

# NORD-LOCK®

*Bolt securing system*

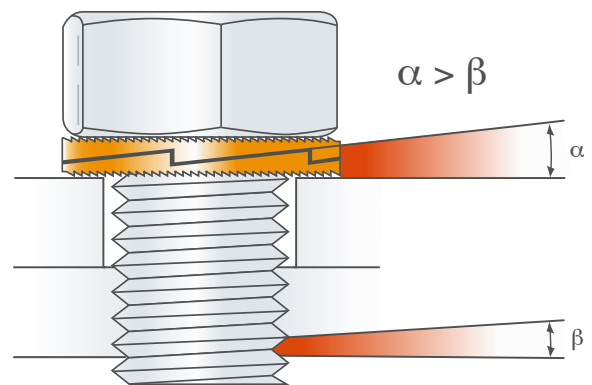


## Technical information

# A closer look

**NORD-LOCK's proven wedge-locking method meeting DIN 25201 utilises tension instead of friction to secure a bolted joint, making it superior to traditional methods.**

The NORD-LOCK bolt securing system incorporates a pair of washers that have cam faces on one side with the cam angle " $\alpha$ " greater than the thread pitch " $\beta$ ". In addition, there are radial teeth on the opposite sides. The pre-assembled washers are installed in pairs, cam face to cam face.



When the bolt and/or nut is tightened the teeth of the NORD-LOCK washers grip and lock the mating surfaces, allowing movement only across the cam faces. Any rotation of the bolt/nut is blocked by the wedge effect of the cams.

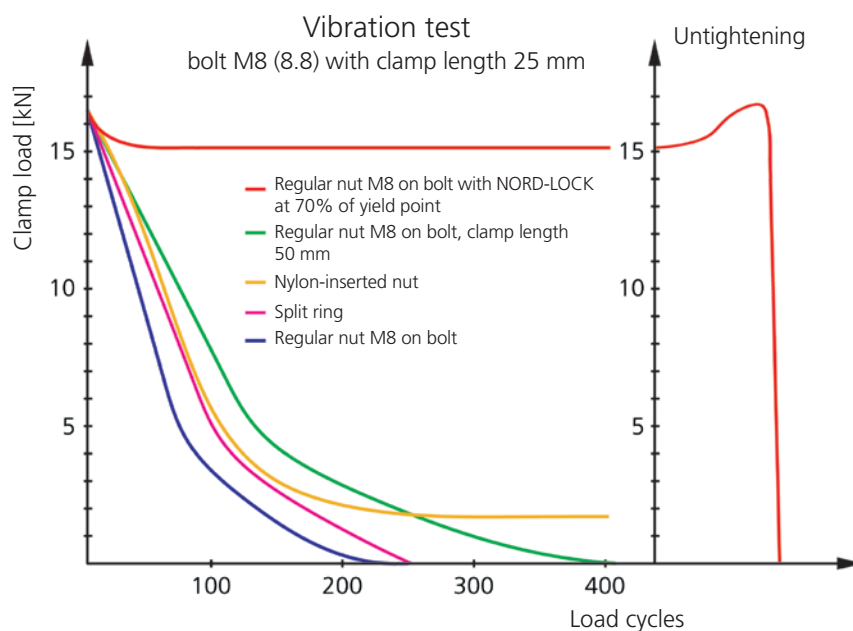


# The talent behind the curves

**Working together with us can optimise your applications. Put your bolted joints to the test simulating a worst-case scenario. At our in-house laboratory we run vibration tests and measure torque-load ratios.**

The Junker vibration test meeting DIN 65151 is an excellent method for testing and comparing the security of bolted joints. In a Junker test the bolted joint is subjected to transverse movements while the tension is being continuously measured by a load cell.

The diagram displays NORD-LOCK's superior performance. Most of the commonly used locking devices show limited holding performance when exposed to vibration. Whereas, bolted joints secured with NORD-LOCK washers only lose some of the initial preload due to normal settlements between the contact surfaces. NORD-LOCK's unique wedge-locking function is proved by the clear increase in clamp load during untightening.



