ₁
5/8	.234	.188	#5/8 234 DBL COIL -T ₁
5/8	.242	.202	#5/8 EH DBL COIL -T ₁
3/4	.234	.188	3/4 REG DBL COIL -T ₁
3/4	.266	.219	#3/4 266 DBL COIL -T ₁
3/4	.279	.241	#3/4 EH DBL COIL -T ₁

METRIC HELICAL SPRING LOCKWASHERS

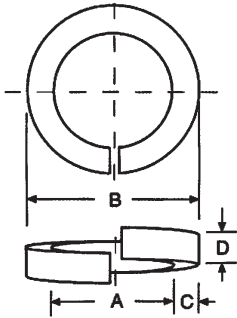
DIN 127B



Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
M3	3.1	3.4	6.2	1.2	.7	M3 DIN 127B -T ₁
M4	4.1	4.4	7.6	1.4	.8	M4 DIN 127B -T ₁
M5	5.1	5.4	9.2	1.7	1.1	M5 DIN 127B -T ₁
M6	6.1	6.5	11.8	2.35	1.5	M6 DIN 127B -T ₁
M7	7.1	7.5	12.8	2.35	1.5	M7 DIN 127B -T ₁
M8	8.1	8.5	14.8	2.85	1.9	M8 DIN 127B -T ₁
M10	10.2	10.7	18.1	3.3	2.05	M10 DIN 127B -T ₁
M12	12.2	12.7	21.1	3.8	2.35	M12 DIN 127B -T ₁
M14	14.2	14.7	24.1	4.3	2.85	M14 DIN 127B -T ₁
M16	16.2	17.0	27.4	4.8	3.3	M16 DIN 127B -T ₁
M18	18.2	19.0	29.4	4.8	3.3	M18 DIN 127B -T ₁
M20	20.2	21.2	33.6	5.8	3.8	M20 DIN 127B -T ₁
M22	22.5	23.5	35.9	5.8	3.8	M22 DIN 127B -T ₁
M24	24.5	25.5	40.0	6.75	4.8	M24 DIN 127B -T ₁
M30	30.5	31.7	48.2	7.75	5.8	M30 DIN 127B -T ₁

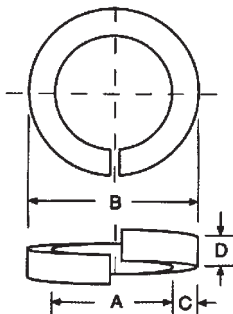
Specify Material-WCL stocks a variety in carbon steel and stainless.

SQUARE SECTION DIN 7980



Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
M6	6.1	6.5	9.7	1.4	1.4	M6 DIN 7980 -T ₁
M8	8.2	8.6	12.8	1.9	1.9	M8 DIN 7980 -T ₁
M10	10.2	10.8	16.1	2.35	2.35	M10 DIN 7980 -T ₁
M12	12.2	13.0	18.3	2.35	2.35	M12 DIN 7980 -T ₁
M14	14.2	15.0	21.4	2.8	2.8	M14 DIN 7980 -T ₁
M16	16.2	17.2	24.6	3.3	3.3	M16 DIN 7980 -T ₁
M18	18.2	19.2	26.6	3.3	3.3	M18 DIN 7980 -T ₁
M20	20.2	21.2	30.6	4.3	4.3	M20 DIN 7980 -T ₁
M22	22.5	23.5	32.9	4.3	4.3	M22 DIN 7980 -T ₁
M24	24.5	25.5	35.9	4.8	4.8	M24 DIN 7980 -T ₁
M30	30.5	31.8	44.2	5.8	5.8	M30 DIN 7980 -T ₁

REGULAR SECTION ASME B18.21.2M-1994

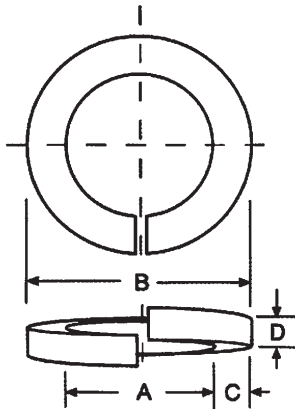


Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
M2.5	2.55	2.70	4.94	1.02	0.64	M2.5 R -T ₁
M3	3.06	3.21	5.83	1.19	0.79	M3 R -T ₁
M3.5	3.58	3.76	6.35	1.19	0.79	M3.5 R -T ₁
M4	4.08	4.26	7.28	1.40	1.02	M4 R -T ₁
M5	5.08	5.26	8.66	1.57	1.19	M5 R -T ₁
M6	6.10	6.29	12.08	2.77	1.57	M6 R -T ₁
M8	8.13	8.36	14.96	3.18	1.98	M8 R -T ₁
M10	10.13	10.38	17.83	3.58	2.39	M10 R -T ₁
M12	12.15	12.45	21.47	4.34	3.18	M12 R -T ₁
M14	14.20	14.50	24.39	4.78	3.58	M14 R -T ₁
M16	16.25	16.63	27.53	5.16	3.96	M16 R -T ₁
M20	20.28	20.66	33.26	5.94	4.78	M20 R -T ₁
M24	24.30	24.81	39.79	7.14	5.94	M24 R -T ₁
M30	30.51	31.25	49.36	8.74	7.54	M30 R -T ₁
M36	36.61	37.50	58.76	10.31	9.12	M36 R -T ₁

METRIC HELICAL SPRING LOCKWASHERS

HEAVY SECTION ASME

B18.21.2M-1994



Nominal Washer Size	Inside Diameter A		Outside Diameter B	Width C	Thickness D	WCL Product Number
	Min.	Max.				
M2.5	2.55	2.70	5.29	1.19	0.79	M2.5 HVY
M3	3.06	3.21	6.24	1.40	1.02	M3 HVY
M3.5	3.58	3.76	6.76	1.40	1.02	M3.5 HVY
M4	4.08	4.26	7.64	1.57	1.19	M4 HVY
M5	5.08	5.26	9.07	1.78	1.42	M5 HVY
M6	6.10	6.29	12.12	2.79	1.96	M6 HVY
M8	8.13	8.36	15.22	3.30	2.46	M8 HVY
M10	10.13	10.38	18.03	3.68	2.92	M10 HVY
M12	12.15	12.45	21.73	4.47	3.84	M12 HVY
M14	14.20	14.50	24.64	4.90	4.32	M14 HVY
M16	16.25	16.63	27.88	5.33	4.80	M16 HVY
M20	20.28	20.66	33.77	6.20	5.74	M20 HVY
M24	24.30	24.81	40.66	7.57	7.21	M24 HVY
M30	30.51	31.24	50.81	9.47	9.25	M30 HVY
M36	36.61	37.50	60.60	11.23	11.18	M36 HVY



Note: All data in this catalog is presented as a general guide. Specifications are subject to modification without notice. Extended inactivity may result in discontinuance of individual parts without notice.

NATIONAL TRACK WASHERS

Track Washers were developed specifically to secure railroad track assemblies and withstand the intense shock and vibration produced by passing trains. Various styles meet and exceed the specifications of the American Railroad Engineering Association (AREA) and their holding power has been tested and proven “on the job” for over 70 years.

The popular Square Section washer requires up to 4800 pounds of pressure to close. Double Coil Track Washers provide twice the reactive spring range as conventional single coil washers.

Track Washers are also used to secure assemblies in structural applications and in car building and rebuilding.



NATIONAL'S AREA 1967

Exceeds the Latest 1967 American Railroad Engineering Association's requirements.

Nominal Bolt Dia. in Inches	Applied Load in Pounds	Release Distance in Inches	Approx. Reactive Pressure in lbs.	Section in Inches	Approx. Number Per Keg	Approx. Net Wt. Per 1000
3/4	20,000	.025	2,500	13/32 x 7/16	1,500	185
13/16	20,000	.025	2,500	13/32 x 7/16	1,500	190
7/8	20,000	.025	2,500	13/32 x 7/16	1,200	195
15/16	20,000	.025	2,500	13/32 x 7/16	1,000	200
1	20,000	.030	5,000	1/2 x 17/32	800	340
1-1/16	20,000	.030	5,000	1/2 x 17/32	700	355
1-1/8	20,000	.030	5,000	17/32 x 17/32	600	400
1-1/4	20,000	.030	5,000	17/32 x 17/32	500	425
1-3/8	20,000	.041	3,200	17/32 x 17/32	500	455
1-1/2	20,000	.041	3,200	17/32 x 17/32	400	485



NATIONAL'S AREA 1933

1933 American Railroad Engineering Association recommended track washer. Still in general use.

Nominal Bolt Dia. in Inches	Applied Load in Pounds	Release Distance in Inches	Approx. Reactive Pressure in lbs.	Section in Inches	Approx. Number Per Keg	Approx. Net Wt. Per 1000
3/4	20,000	.025	2,500	13/32 x 7/16	1,500	185
13/16	20,000	.025	2,500	13/32 x 7/16	1,500	190
7/8	20,000	.025	2,500	13/32 x 7/16	1,200	195
15/16	20,000	.025	2,500	13/32 x 7/16	1,000	200
1	20,000	.031	2,800	7/16 x 7/16	1,000	245
1-1/16	20,000	.031	2,800	7/16 x 7/16	1,000	255
1-1/8	20,000	.036	3,000	15/32 x 15/32	800	285
1-1/4	20,000	.036	3,000	17/32 x 17/32	500	425
1-3/8	20,000	.041	3,200	17/32 x 17/32	500	455
1-1/2	20,000	.041	3,200	17/32 x 17/32	500	485

NATIONAL TRACK WASHERS



PENNSYLVANIA RAILROAD OR MW-6

In general use for many applications.

Nominal Bolt Dia. in Inches	Applied Load in Pounds	Release Distance in Inches	Approx. Reactive Pressure in lbs.	Section in Inches	Approx. Number Per Keg.	Approx. Net Wt. Per 1000
5/8	60,000	.07	100	3/6 x 1/4	.07	85
3/4	60,000	.07	100	27/64 x 1/4	.07	120
7/8	60,000	.08	200	27/64 x 1/4	.08	130
1	60,000	.10	250	27/64 x 1/4	.10	135
1-1/16	60,000	.10	250	27/64 x 1/4	.10	140
1-1/8	60,000	.10	250	27/64 x 1/4	.10	155
1-1/4	60,000	.10	300	1/2 x 3/8	.10	275
1-3/8	60,000	.10	300	1/2 x 3/8	.10	300
1-1/2	60,000	.10	300	1/2 x 3/8	.10	325



PLAIN PATTERN SQUARE SECTION

Offered for lighter work loads or when economy is required. Useful for light or inside track, structural fittings, car building or rebuilding.

Nominal Bolt Dia. in Inches	Section in Inches	Approx. Pounds to Close	Section in Inches	Approx. Number Per Keg	Approx. Net Wt. Per 1000
3/4	1/4 Square	1,300	1/4 x 1/4	3,500	55
3/4	3/8 Square	4,800	3/8 x 3/8	2,000	135
13/16	3/8 Square	4,500	3/8 x 3/8	1,500	145
7/8	1/4 Square	1,200	1/4 x 1/4	3,000	60
7/8	3/8 Square	4,300	3/8 x 3/8	1,500	150
15/16	3/8 Square	4,000	3/8 x 3/8	1,500	160
1	1/4 Square	1,100	1/4 x 1/4	2,500	70
1	3/8 Square	3,500	3/8 x 3/8	1,000	165
1-1/16	3/8 Square	3,200	3/8 x 3/8	1,000	175
1-1/8	3/8 Square	3,000	3/8 x 3/8	1,000	180
1-1/4	3/8 Square	2,000	3/8 x 3/8	900	195

NATIONAL TRACK WASHERS



IMPROVED HI POWER

For applications where live spring action is required both against the clamping load and the work load.

Nominal Bolt Dia. in Inches	Section in Inches	Approx. Number Per Keg	Approx. Net Wt. Per 1000
3/4	7/16 x 5/16	2,000	120
7/8	7/16 x 5/16	1,500	150
1	7/16 x 5/16	1,200	170
1-1/16	7/16 x 5/16	1,000	175
1-1/8	1/2 x 11/32	1,000	235



DOUBLE COIL IMPROVED HI POWER

Live spring action is provided between both the clamping load and the work load with a greater reactive range than a single coil.

