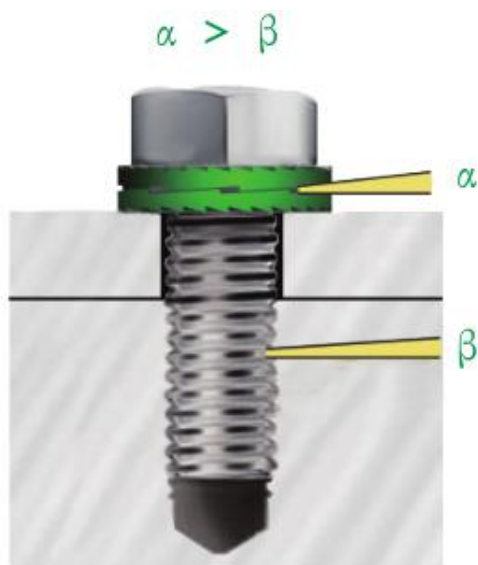
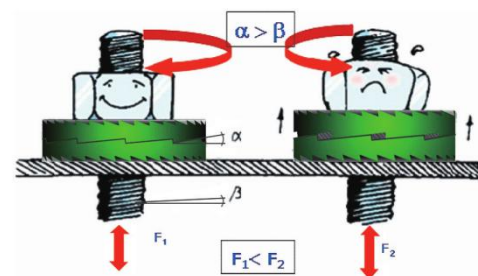


## Product working principle

The unique wedge-type structure of TOP-LOCK® washer changes the traditional lock method that relies on friction, and adopts the international advanced lock technology, which uses tension to prevent the loosening of the connector during strong vibration.

The hardness of TOP-LOCK® washer is greater than the hardness of the supporting bolt/nut and the lower surface connection workpiece (the hardness of the lock washer is shown in the following table). When the nut or bolt is tightened, the outer teeth of the lock washer are inserted into the workpiece and nut to form a whole. The angle of inclination  $\alpha$  of the washer cam is bigger than the pitch  $\beta$  of the screw thread. When the fastener is tightened, the knurled surfaces grip both the bearing surface of the fastener and the material into which the screw is being fastened. The larger angle of the cam  $\alpha$ , compared to the smaller angle of the screw thread  $\beta$ , will not allow the screw to loosen because of the tension caused by the cam lifting. When the operation of the device stops, the tensile force of the bolt forces the bolt/nut back to the initial installation position (self-locking).



## The benefits of TOP-LOCK® washers

- Ensure that the clamping force of the connector is still maintained under strong vibration, which is better than fasteners that rely on friction to prevent loosening
- Prevent bolt loosening caused by vibrations, avoid some related problems caused by fasteners loose.
- Do not need special installation tool, easy to install and disassemble.
- Locking function is not affected by lubricating oil.
- Temperature variation will not make fasteners loose.
- Excellent durability.
- Reusable without loss of performance
- Can use high/low load locking fixed components

## Vibration test according to standard DIN25201 and DIN65151

TOP-LOCK®Material	Scope	Hardness	Salt spray test
Steel washer (Delta protekt® surface coating)	large diameter (expressed in "SP")	$\geq 465\text{HV1}$	>600h
Stainless steel EN1.4404 alloy steel	arge diameter(expressed in "SPSS")	$\geq 520\text{HV0.05}$	>1000h

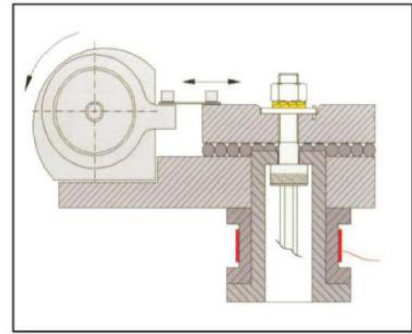
Note: special material, left-hand thread can according to customer request production and processing (such as INCONEL®718/254SMO, etc.)

## Vibration test of TOP-LOCK® washers

Fittings vibration test is one of the reliability of the bolt connection methods. The vibration test of TOP-LOCK® secure fastening system conforms to the DIN 65151 standard and DIN 25201 standard. Pre-tightening force (bolt tensile) is measured by the radial force transducer.

The locking effect with TOP-LOCK® standard nuts is greater than with ordinary ones (such as nut of nylon material). Bolt by the friction between the screw thread lock, thus lost most of the pre-tightening force produced by vibration. This is mainly caused by the sink in the thread. And those from TOP-LOCK® fixed parts only show a small part lost pre-tightening force.

When using TOP-LOCK® washer, after appropriate tighten nut, bolt is firmly locked. Solid locking performance is that pre-tightening force increased when using wrench to loosen the nut (rather than loose nut in an instant). This is the unique feature of TOP-LOCK® washer.