*The unique wedge-locking action of the NORD-LOCK washers can easily be verified. Tighten a bolted joint with NORD-LOCK, then untighten. During untightening, sliding must always occur between the cam faces of the washers. Upon overriding of the cams a "click effect" should be felt when the nut/bolt comes loose. Visual inspection of the mating surfaces should show clear impression marks made by the radial teeth of the washers. When these criteria are met, NORD-LOCK washers will safely lock bolted joints exposed to severe vibration and dynamic loads.*

# High quality material

**NORD-LOCK washers are available in a variety of materials, which all comply with European directives on ELV & RoHS.**

Our standard steel washers are coated with the zinc flake coating Delta Protekt®. The process includes a base and top coat.

Zinc flake coated NORD-LOCK washers endure a minimum of 600 hours of salt spray testing in accordance with ISO 9227. The image to the right shows a sample of zinc flake coated NL24 washers after 1000 hours of salt spray testing.



**NORD-LOCK steel washers** are made of EN 1.7182 or equivalent alloy. All steel washers are through hardened.

**NORD-LOCK stainless steel washers (A4)** are made of EN 1.4404 (US standard AISI 316L) or equivalent alloy. All stainless steel washers are surface hardened.

Other steel alloys available on request

**254SMO** - for highly corrosive environment - made of EN 1.4547 or equivalent alloy

**INCONEL® 718** - for high temperature environment - made of EN 2.4668 or equivalent alloy

**INCONEL®/HASTELLOY® C-276** - for acid environment - made of EN 2.4819 or equivalent alloy

## Hardness table

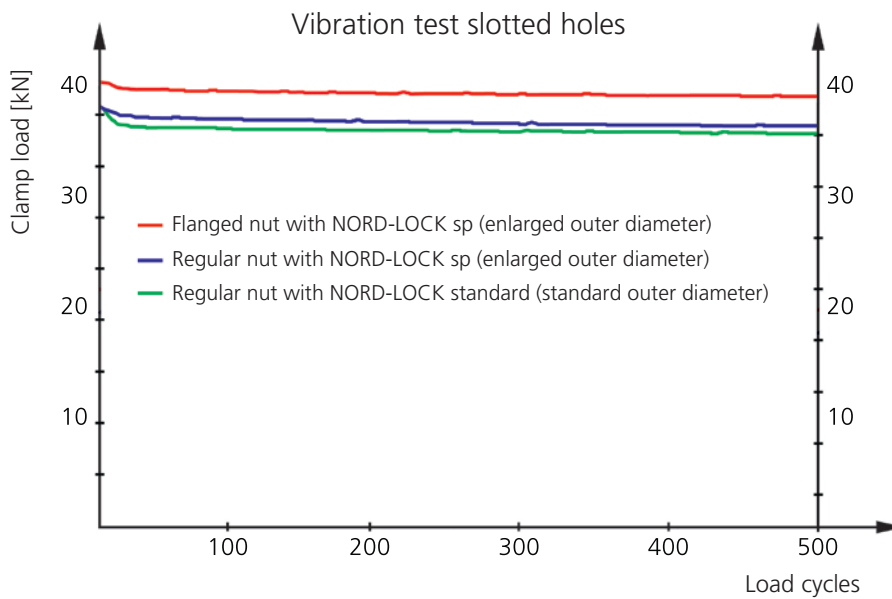
Washer type	Range	Zinc flake coated (fIZnnc - 600)	Non-coated
Steel (through hardened)	NL3 – NL130	> 465 HV1	
Stainless steel A4 (surface hardened)	NL3 ss – NL80 ss		> 520 HV0.05

**Please note:** In order to assure the unique mechanical locking function of the NORD-LOCK washers, the hardness of the mating surfaces must be lower than the hardness of the NORD-LOCK washers (see table above).