Nominal Bolt Dia. in Inches	Section in Inches	Approx. Number Per Keg	Approx. Net Wt. Per 1000
3/4	7/16 x 1/4	900	215
7/8	7/16 x 1/4	900	235
15/16	7/16 x 5/16	600	285
1	7/16 x 5/16	600	300
1-1/8	1/2 x 3/8	400	440
1-1/4	1/2 x 3/8	400	485

Nominal Bolt Dia. in Metric	Section in Metric	Approx. Number Per Keg	Approx. Net Wt. Per 1000
20 MM	9 x 5	1,300	58 KG 130 lbs.
22 MM	10 x 6	1,000	86 KG 190 lbs.
24 MM	10 x 6	600	90 KG 200 lbs.
26 MM	12 x 6	500	126 KG 280 lbs.

NOTE: For each of the six styles shown, we have heavier-duty versions available, including Super AREA, Diamond Crossing Washers and Super Hi Power - all also available in metric.

WCL and ITW are not responsible for application or misapplication of these products, nor corrosion fatiguing caused by environmental conditions.

TENSION GENERATING, ANTI-LOOSENING TWISTED TOOTH LOCKWASHERS

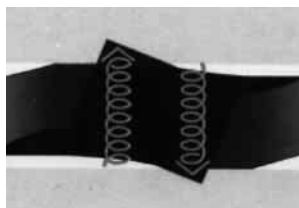


WCL is a leading supplier of the world's largest and most diverse line of tapered, twisted tooth locking washers. Shakeproof lockwashers are the best anti-vibration, anti-loosening mechanical fastening devices available. These resilient washers stand up to high torques and heavy loads. Various styles of economical, standard tooth washers fit all conventional screw types and accommodate a wide range of hole configurations, including countersunk and oversized holes.

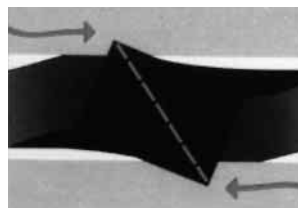
The twisted teeth on the Shakeproof lockwasher compress as torque is applied to the fastening. A strong spring reaction is set up as the specially heat treated teeth seek to return to their fully twisted position. These unique washers make a significant contribution to the integrity of an assembly:

1. Maintain essential tension.
2. React instantly to any loosening influence, setting up a strut action that strongly opposes the loosening rotation of the fastener.
3. Flexed teeth absorb shock and vibration.
4. Resilient teeth absorb high torques and prevent slipping.

Powerful Spring Reaction



Powerful Strut Reaction



MILITARY SPECIFICATIONS

MS16213-, MS35333-, MS35334-, MS35335-, Some MS35336-, MS45904-, MS541413-, MS51414-

MATERIALS

Carbon Steel - SAE 1050 - 1065

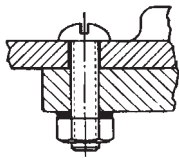
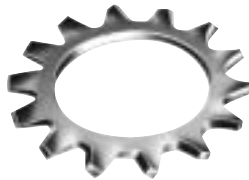
Stainless Steel - SAE 301 - 305, SAE - 316, SAE - 410

Bronze (Copper Alloy) - ASMB 591, Type 425

FINISHES

All types of finishes are in stock or available. Ask your WCL sales person for details.

EXTERNAL TYPE LOCKWASHERS



- Provide maximum torsional resistance.
- Work best with larger head screws (round, pan, binding, etc.)

MATERIALS: Part numbers shown are for washers made of spring steel. These washers are also available in bronze and bronze alloy and in 400 series stainless steel. Many of these are in stock at WCL. Washers can also be produced from 300 series stainless steel and other materials on request. *Specify material when inquiring or ordering.*

SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference	MS35335 -		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
2	0.089	0.095	0.275	0.285	0.017	EXT-0086-01-00	1102-01			
3	0.102	0.109	0.220	0.235	0.013	EXT-0099-00-00	1103-00			
4	0.115	0.123	0.245	0.260	0.015	EXT-0112-00-00	1104-00	-29	-57	-85
4	0.116	0.123	0.275	0.285	0.015	EXT-0112-01-00	1104-01			
4	0.116	0.123	0.215	0.225	0.015	EXT-0112-02-00	1104-02			
5	0.129	0.136	0.270	0.285	0.015	EXT-0125-00-00	1105-00			
6	0.141	0.150	0.305	0.320	0.020	EXT-0138-00-00	1106-00	-30	-58	-86
6	0.142	0.150	0.370	0.381	0.022	EXT-0138-01-00	1106-01			
6	0.150	0.142	0.306	0.317	0.017	EXT-0138-05-00	1106-05			
8	0.168	0.176	0.365	0.381	0.020	EXT-0164-00-00	1108-00	-31	-59	-87
8	0.168	0.176	0.370	0.381	0.025	EXT-0164-01-00	1108-01			
8	0.168	0.176	0.680	0.695	0.039	EXT-0164-02-00	1108-02			
8	0.168	0.176	0.494	0.506	0.020	EXT-0164-05-00	1108-05			
8	0.168	0.176	0.494	0.506	0.022	EXT-0164-08-00	1108-08			
8	0.165	0.170	0.306	0.317	0.020	EXT-0164-11-00	1108-11			
10	0.195	0.204	0.395	0.410	0.022	EXT-0190-00-00	1110-00	-32	-60	-88
10	0.195	0.199	0.335	0.345	0.017	EXT-0190-03-00	1110-03			
10	0.195	0.204	0.395	0.406	0.029	EXT-0190-04-00	1110-04			
10	0.195	0.204	0.494	0.506	0.025	EXT-0190-07-00	1110-07			
12	0.221	0.231	0.460	0.475	0.025	EXT-0216-00-00	1112-00			
12	0.218	0.224	0.395	0.406	0.022	EXT-0216-05-00	1112-05			
1/4	0.256	0.267	0.494	0.510	0.025	EXT-0250-00-00	1114-00	-33	-61	-89
1/4	0.257	0.263	0.428	0.440	0.017	EXT-0250-02-00	1114-02			
1/4	0.256	0.267	0.882	0.898	0.045	EXT-0250-04-00	1114-04			
1/4	0.256	0.267	0.365	0.375	0.020	EXT-0250-05-00	1114-05			
1/4	0.256	0.267	0.680	0.695	0.039	EXT-0250-09-00	1114-09			
1/4	0.246	0.25	0.365	0.375	0.017	EXT-0250-11-00	1114-11			
1/4	0.256	0.267	0.882	0.898	0.039	EXT-0250-16-00	1114-16			
1/4	0.256	0.267	0.365	0.375	0.029	EXT-0250-18-00	1114-18			
5/16	0.320	0.332	0.588	0.610	0.029	EXT-0312-00-00	1118-00	-34	-62	-90
5/16	0.320	0.332	0.680	0.695	0.035	EXT-0312-02-00	1118-02			
5/16	0.353	0.357	0.640	0.654	0.035	EXT-0312-11-00	1118-11			
3/8	0.384	0.398	0.670	0.694	0.035	EXT-0375-00-00	1120-00	-35	-63	-91
1/8 Pipe	0.406	0.420	0.680	0.695	0.035	EXT-0375-01-00	1120-01			
3/8	0.384	0.398	0.883	0.898	0.039	EXT-0375-06-00	1120-06			

EXTERNAL TYPE LOCKWASHERS

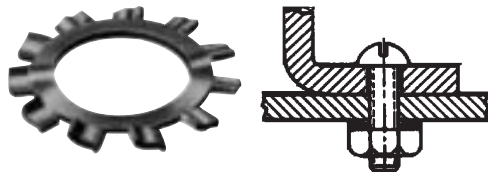
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference	MS35335 -		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
3/8	0.384	0.398	0.615	0.635	0.035	EXT-0375-08-00	1120-08			
3/8	0.384	0.398	1.240	1.260	0.035	EXT-0375-09-00	1120-09			
3/8	0.380	0.387	0.550	0.562	0.015	EXT-0375-12-00	1120-12			
7/16	0.448	0.464	0.740	0.760	0.035	EXT-0437-00-00	1122-00	-36	-64	-92
7/16	0.468	0.488	0.740	0.760	0.035	EXT-0437-09-00	1122-09			
1/2	0.513	0.530	0.882	0.900	0.039	EXT-0500-00-00	1124-00	-37	-65	-93
1/2	0.512	0.529	1.380	1.410	0.055	EXT-0500-01-00	1124-01			
1/2	0.512	0.529	0.882	0.898	0.050	EXT-0500-06-00	1124-06			
9/16	0.576	0.596	0.960	0.985	0.039	EXT-0562-00-00	1126-00	-38	-66	-94
5/8	0.641	0.663	1.045	1.070	0.045	EXT-0625-00-00	1128-00	-39	-67	-95
5/8	0.625	0.635	0.839	0.849	0.035	EXT-0625-06-00	1128-06			
11/16	0.690	0.696	0.914	0.922	0.035	EXT-0687-05-00	1130-05			
3/4	0.768	0.79	1.220	1.260	0.050	EXT-0750-00-00	1132-00	-40	-68	-96
7/8	0.897	0.927	1.380	1.410	0.055	EXT-0875-00-00	1134-00**	-41	-69	-97
1	1.025	1.060	1.590	1.620	0.062	EXT-1000-00-00	1136-00	-42	-70	-98
1-1/8	1.128	1.142	1.797	1.827	0.062	EXT-1125-03-00	1138-03			
1-1/4	1.269	1.293	2.172	2.202	0.062	EXT-1250-01-00	1140-01			
1.5625	1.560	1.580	2.359	2.392	0.094	EXT-1562-01-00	1145-01			
2-3/4	2.800	2.825	3.490	3.510	0.078	EXT-2750-01-00	1164-01			
2-3/4	2.800	2.825	3.490	3.510	0.078	EXT-2750-02-00	1164-02*			

* Left Hand Twist

**Type B option also stocked

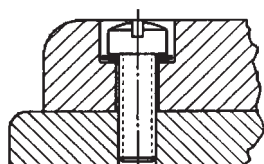
SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

TYPE "B" TOOTH FORM



The Type "B" is listed as an alternative tooth form in ASME B18.21.1 Military Standards, S.A.E., etc. It is available for many of the styles and sizes of tooth washers shown in this catalog, including external, internal, external-internal and many others. To order, specify the WCL part number and designate "Type B" for example: 1114-00 Type B.

INTERNAL TYPE LOCKWASHERS



- Work best with smaller screw heads (such as fillister heads).
- Use where appearance warrants that teeth be hidden.
- Use where snagging or scratching could be a problem.
- Internal teeth lock into bolt head or nut to prevent backoff rotation.

MATERIALS: Part numbers shown are for washers made of spring steel. These washers are also available in bronze and bronze alloy and in 400 series stainless steel. Many of these are in stock at WCL. Washers can also be produced from 300 series stainless steel and other materials on request. *Specify material when inquiring or ordering.*

SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference	MS35335 -		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
2	.089	.095	.175	.200	.013	INT-0086-00-00	1202-00	-35	-69	-103
2	.089	.096	.175	.185	.007	INT-0086-01-00	1202-01			
2	.094	.098	.175	.185	.013	INT-0086-04-00	1202-04			
3	.102	.109	.215	.232	.015	INT-0099-00-00	1203-00			
3	.106	.109	.215	.225	.013	INT-0099-00-00	1203-01			
4	.115	.123	.255	.270	.015	INT-0112-00-00	1204-00	-36	-70	-104
4	.116	.123	.215	.225	.015	INT-0112-03-00	1204-03			
5	.129	.136	.245	.280	.017	INT-0125-00-00	1205-00			
5	.124	.128	.215	.225	.017	INT-0125-08-00	1205-08			
6	.141	.150	.275	.295	.017	INT-0138-00-00	1206-00	-37	-71	-105
6	.142	.150	.245	.255	.017	INT-0138-01-00	1206-01			
6	.146	.151	.275	.285	.018	INT-0138-05-00	1206-05			
6	.142	.150	.307	.317	.025	INT-0138-06-00	1206-06			
6	.142	.150	.278	.288	.013	INT-0138-07-00	1206-07			
8	.168	.176	.325	.340	.020	INT-0164-00-00	1208-00	-38	-72	-106
8	.168	.176	.325	.336	.025	INT-0164-01-00	1208-01			
8	.168	.176	.300	.311	.020	INT-0164-05-00	1208-05			
8	.168	.176	.325	.336	.010	INT-0164-06-00	1208-06			
8	.168	.176	.494	.506	.017	INT-0164-08-00	1208-08			
8	.166	.170	.275	.285	.020	INT-0164-11-00	1208-11			
8	.165	.169	.278	.288	.018	INT-0164-12-00	1208-12			
10	.195	.204	.365	.381	.022	INT-0190-00-00	1210-00	-39	-73	-107
10	.195	.204	.495	.505	.025	INT-0190-01-00	1210-01			
10	.188	.194	.593	.607	.029	INT-0190-03-02	1210-03			
10	.195	.204	.300	.311	.017	INT-0190-06-00	1210-06			
10	.195	.204	.370	.381	.010	INT-0190-07-00	1210-07			
10	.195	.204	.743	.758	.020	INT-0190-10-00	1210-10			
10	.204	.210	.300	.311	.017	INT-0190-15-00	1210-15			
12	.221	.231	.394	.410	.022	INT-0216-00-00	1212-00			
12	.218	.222	.372	.383	.017	INT-0216-03-00	1212-03			
12	.218	.222	.372	.383	.022	INT-0216-08-00	1212-04			