Amplitude:  $\pm 0.3\text{mm}$

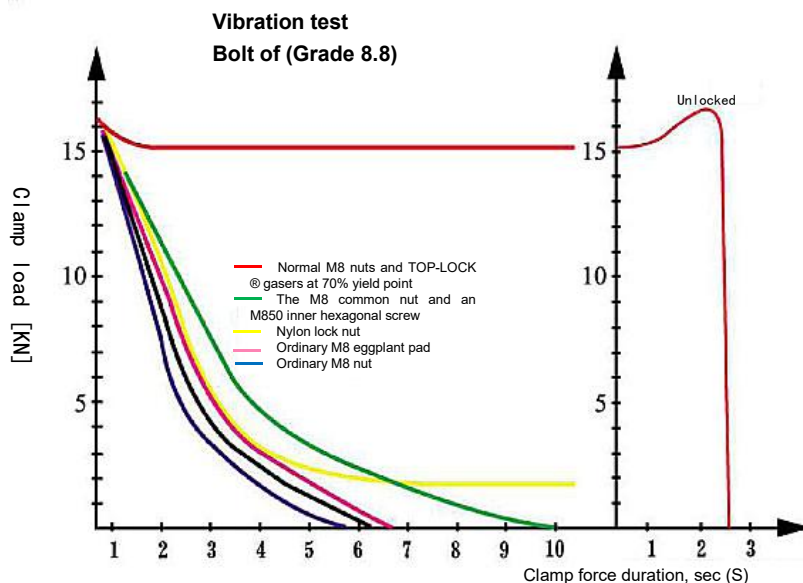
Frequency: 40Hz

Standard force length: 25mm

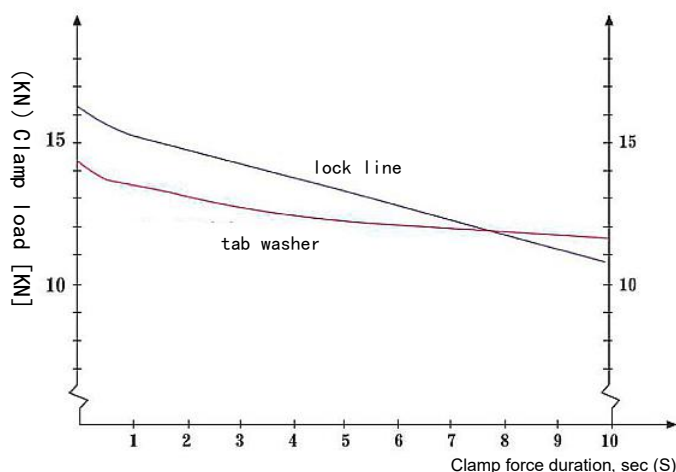
Hardness of fastening material: HRA63-65



TOP-LOCK® locking and fastening systems serve high-standard and demanding industries such as rail transit, Marine Bridges, heavy machinery, industrial machinery, aerospace, wind power, nuclear power plants, etc.



Vibration testing for lock line and the tab washer

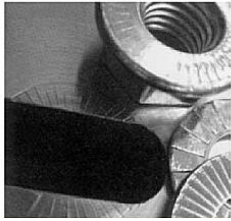


Ear washer

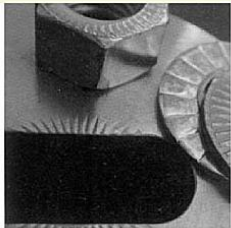


stitching machine

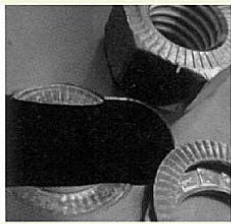
## Long hole parts and soft materials



Flange nuts are used with TOP-LOCK® large outside diameter washers



Coated surfaces using TOP-LOCK® standard outer diameter washers

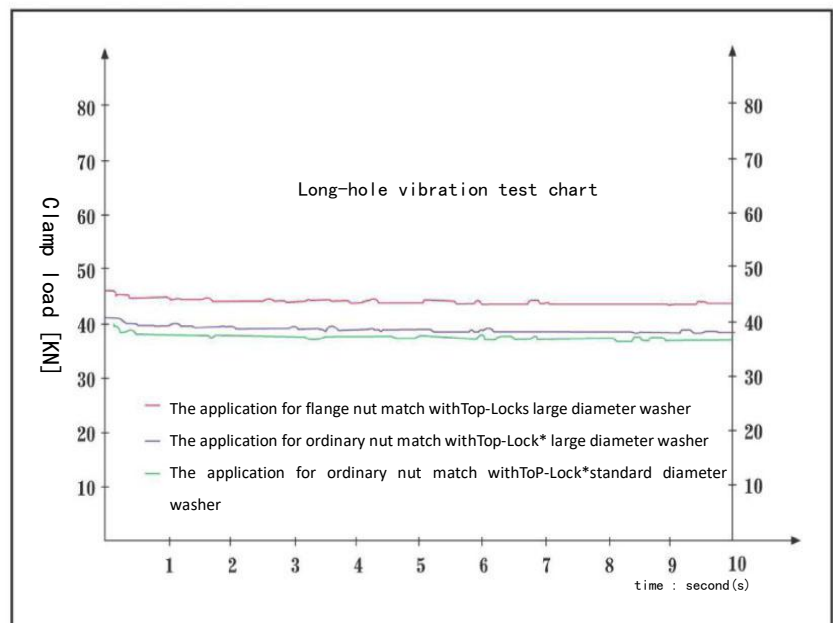


Ordinary nuts are used with TOP-LOCK® standard outer diameter washers

In order to increase the force area and protect the surface integrity of the workpiece, it is recommended to use flanged nuts and bolts to attach large outside diameter TOP-LOCK® washers.

Standard bolts and standard TOP-LOCK® washers are also usually available. However, it is best to perform a tightening test to determine the use of standard or large outside diameter washers.

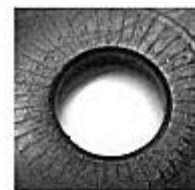
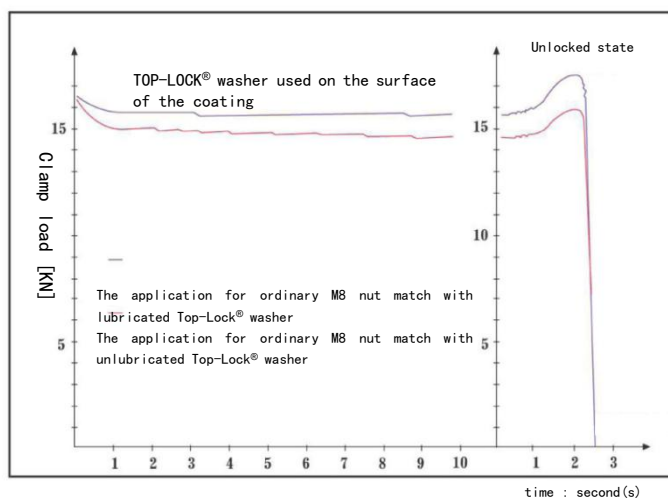
Long-hole vibration test chart



## Coated surface

When tightening on a coated surface, if the coating is thicker and softer, it is possible to slip, and if it is a hard coating, it will not slide between the washer and the nut or nut. TOP-LOCK® large outside diameter washers are recommended for this type of operation.