# Counter-bores & slots

NORD-LOCK's outer diameters are suitable for counter-bores. In addition, washers with enlarged outer diameter (sp) are available for use on large/slotted holes, painted surfaces or soft materials, e.g. aluminium. For optimum results use NORD-LOCK sp washers together with flanged nuts/bolts.



Example for Junker vibration of M12 bolt (8.8)



Flanged nut with NL sp (enlarged outer diameter)



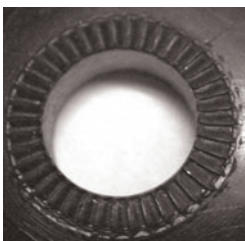
Regular nut with NL sp (enlarged outer diameter)



Regular nut with NL (standard outer diameter)



Painted surface after use of NORD-LOCK with enlarged outer diameter



Painted surface after use of NORD-LOCK with standard diameter

## Painted surfaces

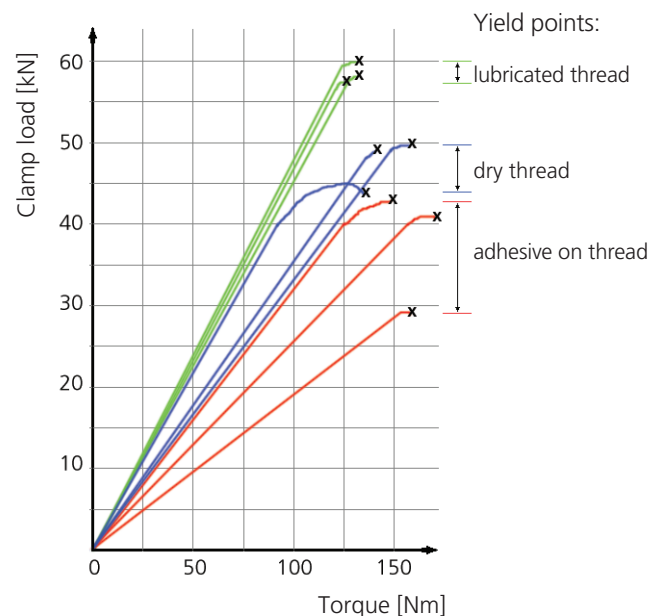
NORD-LOCK washers safely secure bolted joints on painted surfaces provided the washers' teeth properly impress into the painted mating surface. Upon untightening sliding will occur between the cam faces of the washers assuring the unique wedge-locking effect while avoiding any abrading of the painted surface.

# Minimize torsional stress

During tightening, bolts are subjected to both tensile and torsional stress. The desired tensile stress (clamp load) is achieved when the bolt is axially elongated. Unwanted torsional stress (twisting) in bolts arises during tightening due to friction between the contact surfaces in the threads. High thread friction increases twisting of the bolts and causes yielding at lower clamp load levels than normal.

Applying an adhesive significantly increases thread friction during tightening. The graph to the right shows that when tightening bolts with adhesives on the threads, only half as much clamp load was obtained before reaching the yield points compared to when tightening similar bolts lubricated. Since NORD-LOCK's unique wedge-locking technique is not affected by lubrication, the thread friction, and thereby also the torsional stress, can be minimized.

In addition, the diagram shows that at any given torque value the clamp load deviation for lubricated bolts is very low. Using NORD-LOCK washers together with lubrication, bolted joints will be safely locked at the highest possible preload level.