* Left Hand Twist

INTERNAL TYPE LOCKWASHERS

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference	MS35335 -		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
1/4	.256	.267	.466	.478	.025	INT-0250-00-00	1214-00	-40	-74	-108
1/4	.256	.267	.555	.565	.025	INT-0250-01-00	1214-01			
1/4	.256	.267	.396	.408	.017	INT-0250-05-00	1214-05	-125	-135	-145
1/4	.256	.267	.466	.478	.025	INT-0250-06-00	1214-06*			
1/4	.256	.267	.806	.818	.025	INT-0250-07-00	1214-07			
1/4	.256	.267	.618	.632	.025	INT-0250-09-00	1214-09			
1/4	.256	.267	.396	.408	.025	INT-0250-10-00	1214-10			
1/4	.256	.267	.396	.408	.013	INT-0250-11-00	1214-11			
1/4	.256	.267	.618	.632	.029	INT-0250-12-00	1214-12			
1/4	.256	.267	.595	.615	.022	INT-0250-14-00	1214-14			
1/4	.252	.256	.396	.408	.017	INT-0250-15-00	1214-15			
16	.285	.296	.494	.506	.029	INT-0281-01-00	1216-01			
5/16	.320	.332	.594	.610	.029	INT-0312-00-00	1218-00	-41	-75	-109
5/16	.314	.322	.425	.435	.022	INT-0312-02-00	1218-02			
5/16	.314	.322	.425	.435	.015	INT-0312-04-00	1218-04			
5/16	.320	.332	.740	.760	.045	INT-0312-05-00	1218-05			
3/8	.384	.398	.670	.692	.035	INT-0375-00-00	1220-00	-42	-76	-110
3/8	.384	.398	.678	.692	.022	INT-0375-01-00	1220-01			
3/8	.377	.391	.493	.507	.022	INT-0375-02-00	1220-02			
3/8	.405	.415	.678	.692	.022	INT-0375-04-00	1220-04			
3/8	.380	.387	.557	.567	.017	INT-0375-05-00	1220-05†			
3/8	.384	.398	1.147	1.166	.035	INT-0375-06-00	1220-06			
3/8	.410	.425	.595	.615	.022	INT-0375-08-00	1220-08			
3/8	.380	.387	.557	.567	.025	INT-0375-10-00	1220-10†			
3/8	.380	.387	.557	.567	.020	INT-0375-13-00	1220-13†			
3/8	.395	.400	.733	.747	.039	INT-0375-14-00	1220-14			
3/8	.377	.391	.595	.615	.022	INT-0375-15-00	1220-15			
7/16	.448	.464	.740	.789	.035	INT-0437-00-00	1222-00	-43	-77	-111
7/16	.472	.480	.593	.607	.017	INT-0437-01-00	1222-01†	-126	-136	-146
7/16	.439	.442	.533	.547	.022	INT-0437-04-00	1222-04			
7/16	.448	.463	.774	.789	.020	INT-0437-05-00	1222-05			
7/16	.472	.480	.593	.607	.022	INT-0437-09-00	1222-09†			
7/16	.448	.463	.593	.607	.017	INT-0437-13-00	1222-13			
1/2	.512	.530	.867	.900	.039	INT-0500-00-00	1224-00	-44	-78	-113
1/2	.505	.512	.620	.630	.020	INT-0500-02-00	1224-02†			
1/2	.512	.529	.867	.883	.039	INT-0500-03-00	1224-03			
1/2	.545	.560	.765	.785	.025	INT-0500-06-00	1224-06			
1/2	.512	.529	.774	.789	.035	INT-0500-07-00	1224-07			
1/2	.512	.529	.774	.789	.010	INT-0500-08-00	1224-08			
1/2	.545	.560	.765	.785	.030	INT-0500-10-00	1224-10			
1/2	.505	.512	.620	.630	.013	INT-0500-12-00	1224-12†			
1/2	.520	.530	.733	.747	.029	INT-0500-14-00	1224-14			
9/16	.576	.596	.957	.985	.039	INT-0562-00-00	1226-00			
9/16	.575	.585	.763	.777	.029	INT-0562-03-00	1226-03			

* Left Hand Twist

† Alternate Tooth Twist

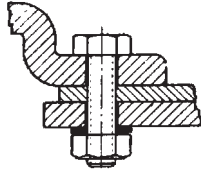
INTERNAL TYPE LOCKWASHERS

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference	MS35335 -		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
9/16	.565	.572	.678	.692	.017	INT-0562-07-00	1226-07	-127	-137	-147
9/16	.575	.585	.763	.777	.015	INT-0562-08-00	1226-08			
5/8	.640	.663	1.045	1.071	.045	INT-0625-00-00	1228-00	-46	-80	-115
5/8	.640	.659	1.053	1.071	.022	INT-0625-01-00	1228-01			
5/8	.640	.659	.867	.883	.022	INT-0625-02-00	1228-02			
5/8	.690	.700	.945	.968	.029	INT-0625-03-00	1228-03			
5/8	.640	.659	1.053	1.071	.045	INT-0625-04-00	1228-04*			
5/8	.640	.659	.867	.883	.022	INT-0625-05-00	1228-05*			
5/8	.625	.630	.774	.789	.020	INT-0625-06-00	1228-06			
5/8	.640	.659	.945	.965	.045	INT-0625-07-00	1228-07			
11/16	.704	.728	1.130	1.166	.045	INT-0687-00-00	1230-00			
3/4	.769	.795	1.220	1.245	.050	INT-0750-00-00	1232-00	-47	-81	-116
3/4	.769	.795	1.220	1.245	.025	INT-0750-03-00	1232-03			
3/4	.757	.760	1.047	1.077	.022	INT-0750-04-00	1232-04			
3/4	.775	.785	1.047	1.077	.022	INT-0750-07-00	1232-07	-129	-139	-149
3/4	.790	.800	1.220	1.245	.050	INT-0750-08-00	1232-08			
3/4	.757	.760	1.047	1.077	.022	INT-0750-12-00	1232-12†			
13/16	.832	.861	1.290	1.315	.050	INT-0812-00-00	1233-00			
13/16	.832	.856	1.047	1.386	.050	INT-0812-03-00	1233-03			
13/16	.860	.870	1.365	1.386	.050	INT-0812-04-00	1233-04			
7/8	.894	.927	1.364	1.410	.055	INT-0875-00-00	1234-00	-48	-82	-117
7/8	.894	.918	1.364	1.386	.025	INT-0875-01-00	1234-01			
7/8	.880	.890	1.080	1.110	.020	INT-0875-04-00	1234-04			
7/8	.894	.918	1.364	1.386	.020	INT-0875-05-00	1234-05			
15/16	.985	1.015	1.360	1.390	.029	INT-0937-02-00	1235-02			
1	1.019	1.060	1.590	1.637	.062	INT-1000-00-00	1236-00	-49	-83	-118
1	1.010	1.020	1.360	1.390	.025	INT-1000-05-00	1236-05			
1 1/8	1.144	1.192	1.799	1.830	.062	INT-1125-00-00	1238-00			
1 1/8	1.163	1.175	1.425	1.450	.015	INT-1125-04-00	1238-04			
1 1/8	1.163	1.175	1.425	1.450	.025	INT-1125-08-00	1238-08			
1 3/16	1.206	1.231	1.799	1.825	.030	INT-1187-02-00	1239-02			
1 1/4	1.260	1.280	1.921	1.950	.062	INT-1250-01-00	1240-01	-51	-85	-120
1 1/4	1.260	1.280	1.799	1.825	.025	INT-1250-02-00	1240-02			
1 5/16	1.331	1.356	1.921	1.950	.062	INT-1312-00-00	1241-00			
1 3/8	1.394	1.418	1.920	1.950	.062	INT-1375-00-00	1242-00			
1 3/8	1.394	1.418	1.920	1.950	.030	INT-1375-01-00	1242-01			
1 1/2	1.500	1.530	2.485	2.515	.078	INT-1500-00-00	1244-00			
1 1/2	1.500	1.530	2.485	2.515	.055	INT-1500-01-00	1244-01			
1 5/8	1.630	1.645	1.797	1.827	.015	INT-1625-02-00	1246-02			
1 3/4	1.750	1.780	2.625	2.655	.078	INT-1750-00-00	1248-00			
1 3/4	1.768	1.790	2.219	2.281	.029	INT-1750-01-00	1248-01			
1 3/4	1.750	1.780	2.610	2.640	.055	INT-1750-02-00	1248-02			
1 7/8	1.875	1.905	2.495	2.545	.078	INT-1875-00-00	1250-00			
1 15/16	1.938	1.968	2.610	2.640	.078	INT-1937-00-00	1251-00			
2	2.010	2.030	2.865	2.900	.062	INT-2000-01-00	1252-01			
2	2.015	2.030	2.470	2.500	.025	INT-2000-02-00	1252-02			
2 1/2	2.490	2.510	2.985	3.015	.078	INT-2500-01-00	1260-01			

* Left Hand Twist

† Alternate Tooth Twist

HEAVY DUTY INTERNAL TYPE LOCKWASHERS



- Retain locking tension under heavy loads.
- Use with heavy bolts and nuts and with heat treated bolts.
- Strong internal teeth lock into bolt head or nut to prevent backoff rotation.

Steel parts are available plain or with a zinc .00015" standard finish. Other materials and finishes available on request.

Typical Applications: Castings, heavy machinery and equipment.

SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCLPart Number	Cross Reference	MS35334-
	Min.	Max.	Min.	Max.				Steel CD2 Finish
1/4	.256	.267	.536	.500	.039	INTH-0250-00-00	1414-00	-19
1/4	.256	.267	.594	.607	.039	INTH-0250-01-00	1414.01	
5/16	.320	.332	.590	.607	.045	INTH-0312-00-00	1418-00	-20
3/8	.384	.398	.700	.748	.045	INTH-0375-00-00	1420-00	-21
7/16	.448	.464	.800	.858	.062	INTH-0437-00-00	1422-00	-22*
1/2	.512	.530	.880	.924	.062	INTH-0500-00-00	1424-00	-23
9/16	.576	.596	.990	1.034	.062	INTH-0562-00-00	1426-00	-24*
5/8	.640	.663	1.100	1.135	.062	INTH-0625-00-00	1428-00	-25
3/4	.768	.795	1.240	1.265	.078	INTH-0750-00-00	1432-00	-26
7/8	.894	.927	1.400	1.447	.078	INTH-0875-00-00	1434-00	-26

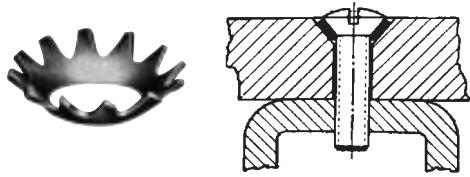
* Inactive for new design per specification but still available.

SAMPLES SERVICE



To request a sample of any of our products to evaluate before ordering, please call us toll free at **1-800-331-3816**, or visit our web site www.wclco.com

COUNTERSUNK TYPE LOCKWASHERS



- For use with flat and oval head screws having either 80° or 100° countersunk angles.
- Where appearance or snagging are important considerations a version with a smooth external flange and internal teeth is available.