Lubricated bolts are used in vibration test charts for coated surfaces



Coated surfaces using TOP-LOCK® large outside diameter washers



Coated surfaces using TOP-LOCK® standard outer diameter washers

# TOP-LOCK® steel washer

EN1.7182 or equivalent. Coated (Delta Protekt®) , quenched

Specification Table

Washer size	Bolt size		$\Phi i$ [mm]	$\Phi o$ [mm]	Th T [mm]	Min package (pairs)	App. weight kg/100pairs
	Metric	Inch					
TL3	M3	#5	3.4	7.0	1.8	200	0.03
TL3.5	M3.5	#6	3.9	7.6	1.8	200	0.04
TL3.5sp	M3.5	#6	3.9	9.0	1.8	200	0.06
TL4	M4	#8	4.4	7.6	1.8	200	0.04
TL4sp	M4	#8	4.4	9.0	1.8	200	0.06
TL5	M5	#10	5.4	9.0	1.8	200	0.05
TL5sp	M5	#10	5.4	10.8	1.8	200	0.11
TL6	M6		6.5	10.8	1.8	200	0.07
TL6sp	M6		6.5	13.5	2.5	200	0.20
TL1/4"		1/4"	7.2	11.5	2.5	200	0.08
TL1/4"sp		1/4"	7.2	13.5	2.5	200	0.18
TL8	M8	5/16"	8.7	13.5	2.5	200	0.15
TL8sp	M8	5/16"	8.7	16.6	2.5	200	0.28
TL3/8"		3/8"	10.3	16.6	2.5	200	0.23
TL3/8"sp		3/8"	10.3	21.0	2.5	200	0.48
TL10	M10		10.7	16.6	2.5	200	0.22
TL10sp	M10		10.7	21.0	2.5	200	0.47
TL11	M11	7/16"	11.4	18.5	2.5	200	0.29
TL12	M12		13.0	19.5	2.5	200	0.29
TL12sp	M12		13.0	25.4	3.4	100	0.93
TL1/2"		1/2"	13.5	19.5	2.5	200	0.27
TL1/2"sp		1/2"	13.5	25.4	3.4	100	0.90
TL14	M14	9/16"	15.2	23.0	3.4	100	0.56
TL14sp	M14	9/16"	15.2	30.7	3.4	100	1.41
TL16	M16	5/8"	17.0	25.4	3.4	100	0.67
TL16sp	M16	5/8"	17.0	30.7	3.4	100	1.28
TL18	M18		19.5	29.0	3.4	100	0.85
TL18sp	M18		19.5	34.5	3.4	100	1.58
TL3/4"		3/4"	20.0	30.7	3.4	100	1.05
TL3/4"sp		3/4"	20.0	39.0	3.4	100	2.21
TL20	M20		21.4	30.7	3.4	100	0.93
TL20sp	M20		21.4	39.0	3.4	100	2.09
TL22	M22	7/8"	23.4	34.5	3.4	100	1.25
TL22sp	M22	7/8"	23.4	42.0	4.6	50	3.19
TL24	M24		25.3	39.0	3.4	100	1.74
TL24sp	M24		25.3	48.5	4.6	50	4.51
TL1"		1"	27.9	39.0	3.4	100	1.53
TL1"sp		1"	27.9	48.5	4.6	50	4.20
TL27	M27		28.4	42.0	5.8	50	3.14
TL27sp	M27		28.4	48.5	5.8	25	5.27
TL30	M30	1 1/8"	31.4	47.0	5.8	50	4.10
TL30sp	M30	1 1/8"	31.4	58.5	6.6	25	8.58
TL33	M33	1 1/4"	34.4	48.5	5.8	25	3.89
TL33sp	M33	1 1/4"	34.4	58.5	6.6	25	8.00
TL36	M36	1 3/8"	37.4	55.0	5.8	25	5.49
TL36sp	M36	1 3/8"	37.4	63.0	6.6	25	9.15
TL39	M39	1 1/2"	40.4	58.5	5.8	25	5.89
TL42	M42		43.2	63.0	5.8	25	7.97
TL45	M45	1 3/4"	46.2	70.0	7.0	25	10.20
TL48	M48		49.6	75.0	7.0	25	12.00
TL52	M52	2"	53.6	80.0	7.0	25	13.00
TL56	M56	2 1/4"	59.1	85.0	7.0	10	13.50
TL60	M60		63.1	90.0	7.0	10	15.20
TL64	M64	2 1/2"	67.1	95.0	7.0	10	16.70
TL68	M68		71.1	100.0	9.5	1	28.20
TL72	M72		75.1	105.0	9.5	1	30.70
TL76	M76	3"	79.1	110.0	9.5	1	33.30
TL80	M80	3 1/8"	83.1	115.0	9.5	1	36.00
TL85	M85		88.1	120.0	9.5	1	37.80
TL90	M90		92.4	130.0	9.5	1	47.70
TL95	M95		97.4	135.0	9.5	1	49.80
TL100	M100	4"	103.4	145.0	9.5	1	58.90
TL105	M105		108.4	150.0	9.5	1	61.30
TL110	M110		113.4	155.0	9.5	1	63.50
TL115	M115		118.4	165.0	9.5	1	75.30
TL120	M120		123.4	170.0	9.5	1	77.90
TL125	M125		128.4	173.0	9.5	1	76.60
TL130	M130	5"	133.4	178.0	9.5	1	79.20