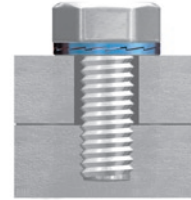
Example of a torque-load diagram for M12 bolt (8.8)



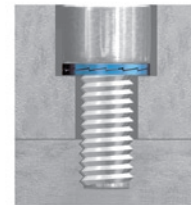


**NORD-LOCK washers can be used with standard and high grade bolts.**

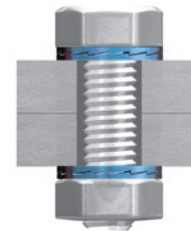
*NORD-LOCK for tapped holes.*



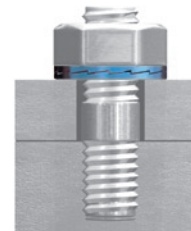
*NORD-LOCK washers are sized for counter-bores.*



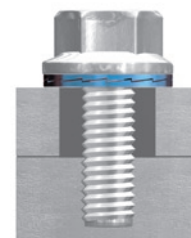
*Through holes require two pairs of NORD-LOCK.*



*For stud bolts NORD-LOCK washers lock the nut, and eliminate the need for adhesives.*



*Use a flanged nut/bolt together with NORD-LOCK "sp" washers for slotted holes or on soft material.*



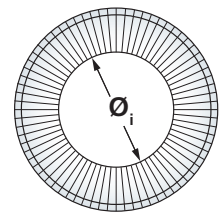
*NORD-LOCK washers must not be used on washers that are not captivated in place.*



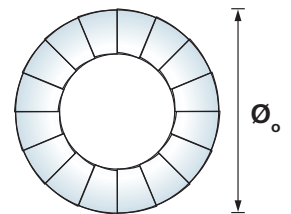
# NORD-LOCK washer dimensions METRIC - preassembled pairs