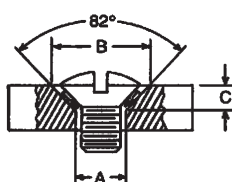
SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

82° COUNTERSUNK - EXTERNAL TYPE										
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Numbers	Cross Reference	MS35336 ⁻¹		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
2	.089	.095	.170	.183	.013	CTSK-0086-00-00	1502-00			
4	.113	.123	.224	.238	.015	CTSK-0112-00-00	1504-00	-3	-5	-55
6	.140	.150	.283	.298	.017	CTSK-0138-00-00	1506-00	-9	-11	-56
6	.142	.150	.285	.300	.013	CTSK-0138-02-00	1506-02			
8	.167	.177	.324	.340	.017	CTSK-0164-00-00	1508-00	-15	-17	-57
10	.195	.205	.353	.372	.022	CTSK-0190-00-00	1510-00	-21	-23	-58
12	.220	.231	.429	.447	.022	CTSK-0216-00-00	1512-00			
1/4	.255	.267	.458	.478	.022	CTSK-0250-00-00	1514-00	-27	-29	-59
16	.273	.287	.523	.543	.025	CTSK-0281-00-00	1516-00			
5/16	.318	.337	.603	.625	.025	CTSK-0312-00-00	1518-00	-33	-35	-60
3/8	.383	.398	.776	.801	.029	CTSK-0375-00-00	1520-00	-39	-41	-61
7/16	.448	.463	.863	.890	.035	CTSK-0437-00-00	1522-00			
7/16	.448	.463	.890	.915	.035	CTSK-0437-02-00	1522-02			
1/2	.512	.529	.977	1.007	.039	CTSK-0500-00-00	1524-00	-51	-53	-63
5/8	.650	.675	REF.	1.312	.051	CTSK-0625-00-00	1528-00			

100° COUNTERSUNK - EXTERNAL TYPE										
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Numbers	Cross Reference	MS35336 ⁻¹		
	Min.	Max.	Min.	Max.				Steel Plated	Stainless Steel	Bronze Alloy
8	.168	.176	.324	.340	.015	CTSK-0164-04-00	1508-04	-9		-123
10	.195	.204	.377	.394	.017	CTSK-0190-05-00	1510-05	-17		-125
1/4	.256	.267	.473	.493	.022	CTSK-0250-05-00	1514-05	-25		-127

82° COUNTERSUNK - INTERNAL FLANGE TYPE							
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Numbers	Cross Reference
	Min.	Max.	Min.	Max.			
8	.207	.215	.615	.635	.025	CTSK-0164-07-00	1508-07
5/16	.340	.362	.802	.818	.029	CTSK-0312-04-00	1518-04*

* For 1/4" HD screw
 1 WCL acquires countersunk washers from our Vendors, and tests to certify performance to MS35336 specifications. Due to manufacturing tolerances some parts do not conform to military specifications. Inquire with WCL sales staff for more information.

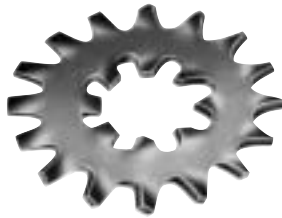


Screw Size	4	5	6	8	10	12	1/4	5/16	3/8
A	1/8	5/32	11/64	13/64	15/64	1/4	9/32	23/64	27/64
B	9/32	5/16	11/32	25/64	29/64	33/64	37/64	45/64	27/32
C	.090	.095	.100	.110	.125	.155	.165	.200	.245

Note: Dimensions are approximate.

Countersinking specifications to accommodate 82° flat and oval head screws with WCL Countersunk Lockwashers

EXTERNAL-INTERNAL TYPE LOCKWASHERS



- Use where large bearing surface is desired.
- Use to span oversized or elongated holes.
- Use as insert between two adjustable pieces to maintain their position after original setting.
- Ideal for electrical bonding.

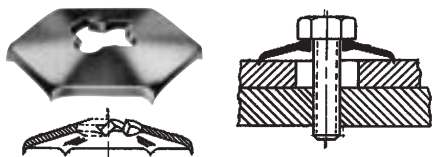
Steel parts are available plain or with a zinc .00015" standard finish. Other materials and finishes available on request.

SPECIFICATIONS: All commercial and military tooth lockwashers supplied by WCL Company and listed on these pages conform to ASME B18.21.1 and to all applicable specifications as reported by IFI.

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Numbers	Cross Reference	MS45904
	Min.	Max.	Min.	Max.				Steel Plated
4	.115	.123	.460	.475	.017	EIT-0112-12-01	4004-12-01	-51
6	.141	.150	.495	.510	.025	EIT-0138-14-00	4006-14-00	-54
8	.168	.176	.494	.506	.025	EIT-0164-14-00	4008-14-00	
8	.168	.176	.580	.610	.029	EIT-0164-18-00	4008-18-00	-57
8	.168	.176	.680	.695	.029	EIT-0164-20-01	4008-20-01	-58
8	.168	.176	.740	.760	.029	EIT-0164-22-01	4008-22-01	-59
10	.195	.204	.494	.506	.025	EIT-0190-14-00	4010-14-00	
10	.195	.204	.580	.610	.029	EIT-0190-18-00	4010-18-00	-60
10	.195	.204	.680	.695	.035	EIT-0190-20-01	4010-20-01	-61
10	.195	.204	.740	.760	.035	EIT-0190-22-00	4010-22-00	-62
10	.195	.204	.882	.898	.035	EIT-0190-24-00	4010-24-00	-63
12	.221	.231	.670	.690	.035	EIT-0216-20-00	4012-20-00	
12	.221	.231	.740	.760	.035	EIT-0216-22-00	4012-22-00	
12	.221	.231	.882	.898	.035	EIT-0216-24-00	4012-24-00	
1/4	.256	.267	.680	.685	.035	EIT-0250-20-00	4014-20-00	
1/4	.256	.267	.725	.760	.035	EIT-0250-22-00	4014-22-00	-68
1/4	.256	.267	.882	.898	.035	EIT-0250-24-00	4014-24-00	-69
1/4	.256	.267	.882	.898	.045	EIT-0250-24-01	4014-24-01	
1/4	.256	.267	.965	.985	.039	EIT-0250-00-01	4014-00-01	-70
1/4	.256	.267	1.045	1.070	.039	EIT-0250-28-00	4014-28-00	-71
5/16	.320	.332	.865	.900	.035	EIT-0312-24-00	4018-24-00	-72
5/16	.320	.332	.965	.985	.039	EIT-0312-26-00	4018-26-00	-73
5/16	.320	.332	1.045	1.070	.045	EIT-0312-28-00	4018-28-00	-74
5/16	.323	.337	1.240	1.260	.050	EIT-0312-32-00	4018-32-00	
3/8	.384	.398	.965	.985	.039	EIT-0375-26-00	4020-26-00	-76
3/8	.384	.398	.965	.985	.050	EIT-0375-26-01	4020-26-01	
3/8	.384	.398	1.045	1.070	.045	EIT-0375-28-00	4020-28-00	-77
3/8	.384	.398	1.240	1.260	.050	EIT-0375-32-00	4020-32-00	-79
7/16	.448	.464	1.045	1.070	.045	EIT-0437-28-00	4022-28-00	
7/16	.448	.463	1.130	1.155	.045	EIT-0437-30-00	4022-30-00	
7/16	.448	.463	1.240	1.260	.050	EIT-0437-32-00	4022-32-00	
1/2	.512	.530	1.220	1.260	.050	EIT-0500-32-00	4024-32-00*	-84
1/2	.512	.529	1.380	1.410	.055	EIT-0500-34-00	4024-34-00	-86
1/2	.512	.529	1.590	1.620	.062	EIT-0500-36-00	4024-36-00	
9/16	.576	.596	1.380	1.430	.055	EIT-0562-34-00	4026-34-00	
5/8	.640	.663	1.380	1.410	.055	EIT-0625-35-00	4028-34-00	
5/8	.640	.659	1.590	1.620	.062	EIT-0625-36-00	4028-36-00	-93

* Also available in Type B

PYRAMIDAL TYPE LOCKWASHERS

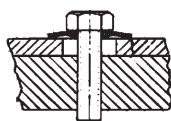


- Provide exceptional holding strength and withstand high torques - ideal for heavy duty applications.
- Ribbed for rigidity under load.
- Sharp points on periphery resist shifting
- Internal teeth lock into bolt head or nut to prevent backoff.
- Ideal where thick materials and high torques are involved.

Nominal Washer Size	Hole Diameter		Across Flats		Across Corners	Minimum Height	Thickness	WT./M	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.						
1/4	.252	.258	.740	.760	.866	.180	.078	8.55	PYRM-0250-14-01	4914-14-01
5/16	.320	.332	.740	.760	.866	.145	.062	.701	PYRM-0312-14-01	4918-14-01
5/16	.320	.332	.990	1.010	1.150	.180	.062	13.53	PYRM-0375-15-01	4918-18-03
3/8	.384	.398	.990	1.010	1.150	.130	.062	12.10	PYRM-0375-18-01	4920-18-01
3/8	.384	.398	1.240	1.260	1.410	.270	.109	36.18	PYRM-0375-23-01	4920-23-01
7/16	.454	.468	1.240	1.260	1.410	.270	.109	34.00	PYRM-0437-23-01	4922-23-01
7/16	.446	.450	1.355	1.375	1.576	.195	.093	35.71	PYRM-0437-25-01	4922-25-01
1/2	.512	.529	1.240	1.260	1.410	.195	.109	31.95	PYRM-0500-23-01	4924-23-01
1/2	.512	.529	1.355	1.375	1.576	.210	.093	32.26	PYRM-0500-25-01	4924-25-01
1/2	.512	.529	1.355	1.375	1.576	.190	.093	33.06	PYRM-0500-25-02	4924-25-02

DOME TYPE LOCKWASHERS

Plain Periphery - Recommended to prevent surface marring.



Toothed Periphery Type - Recommended to prevent shifting.



- Use where force and *rigidity* are required when fastening in soft or thin material.
- Distributes load over wide area.
- Spans oversized or elongated holes.
- Internal teeth lock into bolt head or nut to prevent backoff.

PLAIN PERIPHERY TYPE

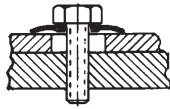
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	Minimum Height	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.				
10	.192	.204	.991	1.009	.040	8.31	DMPP-0190-16-01	4510-16-01
1/4	.256	.267	1.115	1.135	.039	9.99	DMPP-0250-18-01	4514-18-01
5/16	.320	.332	.991	1.009	.050	9.36	DMPP-0312-16-01	4518-16-01
5/16	.320	.332	1.240	1.260	.050	14.61	DMPP-0312-20-01	4518-20-01
3/8	.384	.398	1.365	1.385	.062	22.95	DMPP-0375-22-01	4520-22-01

TOOTHED PERIPHERY TYPE

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	Minimum Height	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.				
10	.196	.200	.991	1.009	.050	9.36	DMTP-0190-16-01	4610-16-01
10	.196	.200	.991	1.009	.029	4.46	DMTP-0190-16-02	4610-16-02
1/4	.256	.267	1.115	1.135	.040	9.46	DMTP-0250-18-01	4614-18-01
3/8	.384	.398	1.365	1.385	.062	21.73	DMTP-0375-22-01	4620-22-01
3/8	.380	.390	1.595	1.625	.078	40.28	DMTP-0375-26-01	4620-26-01
1/2	.512	.529	1.595	1.625	.078	37.83	DMTP-0500-26-01	4624-26-01
5/8	.640	.659	1.860	1.890	.078	47.60	DMTP-0625-30-01	4628-30-01

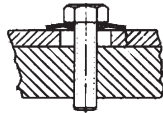
DISHED TYPE LOCKWASHERS

Plain Periphery Type - Recommended where surfaces should not be marred or snagging could be a problem.

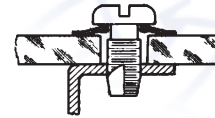
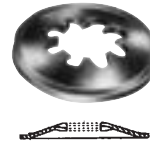


- Use where force and resiliency; are needed when fastening in soft or thin materials.
- Distributes load over wide area.
- Spans oversize or elongated holes.
- Internal teeth lock into bolt head or nut to prevent backoff rotation.

Toothed Periphery Type - Recommended to prevent shifting.



Flat Rim Type - Recommended for electrical applications or when fastening to plastic or other special materials.