TL3-TL8

$\Phi i \pm 0.1\text{mm}$

TL10-TL42

$\Phi i \pm 0.2\text{mm}$

TL45-TL130

$\Phi i + 0.5/-0.0\text{mm}$

TL3-TL24

$\Phi o \pm 0.2\text{mm}$

TL27-TL42

$\Phi o \pm 0.3\text{mm}$

TL45-TL130

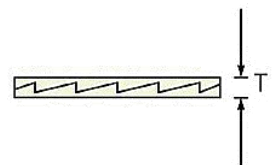
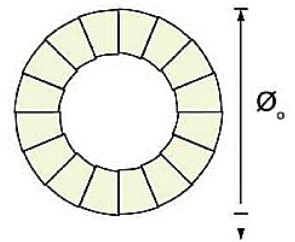
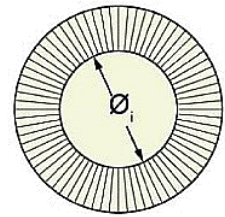
$\Phi o + 0.0/-2.0\text{mm}$

TL3-TL42

$T \pm 0.25\text{mm}$

TL45-TL130

$T \pm 0.75\text{mm}$



Note: there is a tolerance +/- 0.0 0 5 mm for the washer with thickness is 6.6 mm

Note: if the size change failed to notice in advance, Please refer to the actual size.

# Reference torque

TOP-LOCK®steel washer(Delta protekt)®

TOP-LOCK®steel washer and 4.8 class bolts

Washer size	Bolt size	Pitch [mm]	Oil, G <sub>r</sub> =75% μ <sub>is</sub> =0.10, μ <sub>s</sub> =0.16		GTP600, G <sub>r</sub> =75% μ <sub>is</sub> =0.08, μ <sub>s</sub> =0.15		干, G <sub>r</sub> =62% μ <sub>is</sub> =0.15, μ <sub>s</sub> =0.18	
			torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]
TL3	M3	0.5	0.7	1.2	0.6	1.2	0.7	1.0
TL4	M4	0.7	1.5	2.1	1.4	2.1	1.5	1.7
TL5	M5	0.8	3	3.4	2.8	3.4	3	2.8
TL6	M6	1.0	5.2	4.8	4.9	4.8	5.3	4
TL8	M8	1.25	12.5	8.8	11.8	8.8	12.6	7.3
TL10	M10	1.5	25	14	23	14	25	12
TL12	M12	1.75	42	20	40	20	43	17
TL14	M14	2.0	68	28	63	28	68	23
TL16	M16	2.0	103	38	96	38	104	31
TL18	M18	2.5	144	46	135	46	146	38
TL20	M20	2.5	201	59	189	59	204	49
TL22	M22	2.5	266	69	249	69	268	57
TL24	M24	3.0	346	85	325	85	351	70
TL27	M27	3.0	505	110	473	110	514	91
TL30	M30	3.5	690	135	646	135	700	111
TL33	M33	3.5	927	167	868	167	944	138
TL36	M36	4.0	1197	196	1121	196	1218	162
TL39	M39	4.0	1543	234	1445	234	1573	194
TL42	M42	4.5	1941	276	1816	276	1982	228

TOP-LOCK® steel washers and class 10.9 uncoated bolts

Washer size	Bolt size	Pitch [mm]	Oil G <sub>r</sub> =71% μ <sub>is</sub> =0.13, μ <sub>s</sub> =0.14		GTP600, G <sub>r</sub> =75% μ <sub>is</sub> =0.08, μ <sub>s</sub> =0.13	
			torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]
TL3	M3	0.5	1.8	3.2	1.6	3.4
TL4	M4	0.7	4.1	5.6	3.6	5.9
TL5	M5	0.8	8.1	9.1	7.0	9.6
TL6	M6	1.0	14.1	12.9	12.3	13.6
TL8	M8	1.25	34	23	30	25
TL10	M10	1.5	67	37	58	39
TL12	M12	1.75	115	54	99	57
TL14	M14	2.0	183	74	158	78
TL16	M16	2.0	279	100	240	106
TL18	M18	2.5	391	123	337	130
TL20	M20	2.5	547	156	470	165
TL22	M22	2.5	745	194	639	205
TL24	M24	3.0	942	225	809	238
TL27	M27	3.0	1375	294	1176	310
TL30	M30	3.5	1875	358	1608	378
TL33	M33	3.5	2526	443	2157	468
TL36	M36	4.0	3259	522	2788	551
TL39	M39	4.0	4203	624	2588	659
TL42	M42	4.5	5202	716	4445	757

TOP-LOCK®steel washer and 8.8 class bolts

Washer size	Bolt size	Pitch [mm]	Oil G <sub>r</sub> =75% μ <sub>is</sub> =0.10, μ <sub>s</sub> =0.16		GTP600, GF=75% μ <sub>is</sub> =0.08, μ <sub>s</sub> =0.15		干, GF=62% μ <sub>is</sub> =0.15, μ <sub>s</sub> =0.18	
			torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]
TL3	M3	0.5	1.3	2.4	1.2	2.4	1.3	2
TL4	M4	0.7	3.1	4.2	2.8	4.2	3.1	3.5
TL5	M5	0.8	6.0	6.8	5.4	6.8	6	5.6
TL6	M6	1.0	10.5	9.7	9.5	9.7	10.5	8
TL8	M8	1.25	25	18	23	18	25	15
TL10	M10	1.5	49	28	45	28	50	23
TL12	M12	1.75	85	40	77	40	85	33
TL14	M14	2.0	135	55	122	55	136	46
TL16	M16	2.0	205	75	185	75	208	62
TL18	M18	2.5	288	92	260	92	291	76
TL20	M20	2.5	402	118	363	118	408	97
TL22	M22	2.5	548	146	494	146	557	120
TL24	M24	3.0	693	169	625	169	703	140
TL27	M27	3.0	1010	221	910	221	1028	182
TL30	M30	3.5	1379	269	1243	269	1401	222
TL33	M33	3.5	1855	333	1669	333	1889	275
TL36	M36	4.0	2394	392	2156	392	2436	324
TL39	M39	4.0	3087	468	2777	468	3145	387
TL42	M42	4.5	3820	538	3439	538	3890	445