## STEEL, ZINC FLAKE COATED (DELTA PROTEKT®) - ELV & RoHS COMPLIANT

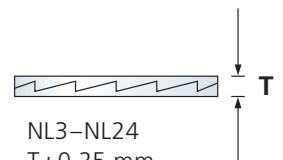
Washer size	Bolt size		$\varnothing_i$ [mm]	$\varnothing_o$ [mm]	Thickness T [mm]	Min. package [pairs]	Approx. weight kg/100 pairs
	Metric	UNC					
NL3	M3	#5	3,4	7,0	1,8	200	0,04
NL3,5	M3,5	#6	3,9	7,6	1,8	200	0,03
NL3,5sp	M3,5	#6	3,9	9,0	1,8	200	0,06
NL4	M4	#8	4,4	7,6	1,8	200	0,04
NL4sp	M4	#8	4,4	9,0	1,8	200	0,06
NL5	M5	#10	5,4	9,0	1,8	200	0,05
NL5sp	M5	#10	5,4	10,8	1,8	200	0,11
NL6	M6		6,5	10,8	1,8	200	0,07
NL6sp	M6		6,5	13,5	2,5	200	0,20
NL1/4"		1/4"	7,2	11,5	1,8	200	0,08
NL1/4"sp		1/4"	7,2	13,5	2,5	200	0,18
NL8	M8	5/16"	8,7	13,5	2,5	200	0,15
NL8sp	M8	5/16"	8,7	16,6	2,5	200	0,29
NL3/8"		3/8"	10,3	16,6	2,5	200	0,23
NL3/8"sp		3/8"	10,3	21,0	2,5	200	0,46
NL10	M10		10,7	16,6	2,5	200	0,23
NL10sp	M10		10,7	21,0	2,5	200	0,44
NL11	M11	7/16"	11,4	18,5	2,5	200	0,29
NL12	M12		13,0	19,5	2,5	200	0,29
NL12sp	M12		13,0	25,4	3,4	100	0,91
NL1/2"		1/2"	13,5	19,5	2,5	200	0,27
NL1/2"sp		1/2"	13,5	25,4	3,4	100	0,93
NL14	M14	9/16"	15,2	23,0	3,4	100	0,63
NL14sp	M14	9/16"	15,2	30,7	3,4	100	1,46
NL16	M16	5/8"	17,0	25,4	3,4	100	0,69
NL16sp	M16	5/8"	17,0	30,7	3,4	100	1,29
NL18	M18		19,5	29,0	3,4	100	0,85
NL18sp	M18		19,5	34,5	3,4	100	1,58
NL3/4"		3/4"	20,0	30,7	3,4	100	1,05
NL3/4"sp		3/4"	20,0	39,0	3,4	100	2,20
NL20	M20		21,4	30,7	3,4	100	0,95
NL20sp	M20		21,4	39,0	3,4	100	2,03
NL22	M22	7/8"	23,4	34,5	3,4	100	1,29
NL22sp	M22	7/8"	23,4	42,0	4,6	50	3,31
NL24	M24		25,3	39,0	3,4	100	1,68
NL24sp	M24		25,3	48,5	4,6	50	4,51
NL1"		1"	27,9	39,0	3,4	100	1,53
NL1"sp		1"	27,9	48,5	4,6	50	4,20
NL27	M27		28,4	42,0	6,6	50	3,29
NL27sp	M27		28,4	48,5	6,6	25	5,39
NL30	M30	1 1/8"	31,4	47,0	6,6	50	4,20
NL30sp	M30	1 1/8"	31,4	58,5	6,6	25	8,96
NL33	M33	1 1/4"	34,4	48,5	6,6	25	3,97
NL33sp	M33	1 1/4"	34,4	58,5	6,6	25	8,31
NL36	M36	1 3/8"	37,4	55,0	6,6	25	5,59
NL36sp	M36	1 3/8"	37,4	63,0	6,6	25	9,15
NL39	M39	1 1/2"	40,4	58,5	6,6	25	6,28
NL42	M42		43,2	63,0	6,6	25	7,47
NL45	M45	1 3/4"	46,2	70,0	7,0	25 *	10,20
NL48	M48		49,6	75,0	7,0	25 *	12,00
NL52	M52	2"	53,6	80,0	7,0	25 *	13,00
NL56	M56	2 1/4"	59,1	85,0	7,0	10 *	13,50
NL60	M60		63,1	90,0	9,5	10 *	15,20
NL64	M64	2 1/2"	67,1	95,0	9,5	10 *	16,70
NL68	M68		71,1	100,0	9,5	1 *	28,19
NL72	M72		75,1	105,0	9,5	1 *	30,70
NL76	M76	3"	79,1	110,0	9,5	1 *	33,31
NL80	M80		83,1	115,0	9,5	1 *	36,02
NL85	M85		88,1	120,0	9,5	1 *	37,84
NL90	M90		92,4	130,0	9,5	1 *	47,67
NL95	M95		97,4	135,0	9,5	1 *	49,81
NL100	M100		103,4	145,0	9,5	1 *	58,91
NL105	M105		108,4	150,0	9,5	1 *	61,28
NL110	M110		113,4	155,0	9,5	1 *	63,65
NL115	M115		118,4	165,0	9,5	1 *	75,28
NL120	M120		123,4	170,0	9,5	1 *	77,94
NL125	M125		128,4	173,0	9,5	1 *	76,63
NL130	M130		133,4	178,0	9,5	1 *	79,17



NL3–NL8  
 $\varnothing_i \pm 0,1$  mm  
 NL10–NL42  
 $\varnothing_i \pm 0,2$  mm  
 NL45–NL130  
 $\varnothing_i +0,5/-0$  mm



NL3–NL24  
 $\varnothing_o \pm 0,2$  mm  
 NL27–NL42  
 $\varnothing_o \pm 0,3$  mm  
 NL45–NL130  
 $\varnothing_o +0/-2,0$  mm



NL3–NL24  
 $T \pm 0,25$  mm  
 NL27–NL42  
 $T +0/-0,5$  mm  
 NL45–NL130  
 $T \pm 0,75$  mm

\* NL45–NL130  
 upon inquiry

Materials and dimensions are subject to change without prior notice.