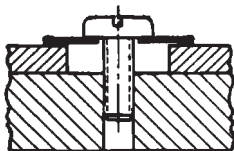
PLAIN PERIPHERY TYPE								
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	Minimum Height	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.				
4	.116	.123	.372	.383	.025	.541	DSPP-0112-06-01	4704-06-01
6	.142	.150	.372	.383	.020	.491	DSPP-0138-06-01	4706-06-01
8	.176	.168	.372	.383	.022	.442	DSPP-0164-06-01	4708-06-01
10	.195	.204	.372	.383	.022	.396	DSPP-0190-06-01	4710-06-01
10	.195	.204	.495	.505	.025	1.05	DSPP-0190-08-01	4710-08-01
10	.195	.204	.618	.632	.025	1.84	DSPP-0190-10-01	4710-10-01
1/4	.256	.267	.865	.885	.030	4.45	DSPP-0250-14-01	4714-14-01

FLAT RIM TYPE								
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	Minimum Height	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.				
4	.120	.124	.265	.275	.022	.221	DSFR-0112-04-01	4704-04-01
4	.120	.124	.265	.275	.015	.242	DSFR-0112-04-02	4704-04-02
6	.146	.150	.323	.333	.025	.372	DSFR-0138-05-01	4706-05-01
6	.146	.150	.323	.333	.017	.253	DSFR-0138-05-02	4706-05-02
6	.146	.150	.372	.383	.029	.650	DSFR-0138-06-02	4706-06-02
10	.195	.204	.494	.506	.025	1.34	DSFR-0190-08-02	4710-08-02
10	.195	.204	.618	.632	.025	1.83	DSFR-0190-10-01	4710-10-01

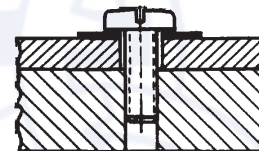
TOOTHED PERIPHERY TYPE								
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	Minimum Height	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.				
4	.116	.123	.556	.569	.025	1.50	DSTP-0112-09-01	4804-09-01
6	.146	.150	.556	.569	.025	1.47	DSTP-0138-09-01	4806-09-01
8	.168	.176	.556	.569	.025	1.42	DSTP-0164-09-01	4808-09-01
10	.195	.204	.556	.569	.029	1.58	DSTP-0190-09-01	4810-09-01
10	.195	.204	.865	.885	.025	3.91	DSTP-0190-14-01	4810-14-01
12	.221	.231	.556	.569	.039	2.08	DSTP-0216-09-01	4812-09-01
12	.221	.231	.865	.885	.039	5.32	DSTP-0216-14-01	4812-14-01
1/4	.256	.267	.678	.698	.050	3.76	DSTP-0250-11-01	4814-11-01
1/4	.256	.267	.865	.885	.039	5.18	DSTP-0250-14-01	4814-14-01
1/4	.288	.293	.865	.885	.062	8.01	DSTP-0250-14-02	4814-14-02
5/16	.320	.332	.990	1.010	.062	10.76	DSTP-0312-16-02	4818-16-02
3/8	.384	.398	.990	1.010	.062	10.11	DSTP-0375-16-01	4820-16-01
3/8	.384	.398	1.240	1.260	.050	14.11	DSTP-0375-20-01	4820-20-01
7/16	.448	.463	1.170	1.190	.062	11.20	DSTP-0437-19-01	4822-19-01
1/2	.510	.529	1.240	1.260	.050	12.79	DSTP-0500-20-01	4824-20-01

WIDE RIM TYPE LOCKWASHERS

External Type - Recommended to provide maximum torsional resistance.



Internal Type - Recommended where appearance or possible snagging are important considerations.



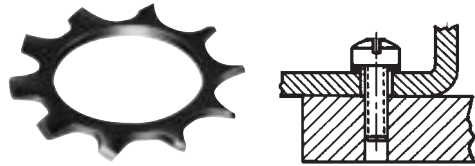
- Use with large diameter screw and bolt heads when extreme torques are not required.
- Spans oversized and elongated holes.

EXTERNAL TYPE								
Nominal Washer Size	Hole Diameter		Rim Width	Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.		Min.	Max.			
6	.142	.150	.050	.370	.381	.022	EXT-0135-01-00	1106-01
8	.168	.176	.093	.494	.506	.020	EXT0164-05-00	1108-05
10	.195	.204	.079	.494	.506	.025	EXT0190-07-00	1110-07
1/4	.256	.267	.196	.882	.898	.045	EXT0250-04-00	1114-04
1/4	.256	.267	.121	.680	.695	.039	EXT0250-09-00	1114-09
1/4	.256	.267	.196	.882	.898	.039	EXT0250-16-00	1114-16
5/16	.320	.332	.089	.680	.695	.035	EXT0312-02-00	1118-02
3/8	.384	.398	.130	.882	.898	.039	EXT0375-06-00	1120-06
3/8	.384	.398	.281	1.240	1.260	.035	EXT0375-09-00	1120-09
1/2	.512	.529	.307	1.380	1.410	.055	EXT0500-01-00	1124-01
1-1/4	1.269	1.293	.158	2.172	2.202	.062	EXT1250-01-00	1140-01
1-9/16	1.560	1.580	.148	2.359	2.392	.094	EXT1562-01-00	1145-01

INTERNAL TYPE								
Nominal Washer Size	Hole Diameter		Rim Width	Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.		Min.	Max.			
6	.142	.150	.044	.307	.317	.025	INT-0138-06-00	1206-06
8	.168	.176	.120	.494	.506	.017	INT-0164-08-00	1208-08
10	.195	.204	.087	.495	.505	.025	INT-0190-01-00	1210-01
10	.195	.204	.186	.743	.758	.020	INT-0190-10-00	1210-10
1/4	.256	.267	.213	.806	.818	.025	INT-0250-07-00	1214-07
1/4	.256	.267	.120	.618	.632	.025	INT-0250-09-00	1214-09
5/16	.320	.332	.137	.740	.760	.045	INT-0312-05-00	1218-05
3/8	.384	.398	.280	1.147	1.166	.035	INT-0375-06-00	1220-06
2	2.010	2.030	.219	2.865	2.900	.062	INT-2000-01-00	1252-01

NARROW RIM TYPE LOCKWASHERS

External Type - Recommended for maximum torsional resistance.



Internal Type - Recommended where appearance or snagging are prime considerations.



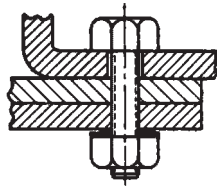
- Small O.D. in relation to I.D.
- Use with small headed screws and special narrow-rimmed nuts.
- Ideal where clearance or appearance may be a factor.

EXTERNAL TYPE								
Nominal Washer Size	Hole Diameter		Rim Width	Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.		Min.	Max.			
4	.116	.123	.019	.215	.225	.015	EXT-0112-02-00	1104-02
10	.195	.199	.031	.335	.345	.017	EXT-0190-03-00	1110-03
1/4	.257	.263	.030	.428	.440	.017	EXT-0250-02-00	1114-02
1/4	.256	.267	.026	.365	.375	.020	EXT-0250-05-00	1114-05
1/4	.246	.250	.034	.365	.375	.017	EXT-0250-11-00	1114-11
1/4	.256	.267	.026	.365	.375	.029	EXT-0250-18-00	1114-18
3/8	.380	.387	.034	.550	.562	.015	EXT-0375-12-00	1120-12
5/8	.625	.635	.054	.839	.849	.035	EXT-0625-06-00	1128-06

EXTERNAL TYPE								
Nominal Washer Size	Hole Diameter		Rim Width	Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.		Min.	Max.			
8	.168	.176	.023	.300	.311	.020	INT-0164-05-00	1208-05
10	.195	.204	.023	.300	.311	.017	INT-0190-06-00	1210-06
5/16	.314	.322	.025	.425	.435	.022	INT-0312-02-00	1218-02
5/16	.314	.322	.025	.425	.435	.015	INT-0312-04-00	1218-04
3/8	.377	.391	.032	.493	.507	.022	INT-0375-02-00	1220-02
3/8	.410	.425	.048	.595	.615	.022	INT-0375-08-00	1220-08
3/8	.380	.387	.045	.557	.567	.025	INT-0375-10-00	1220-10*
7/16	.439	.442	.025	.533	.547	.022	INT-0437-04-00	1222-04
1/2	.545	.560	.055	.765	.785	.025	INT-0500-06-00	1224-06
1/2	.545	.560	.055	.765	.785	.030	INT-0500-10-00	1224-10
9/16	.575	.585	.045	.763	.777	.029	INT-0562-03-00	1226-03
3/4	.757	.760	.064	1.047	1.077	.022	INT-0750-04-00	1232-04
3/4	.775	.785	.064	1.047	1.077	.022	INT-0750-07-00	1232-07
13/16	.818	.828	.064	1.047	1.077	.022	INT-0812-03-00	1233-03
7/8	.880	.890	.043	1.080	1.110	.020	INT-0875-04-00	1234-04
1	1.010	1.020	.087	1.360	1.390	.025	INT-1000-05-00	1236-05
1-1/8	1.163	1.175	.045	1.425	1.450	.025	INT-1125-08-00	1238-08
1-5/8	1.630	1.645	.045	1.797	1.827	.015	INT-1625-02-00	1246-02
1-3/4	1.768	1.790	.142	2.219	2.281	.029	INT-1750-01-00	1248-01

* Alt. Twisted Tooth Type

ALTERNATE INTERNAL TYPE LOCKWASHERS



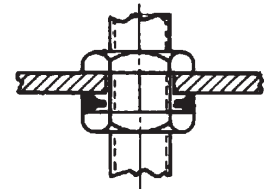
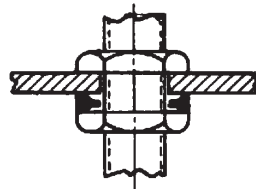
- Provide both clockwise and counter-clockwise locking action.
- Under load, two-way strut action strongly resists rotation in either direction.
- Provide torque brake and contribute to the maintenance of precise tension in the assembly.
- Use with adjustment screws to maintain position.

Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.			
3/8	.380	.387	.557	.567	.017	INT-0375-05-00	1220-05
3/8	.380	.387	.557	.567	.025	INT-0375-10-00	1220-10
3/8	.380	.387	.557	.567	.020	INT-0375-13-00	1220-13
7/16	.472	.480	.593	.607	.017	INT-0437-01-00	1222-01
7/16	.472	.480	.593	.607	.022	INT-0437-09-00	1222-09
1/2	.505	.512	.620	.630	.020	INT-0500-02-00	1224-02
1/2	.505	.512	.620	.630	.013	INT-0500-12-00	1224-12
3/4	.757	.670	1.047	1.077	.022	INT-0750-12-00	1232-12

PIPE LOCKWASHERS

External Type - Recommended for maximum torsional resistance.

Internal Type - Recommended where appearance or snagging are prime considerations.



- Fit pipe diameters
 - Used with nuts having extreme internal diameters in relation to their O.D.'s
- TYPICAL APPLICATIONS: Lamp and instrument board assemblies

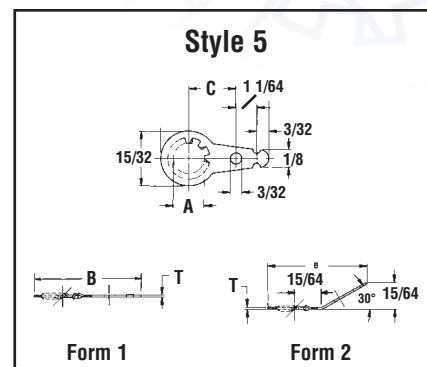
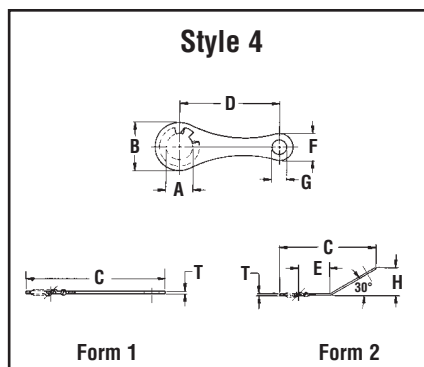
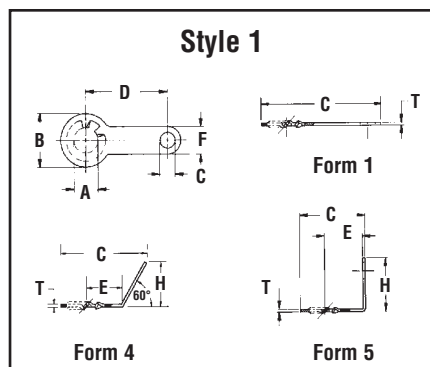
EXTERNAL TYPE							
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.			
1/8	.406	.420	.680	.695	.035	EXT-0375-01-000	1120-01

INTERNAL TYPE							
Nominal Washer Size	Hole Diameter		Outside Diameter		Thickness	WCL Part Number	Cross Reference
	Min.	Max.	Min.	Max.			
3/8	.405	.415	.678	.692	.022	INT-0375-04-00	1220-04
3/8	.410	.425	.595	.615	.022	INT-0375-08-00	1220-08
1/2	.545	.560	.765	.785	.025	INT-0500-06-00	1224-06
1/2	.545	.560	.765	.785	.030	INT-0500-10-00	1224-10
5/8	.690	.700	.945	.968	.029	INT-0625-03-00	1228-03
13/16	.832	.856	1.365	1.386	.050	INT-0812-00-00	1233-00