TOP-LOCK®steel washers and class 12.9 uncoated bolts

Washer size	Bolt size	Pitch [mm]	Oil GF=71% μ <sub>is</sub> =0.13, μ <sub>s</sub> =0.12		GTP600, GF=75% μ <sub>is</sub> =0.08, μ <sub>s</sub> =0.11	
			torque [Nm]	Clamping force load[kN]	torque [Nm]	Clamping force load[kN]
TL3	M3	0.5	2	3.9	1.7	4.1
TL4	M4	0.7	4.6	6.7	4.0	7.1
TL5	M5	0.8	9.1	10.9	7.7	11.5
TL6	M6	1.0	15.8	15.4	13.5	16.3
TL8	M8	1.25	38	28	32	30
TL10	M10	1.5	75	44	64	47
TL12	M12	1.75	128	65	109	68
TL14	M14	2.0	204	89	174	94
TL16	M16	2.0	311	120	263	127
TL18	M18	2.5	437	148	370	156
TL20	M20	2.5	610	188	515	198
TL22	M22	2.5	831	233	699	246
TL24	M24	3.0	1052	270	887	286
TL27	M27	3.0	1533	352	1288	372
TL30	M30	3.5	2091	430	1761	454
TL33	M33	3.5	2815	532	2362	562
TL36	M36	4.0	3633	626	3053	662
TL39	M39	4.0	4683	748	3925	790
TL42	M42	4.5	5799	860	4866	908

Reference torques for other bolt classes are available through our local TOP-LOCK® sales representatives

GTP600=Graphite lubricant

GF=yield rate

μth=thread friction coefficient

μh=coefficient of washer friction



# TOP-LOCK® Stainless steel washer

EN1.4404 or equivalent

Surface hardening, PREN corrosion resistance equivalent of 27\*\*.

Use in chlorine-free or acid-free environments.

Specification Table

Washer size	Bolt size		φi[mm]	φ0[mm]	Th T[mm]	Min package (pairs)	App.weight kg/100pairs
	Metric	Inch					
TL3ss	M3	#5	3.4	7.0	2.2	200	0.04
TL3.5ss	M3.5	#6	3.9	7.6	2.2	200	0.04
TL3.5spss	M3.5	#6	3.9	9.0	2.2	200	0.07
TL4ss	M4	#8	4.4	7.6	2.2	200	0.04
TL4spss	M4	#8	4.4	9.0	2.2	200	0.07
TL5ss	M5	#10	5.4	9.0	2.2	200	0.06
TL5spss	M5	#10	5.4	10.8	2.2	200	0.11
TL6ss	M6		6.5	10.8	2.2	200	0.09
TL6spss	M6		6.5	13.5	2.0	200	0.16
TL1/4"ss		1/4"	7.2	11.5	2.2	200	0.09
TL1/4"spss		1/4"	7.2	13.5	2.2	200	0.15
TL8ss	M8	5/16"	8.7	13.5	2.0	200	0.12
TL8spss	M8	5/16"	8.7	16.6	2.0	200	0.23
TL3/8"ss		3/8"	10.3	16.6	2.0	200	0.19
TL3/8"spss		3/8"	10.3	21.0	2.0	200	0.38
TL10ss	M10		10.7	16.6	2.0	200	0.18
TL10spss	M10		10.7	21.0	2.0	200	0.37
TL11ss	M11	7/16"	11.4	18.5	2.2	200	0.26
TL12ss	M12		13.0	19.5	2.0	200	0.23
TL12spss	M12		13.0	25.4	3.0	100	0.82
TL1/2"ss		1/2"	13.5	19.5	2.0	200	0.22
TL1/2"spss		1/2"	13.5	25.4	3.2	100	0.80
TL14ss	M14	9/16"	15.2	23.0	3.0	100	0.49
TL14spss	M14	9/16"	15.2	30.7	3.2	100	1.31
TL16ss	M16	5/8"	17.0	25.4	3.0	100	0.59
TL16spss	M16	5/8"	17.0	30.7	3.2	100	1.13
TL18ss	M18		19.5	29.0	3.2	100	0.80
TL18spss	M18		19.5	34.5	3.2	100	1.56
TL3/4"ss		3/4"	20.0	30.7	3.2	100	0.96
TL3/4"spss		3/4"	20.0	39.0	3.2	100	2.10
TL20ss	M20		21.4	30.7	3.0	100	0.82
TL20spss	M20		21.4	39.0	3.2	100	2.06
TL22ss	M22	7/8"	23.4	34.5	3.2	100	1.23
TL22spss	M22	7/8"	23.4	42.0	3.2	50	2.22
TL24ss	M24		25.3	39.0	3.2	100	1.59
TL24spss	M24		25.3	48.5	3.2	50	3.50
TL1"ss		1"	27.9	39.0	3.2	100	1.42
TL1"spss		1"	27.9	48.5	3.2	50	2.79
TL27ss	M27		28.4	42.0	6.8	50	3.45
TL27spss	M27		28.4	48.5	6.8	25	5.34
TL30ss	M30	1 1/8"	31.4	47.0	6.8	50	4.49
TL30spss	M30	1 1/8"	31.4	58.5	6.8	25	9.18
TL33ss	M33	1 1/4"	34.4	48.5	6.8	25	4.28
TL36ss	M36	1 3/8"	37.4	55.0	6.8	25	5.96
TL39ss	M39	1 1/2"	40.4	58.5	6.8	25	6.74
TL42ss	M42		43.2	63.0	6.8	25	7.50
TL45ss	M45	1 3/4"	46.2	70.0	6.8	25	10.20
TL48ss	M48		49.6	75.0	6.8	25	12.00
TL52ss	M52	2"	53.6	80.0	9.0	1	18.04
TL56ss	M56	2 1/4"	59.1	85.0	9.0	1	21.30
TL60ss	M60		63.1	90.0	9.0	1	23.50
TL64ss	M64	2 1/2"	67.1	95.0	9.0	1	25.80
TL68ss	M68		71.1	100.0	9.0	1	28.20
TL72ss	M72		75.1	105.0	9.0	1	30.70
TL76ss	M76	3"	79.1	110.0	9.0	1	33.30
TL80ss	M80	3 1/8"	83.1	115.0	9.0	1	36.00

TL3SS-TL8SS

Φi±0.1mm

TL10SS-TL42SS

Φi±0.2mm

TL45SS-TL80SS

Φi+0.5/-0.0mm

TL3SS-TL24SS

Φo±0.2mm

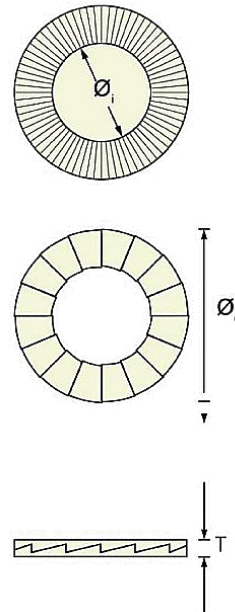
TL27SS-TL42SS

Φo±0.3mm

TL45SS-TL80SS

Φo+0.0/-2.0mm

TL3SS-TL24SS



Note: if the size change failed to notice in advance,  
Please refer to the actual size.

## Reference torque

TOP-LOCK® stainless steel washers and stainless steel bolts work together under the condition of GTP600 lubricant

Washer size	Bolt size	Pitch [mm]	A2-50, A4-50 GF=65% μth=0.14, μb=0.15		A2-70, A4-70 GF=65% μth=0.14, μb=0.15		A2-80, A4-80 GF=65% μth=0.14, μb=0.15	
			torque [Nm]	Clamping force load [kN]	torque [Nm]	Clamping force load [kN]	torque [Nm]	Clamping force load [kN]
TL3SS	M3	0.5	0.4	0.7	0.9	1.5	1.2	2.0
TL4SS	M4	0.7	0.9	1.2	2.0	2.6	2.7	3.4
TL5SS	M5	0.8	1.8	1.9	3.9	4.1	5.3	5.5
TL6SS	M6	1.0	3.2	2.7	6.9	5.9	9.2	7.8
TL8SS	M8	1.25	7.7	5	17	11	22	14
TL10SS	M10	1.5	15	8	33	17	43	23
TL12SS	M12	1.75	26	12	56	25	75	33
TL14SS	M14	2.0	42	16	89	34	119	45
TL16SS	M16	2.0	64	21	136	46	181	61
TL18SS	M18	2.5	89	26	191	56	254	75
TL20SS	M20	2.5	125	33	267	72	356	95
TL22SS	M22	2.5	170	41	364	89	485	118
TL24SS	M24	3.0	214	48	460	103	613	137
TL27SS	M27	3.0	313	63	671	134	895	179
TL30SS	M30	3.5	427	77	915	164	1220	219
TL33SS	M33	3.5	575	95	123	203	1644	270
TL36SS	M36	4.0	742	111	159	239	2121	319
TL39SS	M39	4.0	958	133	205	285	2737	381
TL42SS	M42	4.5	1185	153	254	328	3386	437

GTP600= Graphite lubricant

GF= yield rate

μth= thread friction coefficient

μb= coefficient of washer friction

Reference torques for other bolt classes are available through our local TOP-LOCK® sales representatives

## EN1.4547 or equivalent

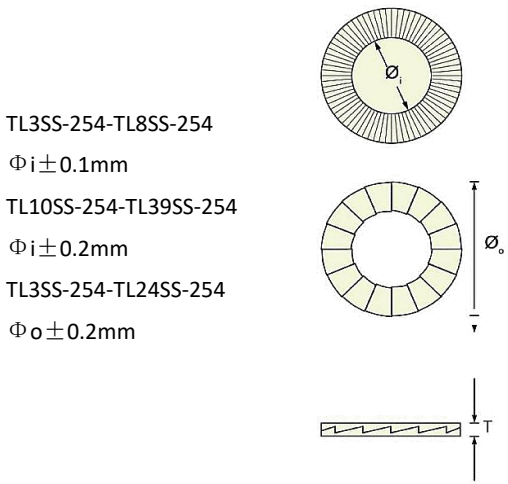
254SMO® is a high performance austenitic stainless steel (EN1.4547 compliant) with strong mechanical strength and corrosion resistance. Due to the high content of Cr, Ni, Mo and N, this material has strong resistance to pitting and linear corrosion.

TOP-LOCK® washer( 254SMO®) is a special design that is particularly useful in environments where EN1.4404 stainless steel washers are not available. Such as chlorine rich environment, salt water environment or gas environment.