TOOTH TYPE SOLDER TERMINALS

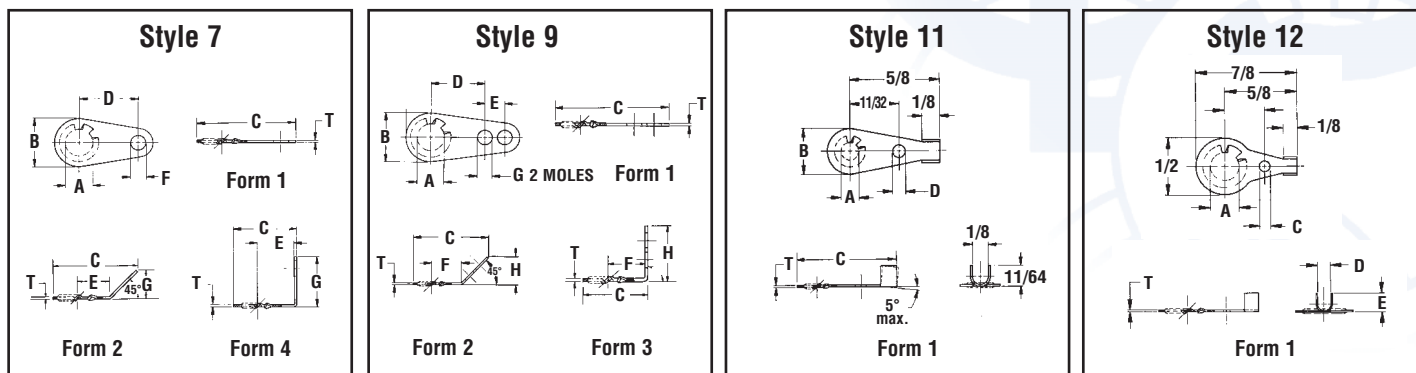
For the many miscellaneous applications that require wire terminations, WCL stocks a wide variety of styles and sizes. With its "built in" tooth lockwasher, the tooth type terminal provides three important benefits:

1. The integral locking teeth anchor the terminal to the base, preventing any shifting of the terminal in handling.
2. The tapered, twisted teeth produce a multiple bite that penetrates oxidized or painted surfaces, assuring good electrical conductivity.
3. The integrated tooth washer/solder lug saves assembly time and assures a cost-effective, quality installation.



Screw Size	WCL Part Number	Style	Form	Reference Dimensions								Thickness	Military Part Number
				A	B	C	D	E	F	G	H		
2	2914-02-01	1	4	.099-.097	.188	.266		.094	.094	.052	.125	.018	
2	2914-02-00	1	1	.099-.097	.188	.328	.188		.094	.052		.017	
4	2522-04-00	1	1	.123-.116	.250	.656	.438		.125	.078		.018	
4	2177-04-00	1	5	.123-.116	.312	.406		.234	.156	.094	.312	.018	MS77071-1
4	2153-04-00	1	1	.123-.116	.312	.734	.500		.156	.094		.018	MS77071-1
6	2153-06-00	1	1	.150-.142	.312	.734	.500		.156	.094		.018	MS77072-2
6	2153-06-03	1	5	.150-.142	.250	.344		.188	.125	.078	.375	.030	MS77071-2
2	2101-02-00	4	1	.095-.089	.312	.875	.625		.172	.094		.018	
4	2103-04-00	4	2	.123-.116	.312	.812		.266	.172	.094	.234	.081	MS77066-1
6	2101-06-00	4	1	.150-.142	.312	.875	.625		.172	.094		.018	MS77070-2
6	2701-06-00	4	1	.150-.142	.312	.875	.625		.172	.094		.018	MS35431-4
6	2103-06-00	4	2	.150-.142	.312	.812		.266	.172	.094	.234	.018	MS77066-2
8	2101-08-00	4	1	.176-.168	.312	.875	.625		.172	.094		.018	MS77070-3
8	2701-08-00	4	1	.176-.168	.312	.875	.625		.172	.094		.018	MS35431-6
10	2168-10-01	4	1	.197-.190	.438	.656	.375		.125	.062		.018	MS77070-4
10	2701-10-00	4	1	.204-.195	.344	.891	.625		.172	.094		.018	MS35431-8
10	2103-10-00	4	2	.204-.195	.344	.828		.266	.172	.094	.234	.018	MS77066-4
10	2101-10-02	4	1	.204-.194	.344	.891	.625		.172	.094		.022	
10	2101-10-00	4	1	.204-.195	.344	.891	.625		.172	.094		.018	MS77070-5
12	2168-12-01	4	1	.223-.216	.438	.656	.375		.125	.062		.018	
12	2101-12-00	4	1	.231-.221	.438	.812	.500		.188	.094		.018	
1/2	2101-14-00	4	1	.267-.256	.438	.812	.500		.188	.094		.018	
10	2118-10-02	5	1	.204-.195	.891	.397						.018	MS77073-1
10	2118-10-00	5	2	.204-.195	.844							.018	MS77069-1
12	2118-12-00	5	2	.231-.221	.844							.018	MS77069-2
1/4	2118-14-00	5	2	.267-.256	.859							.018	MS77069-3

TOOTH TYPE SOLDER TERMINALS



Screw Size	WCL Part Number	Style	Form	Reference Dimensions								Thickness	Military Part Number
				A	B	C	D	E	F	G	H		
2	2106-02-01	7	4	.095-.089	.180	.188		.102	.078	.300		.012	
2	2106-02-04	7	1	.095-.089	.180	.469	.297		.078			.013	
4	2905-04-00	7	2	.123-.116	.250	.453		.125	.088	.219		.030	
4	2106-04-00	7	1	.123-.116	.312	.625	.375		.094			.018	
4	2706-04-00	7	1	.123-.116	.312	.625	.375		.094			.018	MS35431-1
4	2406-04-00	7	1	.123-.116	.312	.625	.375		.094			.018	
6	2106-06-04	7	2**	.150-.142	.312	.578		.156	.094	.109		.018	
6	2106-06-00	7	1	.150-.142	.312	.625	.375		.094			.018	
6	2706-06-00	7	1	.150-.142	.312	.625	.375		.094			.018	MS35431-3
6	2905-06-00	7	2	.150-.142	.250	.453		.125	.088	.219		.030	
8	2106-08-00	7	1	.176-.168	.312	.625	.375		.094			.018	
8	2706-08-00	7	1	.176-.168	.312	.625	.375		.094			.018	MS35431-5
4	2102-04-023	9	3	.123-.116	.312	.422		.125	.250	.094	.328	.018	
4	2104-04-01	9	2	.123-.116	.312	.625		.125	.250	*	.234	.018	
4	2102-04-01	9	1	.123-.116	.312	.719	.344	.125		*		.018	
4	2102-04-00	9	1	.123-.116	.312	.719	.344	.125		.094		.018	MS77067-1
4	2104-04-00	9	2	.123-.116	.312	.625		.125	.250	.094	.234	.018	MS77068-1
5	2104-05-00	9	2	.136-.129	.312	.641		.125	.250	.094	.234	.018	
6	2102-06-00	9	1	.150-.142	.312	.719	.344	.125		.094		.018	MS77067-2
6	2104-06-02	9	2	.150-.142	.312	.625		.125	.250	*	.234	.018	
6	2104-06-00	9	2	.150-.142	.312	.625		.125	.250	.094	.234	.018	MS77068-2
6	2704-06-00	9	2	.150-.142	.312	.641		.125	.250	.094	.234	.018	MS51536-3
8	2102-08-00	9	1	.176-.168	.312	.719	.344	.125		.094		.018	MS77067-3
8	2104-08-00	9	2	.176-.168	.312	.625		.125	.250	.094	.234	.018	MS77068-3
10	2104-10-00	9	2	.240-.195	.312	.641		.125	.250	.094	.234	.018	MS77068-4
4	2108-04-00	11	1	.123-.116	.312	.781	.094					.018	MS77074-2
6	2108-06-00	11	1	.150-.142	.312	.781	.094					.018	MS77074-2
8	2108-08-00	11	1	.176-.168	.312	.781	.094					.018	MS77074-3
10	2108-10-00	11	1	.204-.195	.344	.797	.094					.018	MS77074-4
10	2109-10-01	12	1	.204-.195	.344	.094	.125	.156				.018	MS77074-6
1/4	2109-14-01	12	1	.267-.256	.344	.094	.125	.156				.018	MS77074-7

SHAFT RETAINERS



Shaft retainers, or stud receivers as they are sometimes called, slip easily over smooth, unthreaded shafts and rods, or into recesses, to hold components securely in place. They significantly reduce in-place costs by completely eliminating secondary shaft preparations. No threading, grooving or notching is required.

WCL stocks two basic styles of retainers:

The internal tooth Shakeproof Springrip® shaft retainer slips easily onto a shaft. The internal teeth flex as the retainer is positioned, setting up a strong strut action that strongly resists back-off forces. Application and removal forces for standard internal type Springrip retainers are included in the specifications. These values provide a general indication of the holding power generated by nonstandard sizes. While application force is moderate, removal force can range from 10 to 20 times the original application force, depending on part size.

WCL also offers a solid I.D. (toothless) shaft retainer for maximum resistance to pull or push off forces and an External Tooth Retainer for smooth-walled recesses or cylinders.

The parts shown in this catalog are generally available in C1050 Spring Steel with a Phosphate and Oil finish. Other materials and finishes are available on request.

The Push-On Nut is a variation of the shaft retainer principle. For complete specifications on Rectangular and Round push-On Nuts, see WCL's comprehensive Threaded Products catalog.

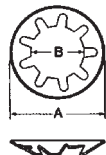
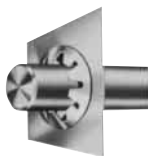


QUALITY

Our mission is to provide the highest quality, most cost effective fasteners and components in conformance with all customer, industry and government requirements and to provide these products in a reliable and timely way. We will conduct every aspect of our business in an ethical manner that will sustain the trust so essential in good customer/supplier relations. At every organizational level, the men and women of WCL are committed to total quality excellence in the design, manufacture and supply of the company's fasteners and components we sell. Inherent in this commitment is a dedication to continuous improvement in every aspect of our products and operations.

INTERNAL TOOTH RETAINERS

STANDARD INTERNAL TOOTH SPRINGRIP™ RETAINERS



Internal tooth retainers slip easily over unthreaded shafts, rods and studs. The internal teeth flex as the retainer is pushed on, engaging the full circumference of the shaft, and setting up a strut action that strongly resists any back-off force. Slightly longer pilot teeth on the standard style are present on all but the smallest diameter parts, and are positioned to guide and center the retainer as it is pushed on the shaft.

SHAFT SIZE DESIGN +/- .002	WCL PART NUMBER	INSIDE DIAMETER B		OUTSIDE DIAMETER A NOM.	MATERIAL THICKNESS	NO. OF GRIP TEETH	NO. OF PILOT TEETH	APPROX. APPLICATION FORCE (LBS.)	APPROX. REMOVAL FORCE (LBS.)
		MIN.	MAX.						
.094	8064-09-00	.085	.088	.394	.010	4	-	15	90
.156	8064-15-00	.146	.150	.394	.010	3	3	10	140
.187	8064-18-00	.177	.181	.394	.015	3	3	15	170
.250	8064-25-00	.234	.239	.462	.015	3	3	20	220
.312	8064-31-00	.288	.292	.598	.015	6	3	20	400
.375	8064-37-00	.350	.355	.680	.015	6	3	20	450
.500	8064-50-00	.483	.490	.776	.017	6	3	25	520

Note: Due to shaft design and material variations, we suggest that you request testing samples prior to placing orders

INTERNAL TOOTH RETAINERS STYLE A

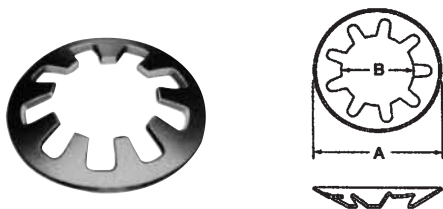
The Style A retainer has somewhat wider, but fewer, internal projections, or teeth, but functions much as the Springrip retainer in terms of on-to-off force ratios.

SHAFT SIZE DESIGN +/- .002	WCL PART NUMBER	INSIDE DIAMETER B		OUTSIDE DIAMETER A NOM.	MATERIAL THICKNESS
		MIN.	MAX.		
.125	R-041210-1	.113	.118	.265	.010
.145	R-041415-1	.133	.140	.273	.015
.156	R-061512-1	.147	.152	.356	.012
.175	R-051710-1	.163	.168	.333	.010
.187	R-051810-1	.173	.178	.333	.010
.187	R-051810-2	.178	.183	.333	.010
.205	R-052010-1	.194	.198	.333	.010
.238	R-072315-1	.228	.236	.460	.015
.238	R-082315-1	.228	.236	.475	.015
.250	R-082310-1	.234	.239	.473	.010
.250	R-082525-1	.235	.240	.472	.025
.250	R-082420-1	.238	.242	.515	.020
.250	R-082410-1	.239	.244	.472	.010
.265	R-082615-1	.244	.250	.472	.015
.265	R-052406-2	.244	.250	.389	.006
.276	R-102712-1	.265	.270	.620	.012
.312	R-093020-1	.298	.302	.540	.020
.312	R-083012-1	.299	.304	.474	.012
.312	R-083015-1	.295	.305	.510	.015
.324	R-113124-1	.312	.316	.680	.024
	R-071232-1	Note 1		.437	.030
.375	R-113615-1	.360	.365	.685	.015
.403	R-103914-1	.390	.394	.625	.014
.495	R-114815-1	.478	.484	.687	.015
Note 2	R-164716-1	.485	.490	1.028	.016
.625	R-186120-1	.618	.608	1.083	.020
.625	R-156115-1	.610	.614	.951	.015
.640	R-146315-1	.625	.631	.875	.015
.659	R-186520-1	.647	.657	1.083	.020
.675	R-216628-1	.659	.669	1.299	.295
.703	R-176813-1	.681	.689	1.082	.013
Note 2	R-167515-1	.760	.740	1.015	.015
.800	R-227825-1	.790	.780	1.375	.025
1.125	R-32J815-1	1.075	1.085	2.000	.015
1.135	R24K215-1	1.120	1.125	1.573	.015

Note: Due to shaft design and material variations, we suggest that you request testing samples prior to placing orders
 1. Irregular hole. Request print.
 2. Internal and external teeth. Request print.

INTERNAL TOOTH RETAINERS

OTHER INTERNAL TOOTH SPRINGRIP RETAINERS



SHAFT SIZE DESIGN +/- .002	WCL PART NUMBER	INSIDE DIAMETER B		OUTSIDE DIAMETER A NOM.	MATERIAL THICKNESS
		MIN.	MAX.		
.078	8063-08-00	.068	.073	.220	.010
.094	8063-09-00	.081	.085	.180	.010
.094	8063-09-03	.081	.086	.265	.010
.087	8063-09-04	.080	.077	.180	.012
.112	8063-11-00	.102	.107	.258	.010
.120	8063-12-01	.110	.115	.265	.010
.125	8063-12-00	.113	.118	.265	.010
.135	8063-13-01	.122	.127	.263	.010
.145	8063-14-00	.133	.140	.281	.015
.156	8063-15-00	.146	.151	.332	.010
.156	8063-15-04	.146	.151	.332	.012
.162	8063-16-01*	.152	.157	.332	.010
.162	8063-16-02	.151	.155	.333	.020
.175	8063-17-02	.164	.166	.332	.010
.181	8063-18-09	.174	.170	.333	.010
.187	8063-18-10	.173	.178	.332	.010
.218	8063-21-01	.202	.207	.402	.013
.226	8063-22-00	.215	.220	.472	.015
.250	8063-25-00	.239	.244	.472	.015
.250	8063-25-03	.240	.235	.477	.025
.250	8063-25-05*	.239	.244	.734	.020
.250	8063-25-10*	.239	.244	.625	.020
.265	8063-26-00	.250	.255	.472	.013
.311	8063-31-00	.295	.301	.626	.020
.312	8063-31-00	.299	.304	.603	.015
.312	8063-31-07**	.288	.292	.598	.025
.312	8063-31-08	.304	.299	.473	.012
.330	8063-31-09	.318	.323	.472	.013
.343	8063-34-01	.328	.333	.687	.010
.375	8063-37-00	.360	.365	.687	.015
.421	8063-43-14	.390	.394	.781	.012
.421	8063-43-03*	.400	.410	.781	.017
.437	8063-43-02*	.427	.432	.781	.010
.437	8063-43-01	.427	.432	.687	.010
.475	8063-47-01	.467	.462	.781	.017
.500	8063-50-02	.493	.498	.781	.010
.552	8063-55-01*	.541	.546	1.000	.020
.625	8063-62-00	.610	.615	.968	.020
.625	8063-62-02	.610	.615	.968	.040
.703	8063-70-00	.686	.693	1.250	.029
.750	8063-75-03	.735	.740	.965	.010
.750	8063-75-01*	.735	.740	1.250	.020
.850	8063-85-00	.835	.840	1.192	.025
1.000	8063-99-04*	.970	.980	1.375	.015
1.062	8063-99-03	1.040	1.045	1.625	.012

Note: Due to shaft design and material variations, we suggest that you request testing samples prior to placing orders

* Part has flat outer rim.

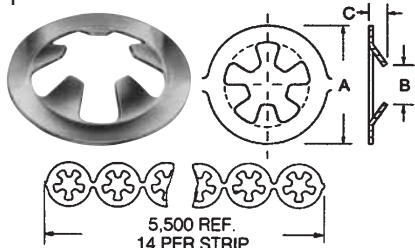
** Part has combination of gripping and pilot teeth.

INTERNAL TOOTH RETAINERS

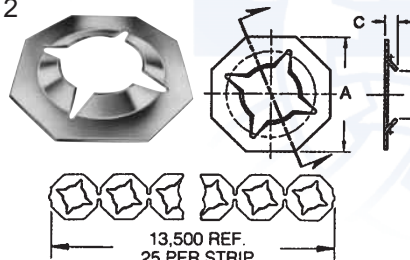
SPRINGRIP™ RETAINERS STRIP FORM

To facilitate installation, strips of 14 or 25 Springrips are available. These strips make RETAINER installation quick and easy. Springrips separate with a twist or lifting of the part.

Form 1



Form 2



* SHAFT SIZE DESIGN	WCL PART NUMBER	FORM	PART DIMENSIONS				STRIP LENGTH	PARTS PER STRIP
			A	B	C	MATERIAL THICKNESS		
.125	8063-12-09*	1	.365	.116	.048 Ref.	.015	5.500	14
.187	6101-00-00***	2	.500	.175	.051Ref	.015	13.500	25
.250	8070-25-00**	2	.500	.234	.063 Ref.	.015	13.500	25

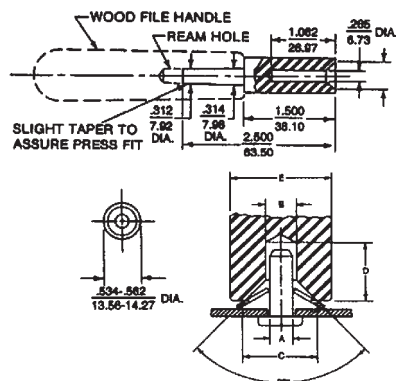
Material: * SAE 1075 Pretempered Carbon Steel. ** 1/2 Hard 301 Stainless Steel. *** 3/4 Hard 301/302 Stainless Steel.

NOTE: Due to shaft design and material variations, we suggest that you request samples prior to placing orders.

NOTE: Dimensions listed are nominal.

APPLICATION TOOLS FOR SPRINGRIP RETAINERS INTERNAL TOOTH

Simple tools can be used for fast, repetitive placement of Springrip retainers. These tools are easily produced in any shop or tool room.



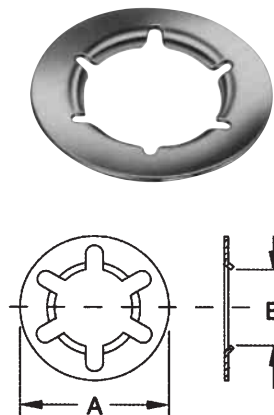
	SPRINGRIP FASTENER 8063-25-00	APPLICATION TOOL DIMENSIONS
A Shaft Diameter	.250	.265
B Clearance Hole Shaft Diameter + .015	.250	.422
C Outside Diameter of Part -.050	.472	.422
D Length of Shaft +.062	1.000 Ref.	1.062
E Outside Diameter of Part + .062	.472	.534

SPECIFICATIONS

Barring clearance restrictions, the outside diameter of the application tool is not critical and can be carried to the next even fractional diameter. For example, .534 diameter can be rounded in the diagram. Tools can be made from carbon drill or equivalent and attached to a simple wooden handle. See diagram and chart for typical tool specifications.

BEARING RETAINERS

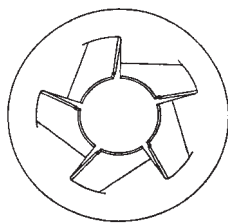
The internal projections, or teeth, on these retainers are slightly longer and a little more dished than those on our conventional retainers. As a result, the bearing is securely nested, but is free to rotate.



WCL PART NUMBER	INSIDE DIAMETER B		OUTSIDE DIAMETER A		MATERIAL THICKNESS
	MIN.	MAX.	MIN.	MAX.	
R-092218-1*	.217	.221	.558	.568	.018
R-092312-1	.231	.237	.552	.573	.012
R-052406-2	.244	.250	.336	.340	.006
R-102811-2	.278 REF.		.624	.628	.011
R-102808-2	.278 REF.		.624	.628	.008
R-122812-1	.270	.280	.757	.763	.012
R-123210-2	.315	.325	.757	.763	.010
R-163110-1	.328 REF.		.969	.975	.010
R-133410-1	.346 REF.		.784	.788	.010
R-133815-2	.375 REF.		.784	.788	.015
R-133815-1	.375 REF.		.784	.788	.015
R-143815-1	.360	.390	.873	.877	.015
R-144115-1	.406	.410	.867	.870	.015
R-134216-1*	.417	.423	.812		.016
R-164515-1	.465	.475	.985	1.015	.015
R-165020-1	.485	.515	.985	.995	.020
R-145118-1	.509	.515	.700		.018
R-187312-1*	.732	.738	1.083	1.103	.012
R-227525-1	.750 REF.		1.375 REF.		.025

* Special design - request print.

PUSH-ON BOLT RETAINERS



These economical, easily installed retainers are ideal for the many applications where it is necessary to position and securely retain a bolt or screw until a nut is applied at a later stage to complete the assembly.

When a nut is applied and tightened down, the teeth on the retainer set up a strut action that resists any loosening or back-off rotation.

Bolt Retainers are easily installed with a standard nutsetter (magnetic if desired), or with a simple, easily made, push-on tool.

INCH

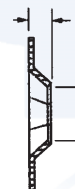
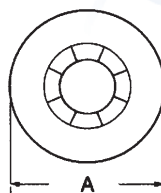
PALNUT#	CREST #	SCREW SIZE	O.D.	MATERIAL THICKNESS
PT138055		#6	11/32	.010
PT164006		#8	3/8	.010
PT164008		#8	1/2	.010
PT190007		#10	7/16	.012
PT250008	PB25050-10	1/4	1/2	.010
PT312010	PB31262-13	5/16	5/8	.013
	PB31262-18	5/16	5/8	.018
PT375125	PB37578-15	3/8	25/32	.015
PT438135		7/16	27/32	.015
PT500015		1/2	15/16	.015
PT562157		9/16	63/64	.015

METRIC

PALNUT#	CREST #	SCREW SIZE	O.D.	MATERIAL THICKNESS
PT040010	PBM495-10	M4	3/8	.010
PT050011		M5	7/16	.012
PT060013	PBM6129-10	M6	1/2	.010
PT060016	PBM6160-10	M6	5/8	.010
PT630013	PBM63127-10	M6.3	1/2	.010
PT080016		M8	5/8	.013
PT100020		M10	25/32	.015
PT120021	PBM1221-15-1	M12	27/32	.015
PT140025	PBM1425-15	M14	1	.015

INTERNAL TOOTH RETAINERS

WIDE RIM RETAINERS SLOTTED INTERNAL TOOTH



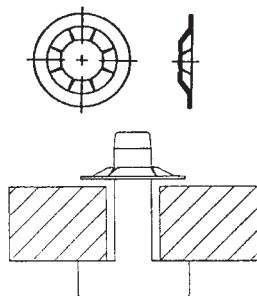
Wide Rim Shaft Retainers securely hold unthreaded shafts or rods while distributing holding force over wide area to protect soft or fragile bearing surfaces. Also effectively span oversize or elongated holes.

When pushed down over unthreaded studs, Wide Rim Retainers set up a strong strut action that requires a pull-off force 10 to 20 times greater than the force required to seat them. Typical stud or shaft materials are steel, plastic, zinc diecast and brass.

Wide Rim Shaft Retainers are widely used on toys, lawn and garden equipment, automotive interiors and exteriors, motors, hand tools, etc.