### Specification Table

Washer size	Bolt size		Φ i	Φ o	Th	Min package (pairs)	App.weight kg/100pairs
	Metric	Inch	[mm]	[mm]	T[mm]		
TL3ss-254	M3	#5	3.4	7.0	2.2	200	0.04
TL3.5ss-254	M3.5	#6	3.9	7.6	2.2	200	0.04
TL3.5spss-254	M3.5	#6	3.9	9.0	2.2	200	0.07
TL4ss-254	M4	#8	4.4	7.6	2.2	200	0.04
TL4spss-254	M4	#8	4.4	9.0	2.2	200	0.07
TL5ss-254	M5	#10	5.4	9.0	2.2	200	0.06
TL5spss-254	M5	#10	5.4	10.8	2.2	200	0.11
TL6ss-254	M6		6.5	10.8	2.2	200	0.09
TL6spss-254	M6		6.5	13.5	2.0	200	0.16
TL1/4"-254		1/4"	7.2	11.5	2.2	200	0.09
TL1/4"spss-254		1/4"	7.2	13.5	2.2	200	0.15
TL8ss-254	M8	5/16"	8.7	13.5	2.0	200	0.12
TL8spss-254	M8	5/16"	8.7	16.6	2.0	200	0.22
TL3/8"ss-254		3/8"	10.3	16.6	2.0	200	0.19
TL3/8"spss-254		3/8"	10.3	21.0	2.2	200	0.38
TL10ss-254	M10		10.7	16.6	2.0	200	0.18
TL10spss-254	M10		10.7	21.0	2.0	200	0.37
TL11ss-254	M11	7/16"	11.4	18.5	2.2	200	0.26
TL12ss-254	M12		13.0	19.5	2.0	200	0.23
TL12spss-254	M12		13.0	25.4	3.0	100	0.82
TL1/2"ss-254		1/2"	13.5	19.5	2.0	200	0.23
TL1/2"spss-254		1/2"	13.5	25.4	3.2	100	0.80
TL14ss-254	M14	9/16"	15.2	23.0	3.0	100	0.49
TL14spss-254	M14	9/16"	15.2	30.7	3.2	100	1.31
TL16ss-254	M16	5/8"	17.0	29.0	3.0	100	0.59
TL16spss-254	M16	5/8"	17.0	34.5	3.2	100	1.13
TL18ss-254	M18		19.5	30.7	3.2	100	0.80
TL18spss-254	M18		19.5	39.0	3.2	100	1.56
TL3/4"ss-254		3/4"	20.0	30.7	3.2	100	0.96
TL3/4"spss-254		3/4"	20.0	39.0	3.2	100	2.14
TL20ss-254	M20		21.4	30.7	3.0	100	0.82
TL20spss-254	M20		21.4	39.0	3.2	100	1.98
TL22ss-254	M22	7/8"	23.4	34.5	3.2	100	1.19
TL22spss-254	M22	7/8"	23.4	42.0	3.2	50	2.44
TL24ss-254	M24		25.3	39.0	3.2	100	1.65
TL24spss-254	M24		25.3	48.5	3.2	50	3.50
TL1"ss-254		1"	27.9	39.0	3.2	100	1.42
TL1"spss-254		1"	27.9	48.5	3.2	50	3.22
TL27ss-254	M27		28.4	42.0	5.8	50	3.10
TL27spss-254	M27		28.4	48.5	5.8	25	5.85
TL30ss-254	M30	1 1/8"	31.4	47.0	5.8	50	4.04
TL33ss-254	M33	1 1/4"	34.4	48.5	5.8	25	4.25
TL36ss-254	M36	1 3/8"	37.4	55.0	5.8	25	5.96
TL39ss-254	M39	1 1/2"	40.4	58.5	5.8	25	6.74

Note: Contact your local TOP-LOCK® sales representative for more material locking washers.



Note: If the size change is not notified in advance, please refer to the actual size.

### Reference torque

TOP-LOCK® washers(254SMO) with stainless steel bolts when using GTP600 lubricant

Washer size	Bolt size	Pitch [mm]	A2-50, A4-50 G <sub>s</sub> =65% $\mu_{ss}=0.14, \mu_{is}=0.15$		A2-70, A4-70 G <sub>s</sub> =65% $\mu_{ss}=0.14, \mu_{is}=0.15$		A2-80, A4-80 G <sub>s</sub> =65% $\mu_{ss}=0.14, \mu_{is}=0.15$	
			torque [Nm]	Clamping force load [kN]	torque [Nm]	Clamping force load [kN]	torque [Nm]	Clamping force load [kN]
TL3SS	M3	0.5	0.4	0.7	0.9	1.5	1.2	2.0
TL4SS	M4	0.7	0.9	1.2	2.0	2.6	2.7	3.4
TL5SS	M5	0.8	1.8	1.9	3.9	4.1	5.3	5.5
TL6SS	M6	1.0	3.2	2.7	6.9	5.9	9.2	7.8
TL8SS	M8	1.25	7.7	5	17	11	22	14
TL10SS	M10	1.5	15	8	33	17	43	23
TL12SS	M12	1.75	26	12	56	25	75	33
TL14SS	M14	2.0	42	16	89	34	119	45
TL16SS	M16	2.0	64	21	136	46	181	61
TL18SS	M18	2.5	89	26	191	56	254	75
TL20SS	M20	2.5	125	33	267	72	356	95
TL22SS	M22	2.5	170	41	364	89	485	118
TL24SS	M24	3.0	214	48	460	103	613	137
TL27SS	M27	3.0	313	63	671	134	895	179
TL30SS	M30	3.5	427	77	915	164	1220	219
TL33SS	M33	3.5	575	95	1233	203	1644	270
TL36SS	M36	4.0	742	111	1591	239	2121	319
TL39SS	M39	4.0	958	133	2053	285	2737	381
TL42SS	M42	4.5	1185	153	2540	328	3386	437

GTP600= Graphite lubricant

GF= yield rate

$\mu_{th}$ = thread friction coefficient

$\mu_{th}$ = coefficient of washer friction

Reference torques for other bolt classes are available through our local TOP-LOCK® sales representatives



## Attention

### The lubrication effect

TOP-LOCK® washer popularizes to use good quality lubricating oil. For example: GTP600 or Molykote(R1000 to reduce friction, to minimize the additive load deviations and to prevent corrosion.

### Repeated use

TOP- LOCK® washer can be reused under normal circumstances, But under the condition of high temperature, we don't suggest to reuse. Please lubricate them before reuse.

### Temperature influence

TOP-LOCK® washer just likes the corresponding materials of bolts/nuts, has the same temperature characteristic. When the temperature is above 200 C, the hardness of TOP- LOCK® washer will decrease, When the temperature is above 500 C, the hardness of washer- stainless steel (A4), begin to reduce, When the temperature is above 700 c, we recommend the TOP- LOCK® washer with the material is Inconel ® 718.

### Load area computation

The load area [mm<sup>2</sup>] under the washer, must be greater than the quotient of the clamping pressure [N] divided by the yield strength [N/mm<sup>2</sup>]

$$\text{Load area[mm}^2\text{]} > \frac{\text{clamping pressure[N]}}{\text{yield strength[N/mm}^2\text{]}}$$

## Application industry

- High speed railway.
- Wind power generation
- Aerospace engineering
- Transportation
- transmission agent
- Shipbuilding
- Mining machinery
- compression engine
- Construction machinery
- foundry industry
- drilling equipment
- public service
- Oil drilling rig (onshore/offshore)

## Material physical properties table

TOP-LOCK® Application parameters	Washer (steel)	Washer(stainless steel)	Washer (254SMO®)	Washer INCONEL®/HASTELLOY® C-276	INCONEL®718
Material type and process	EN1.7182 or equivalent Through hardened Delta Protekt base coat (KL100)and top coat (VH301GZ)	EH AISI316 (1.4404)Or equivalent, surface hardening (quenching)	EH 1.4547 Or equivalent grade, surface hardened (quenching)	EN 2.4819 or equivalent grade, surface hardened (quenching)	2.4668 Or equivalent surface hardened (quenching)
hardness	≥465HV1	≥520 HV0.05	≥600 HV0.05	≥520 HV0.05	≥620 HV0.05
Corrosion resistance	Minimum 600 hours in salt spray test (according to IS09227)	Minimum1000 hours in salt spray test (according to IS09227).	Minimum1000 hours in salt spray test (according to IS09227).	Minimum1000 hours in salt spray test (according to IS09227).	Minimum1000 hours in salt spray test (according to IS09227).
Temperature range	-50 to 200℃	-160 to 500℃	-160 to 500℃	-160 to 500℃	-160 to 700℃
Bolt grades	Up to 12.9	Up to A4-80	Up to A4-80	Up to A4-80	Up to A4-80
Application environment	General steel applications	General stainless steel applications.Non chlorine/acid environments	General salt water applications, pumps,chloride applications,heat exchangers,nuclear,desalinati on, foodprocessing & medical equipment	General acidic environments,process and chemical industry.evaporators, offshore downhole tooling	Applications with high temperatur es gas turbines, turbo charges, incinerators

## Installation guide

### Installation Type

Threaded hole



Borehole



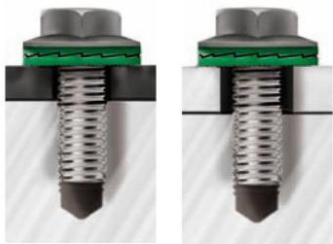
Through hole



Double column  
head bolt



Large/slotted holes and  
soft substrate surface

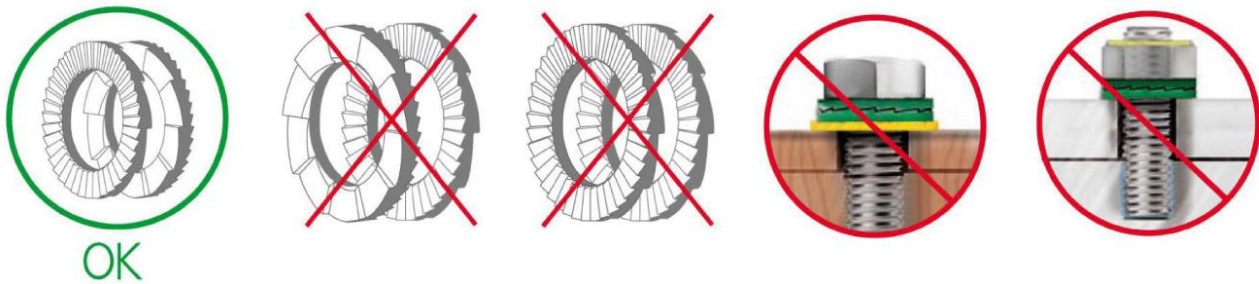


For applications with large/cut holes and soft matrix surfaces (rubber, paint surfaces, etc.), we promote the use of large outside diameter anti-loose washers to bind bolts or nuts with flange heads, the main purpose of which is to reduce the unit load on the matrix surface.

Note: Special requirements can be customized.

## installation instructions

This kind of washers are glued by two single ones together in order to avoid positioning errors during initial assembly. In repeated use, the correct positioning of the washer must be checked to ensure that the inner bevel face is relatively combined.



\*Not to be used on movable substrate surface.(For example, a flat washer exists between TOP-LOCK® washer and the substrate surface)

\*Not to be used on too soft substrate surface.(For example: rubber, wood, plastic)

\*Not to be used in presence of very high settlement surface of the substrate.

Not recommended for use on workpieces with a surface hardness greater than that of TOP-LOCK® lockout washers

\*Not to be used under self -locking screw and thread self-locking conditions.

\*Not to be used with "left turning" threads screw working conditions.(Contact TOP-LOCK® sales representative to order left-handed washers)