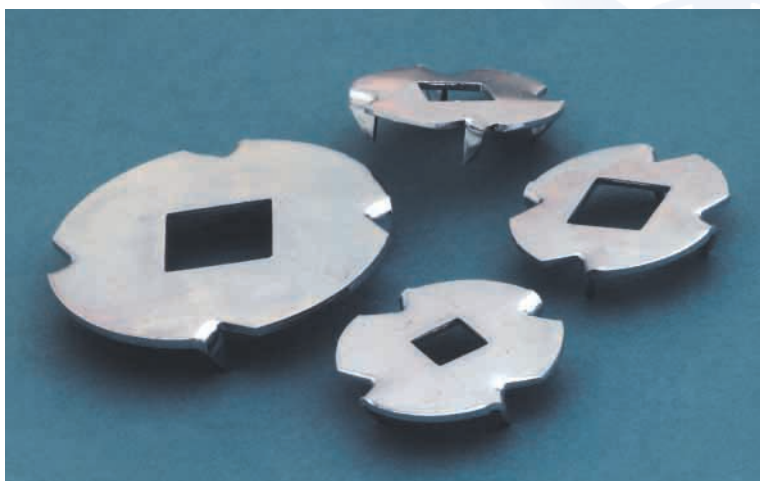
SHAFT SIZE DESIGN +/- .002	WCL PART NUMBER	INSIDE DIAMETER B		OUTSIDE DIAMETER A NOM.	HEIGHT (REF.)	MATERIAL THICKNESS
		MIN.	MAX.			
.158	8065-16-00	.142	.148	.472	.055	.012
.236	8065-23-00	.220	.226	.531	.072	.017
.311	8065-31-00	.295	.301	.626	.071	.020

OTHER WIDE RIM SHAFT RETAINERS



PALNUT#	CREST #	STUD SIZE	O.D.	MATERIAL THICKNESS
PS125306		1/8	3/8	.010
PS125006	P12537-13	1/8	3/8	.013
PD156007	P15643-13	5/32	7/16	.013
PS188307	P18843-10	3/16	7/16	.010
PS188007	P18843-15	3/16	7/16	.014
PS250385		1/4	17/32	.012
PS250085	P25053-17	1/4	17/32	.016
PS312310	P31262-15	5/16	5/8	.014
PS312010	P31262-21	5/16	5/8	.021
PS375312	P37575-17	3/8	3/4	.017
PS375012	P37575-25	3/8	3/4	.026
PS438014		7/16	7/8	.030
PS500016		1/2	1	.035

TORQUE WASHER LINE

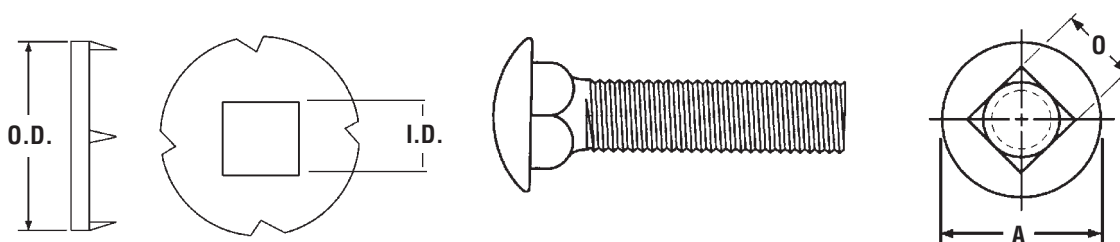


A complete line of unique square-holed Torque Washers is now available from WCL Company.

The square-holed washer is designed for use with a carriage bolt. Four bent prongs on the washer can be embedded in wood, plywood and other ductile materials, making the washer self-retaining during assembly. The finished square hole in the washer mates with the square shoulder on the carriage bolt. As the washer is fixed in place, the square shouldered bolt is

prevented from rotating. The washer also provides a smooth bearing surface and distributes the fastening load, preventing embedment in the soft material and the splitting and loss of holding power that can result.

WCL stocks Torque Washers with square inside diameters of 1/4", 5/16" and 3/8" in a 1" O.D. and a 1/2" square hole washer with a 1-3/4" O.D. Also available soon are 5/8" and 3/4" square hole with a 1-3/4" O.D.



Part Number	Size	I.D.	O.D.	THK	Carriage Bolt Size	Head Diameter (A)		Square Width	
						Min.	Max.	Min.	Max.
WCL-TWZ4	1/4"	.270	1.10	18GA	1/4"	.563	.594	.245	.260
WCL-TWZ5	5/16"	.345	1.10	18GA	5/16"	.688	.719	.307	.324
WCL-TWZ6	3/8"	.405	1.10	18GA	3/8"	.782	.844	.368	.388
WCL-TWZ6H	3/8"	.405	1.75	16GA	3/8"	.782	.844	.368	.388
WCL-TWZ8	1/2"	.535	1.75	16GA	1/2"	1.032	1.094	.492	.515
WCL-TWZ10	5/8"	.655	1.75	16GA	5/8"	1.219	1.344	.616	.642
WCL-TWZ12	3/4"	.775	1.75	16GA	3/4"	1.469	1.594	.741	.768

WCL'S MATERIAL AND FINISH CODES

MATERIALS AND FINISHES

Most of the washers shown in this catalog are available in the following materials and finishes.

Materials

- C1050 Spring Steel
- 400 Series Stainless Steel
- 300 Series Stainless Steel
- Bronze
- Aluminum
- Beryllium Copper
- K-Monel

Finishes

- Plain
- Zinc, .00015" thick

Other materials and finishes are available on special request.

APPROVALS

Shakeproof Lockwashers qualify under the majority of Standards requirements established by the Armed Forces, American Standards Association, the Society of Automotive Engineers and the American Society of Mechanical Engineers for components of this type.

Military Specifications

MS 3533, MS 35334, MS 35335, MS 35336 and MS 45904

American Society of Mechanical Engineers

ASME B 18.21.1

Federal Specifications

FF-W-100

Laboratory Accreditation

ITW Shakeproof (Elgin) A2LA Approved

METRIC SIZES

External Tooth and Internal Tooth washers are available in metric sizes to DIN 6797-A and DIN 6797-J, respectively. Most other types of tooth washers are available in metric soft conversions. Please inquire with WCL sales for specification charts that are available to be faxed on soft conversions to ITW standards.

NOTE: All data in this catalog is presented as a general guide. The configuration of some special parts may vary slightly from the typical products depicted in photographs and drawings. Specifications are subject to modification without notice. Extended inactivity may result in discontinuance of individual parts without notice. It may be helpful to request a sales print before ordering a new part.

MIL-SPEC TEST REQUIREMENTS

Any specifications for **MIL-SPEC** hardware (such as **AN**, **MS** and **NAS** parts) includes the tests that parts are required to pass to qualify as **MIL-SPEC** parts.

As a service to its valued customers, **WCL** offers the following as a general guide to test and certification requirements for the **MIL-SPEC** hardware items it sells.

FLAT WASHERS

MIL-SPEC designations for flat washers include, but are not limited to, **AN960**, **MS15795**, **MS27183**, **NAS620**, and **NAS1252**. These are covered by military procurement specification **FF-W-92** which has, as minimum requirements.

- | | |
|---|---|
| 1. Chemical analysis | 3. Workmanship |
| 2. Process certification on protective finish | 4. Magnetic permeability (stainless steel only) |

HELICAL SPRING LOCKWASHERS

MIL-SPEC designations include, but are not limited to, **MS35338**, **MS35340**, **MS51848**, **NAS1640** and **NAS1676**. These are covered by military procurement specification **ASME B18.21.1** or **FF-W-84** which has some, or all, of the following.

- | | |
|----------------------|--|
| 1. Interlinking test | 6. Chemical analysis (mill certification acceptable) |
| 2. Free height test | 7. Magnetic permeability (on stainless steel) |
| 3. Twist test | 8. Process certification on protective finish |
| 4. Pressure test | 9. Decarb test (on carbon steel) |
| 5. Hardness test | 10. Embrittlement test (electro plated) |

SPRING WASHERS - CURVED, WAVE AND BELLEVILLE

MIL-SPEC designations for spring washers include but are not limited to, **M12133/1** and **M12133/2** and are covered by military specification **MIL-W-12133** which has, as minimum requirements:

- | | |
|--|--|
| 1. Chemical analysis | 5. Decarburization (carbon steel only) |
| 2. Process certification on protective coating and surface treatment | 6. Load Deflection |
| 3. Inspection for cracks | 7. Permanent set |
| 4. Hardness test | 8. Repeated loading |

TOOTH LOCKWASHERS

MIL-SPEC designations for tooth lockwashers include, but are not limited to **MS35333**, **MS35335**, **MS35336**, **MS35790** and **MS45904**. These are covered by military procurement specification **ASME B18.21.1** or **FF-W-100** which has some or all of the following.

- | | |
|---|--|
| 1. Hardness test | 5. Spread test |
| 2. Process certification on protective finish | 6. Twist test |
| 3. Chemical analysis | 7. Temper test |
| 4. Compression and flattening test | 8. Decarb test (on carbon steel) |
| | 9. Embrittlement test (electro plated) |

The above list provides a guide relating to the most popular types of MIL-SPEC washers. It should not be construed as a complete list of all military specifications and documents pertaining to washers or as a list of all tests or analysis that may be required.

Many OEM's also have special requirements (including testing) that must be met to be in compliance with their part specifications and purchase requirements.

Review all relevant documents carefully before requesting quotations to avoid unexpected costs for testing and analysis. When in doubt, discuss the requirements with your **WCL** sales associates.

Remember, if it has not been properly tested, it is not MIL-SPEC hardware.

CERTIFICATIONS AVAILABLE

WCL Company maintains quality control per MIL-I-45208A and maintains certification on most parts for a minimum of seven years after date of purchase. Certifications on file at WCL Company are available for customer or government review, at our facility, upon reasonable request.

The following are some of the Certificates of Compliance and test results available from WCL Company for certifications on file.

TYPE	SOURCE
CERTIFICATES OF COMPLIANCE	<p>WCL Company - certifies part compliance with customers purchase order. Comes standard with every order. No Charge</p> <p>In most cases, manufacturer's Certificates of Compliance can be supplied on request. Please note: WCL Company's suppliers have their own part numbers which may appear on certifications and may or may not be the same as Military and/or O.E.M. part numbers. \$20.00</p>
CHEMICAL AND HARDNESS TESTS	<p>Test results can be provided on WCL letterhead as verified by our supplier or by independent laboratory test. \$10.00</p> <p>Most results can also be provided on manufacturer's letterhead. \$20.00</p>
PROCUREMENT SPECIFICATION REQUIREMENTS	<p>Compliance with procurement specification requirements, as tested by one or more of the following: our supplier, independent laboratory and/or WCL Quality Control Department, can be certified on WCL letterhead. \$10.00</p> <p>Certification similar to the above, on manufacturer's letterhead, can be provided in most cases \$30.00</p>
PLATING	<p>In most cases, copies of plating certifications from plating processors can be supplied on request. \$10.00</p>
MISCELLANEOUS	<p>Not all tests and required certifications are listed above. If the test certification you require is not shown, check with your WCL sales representatives.</p>
ORDERING INFORMATION	<p>An example of a WCL part number reads as follows: FW-0266-0625-049-ST1-ZN1</p> <p style="text-align: center;"> <u>FW</u> <u>.266</u> <u>.625</u> <u>.049</u> <u>ST1</u> <u>ZN1</u> MAT=Material ST1=Commercial Steel Type I.D. O.D. THK. MAT FIN FIN=Finish ZN1=Zinc and Clear </p>

FASTENERS IN STOCK AT WCL



Standard Tooth Lock Washers



Serns® Preassembled Screws & Washers



Panel Fasteners and Clips



Helical Spring Lock Washers



Thread Forming and Self Drilling Screws



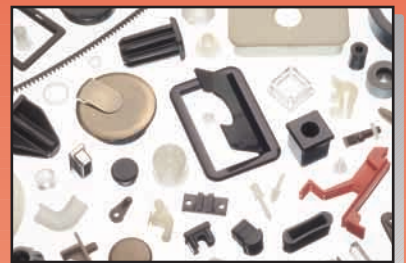
Standoffs



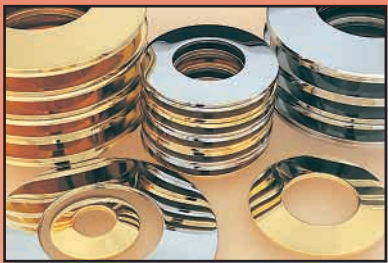
Special Tooth Lock Washers



Brass Inserts For Plastics



Furniture Components



Belleville Disc Springs



Metallic Flat Washers



Non-Metallic Flat Washers



Spring Washers



Special Stampings



Retainers - Internal or External



WEST COAST LOCKWASHER, 16730 East Johnson Drive, P.O. Box 3588 Industry, CA 91744

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