Please consult our website for current dimensions:

[www.nord-lock.com](http://www.nord-lock.com)

# Torque guidelines

NORD-LOCK zinc flake coated (DP = Delta Protekt®) washers with electro zinc plated **bolt 8.8**

Washer size	Bolt size	Pitch [mm]	Oil, $G_f=0,75$ $\mu_g=0,10, \mu_w=0,16$		GTP600, $G_f=0,75$ $\mu_g=0,08, \mu_w=0,15$		Dry, $G_f=0,62$ $\mu_g=0,15, \mu_w=0,18$	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
NL3	M3	0,5	1,3	2,4	1,2	2,4	1,3	2,0
NL4	M4	0,7	3,1	4,2	2,8	4,2	3,1	3,5
NL5	M5	0,8	6,0	6,8	5,4	6,8	6,0	5,6
NL6	M6	1,0	10,5	9,7	9,5	9,7	10,5	8,0
NL8	M8	1,25	25	18	23	18	25	15
NL10	M10	1,5	49	28	45	28	50	23
NL12	M12	1,75	85	40	77	40	85	33
NL14	M14	2,0	135	55	122	55	136	46
NL16	M16	2,0	205	75	185	75	208	62
NL18	M18	2,5	288	92	260	92	291	76
NL20	M20	2,5	402	118	363	118	408	97
NL22	M22	2,5	548	146	494	146	557	120
NL24	M24	3,0	693	169	625	169	703	140
NL27	M27	3,0	1010	221	910	221	1028	182
NL30	M30	3,5	1379	269	1243	269	1401	222
NL33	M33	3,5	1855	333	1669	333	1889	275
NL36	M36	4,0	2394	392	2156	392	2436	324
NL39	M39	4,0	3087	468	2777	468	3145	387
NL42	M42	4,5	3820	538	3439	538	3890	445



Torque guidelines for other bolt grades are available on request through your local NORD-LOCK representative.

GTP600 = graphite lubricant

$G_f$  = ratio of yield point

$\mu_g$  = thread friction

$\mu_w$  = washer friction

NORD-LOCK zinc flake coated (DP) with non-plated **bolt 10.9**

Washer size	Bolt size	Pitch [mm]	Oil, $G_f=0,71$ $\mu_g=0,13, \mu_w=0,14$		GTP600, $G_f=0,75$ $\mu_g=0,08, \mu_w=0,13$	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
NL3	M3	0,5	1,8	3,2	1,6	3,4
NL4	M4	0,7	4,1	5,6	3,6	5,9
NL5	M5	0,8	8,1	9,1	7,0	9,6
NL6	M6	1,0	14,1	12,9	12,3	13,6
NL8	M8	1,25	34	23	30	25
NL10	M10	1,5	67	37	58	39
NL12	M12	1,75	115	54	99	57
NL14	M14	2,0	183	74	158	78
NL16	M16	2,0	279	100	240	106
NL18	M18	2,5	391	123	337	130
NL20	M20	2,5	547	156	470	165
NL22	M22	2,5	745	194	639	205
NL24	M24	3,0	942	225	809	238
NL27	M27	3,0	1375	294	1176	310
NL30	M30	3,5	1875	358	1608	378
NL33	M33	3,5	2526	443	2157	468
NL36	M36	4,0	3259	522	2788	551
NL39	M39	4,0	4203	624	3588	659
NL42	M42	4,5	5202	716	4445	757

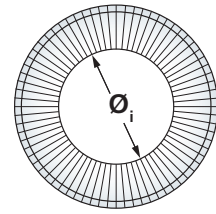
NORD-LOCK zinc flake coated (DP) with non-plated **bolt 12.9**

Washer size	Bolt size	Pitch [mm]	Oil, $G_f=0,71$ $\mu_g=0,13, \mu_w=0,12$		GTP600, $G_f=0,75$ $\mu_g=0,08, \mu_w=0,11$	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
NL3	M3	0,5	2,0	3,9	1,7	4,1
NL4	M4	0,7	4,6	6,7	4,0	7,1
NL5	M5	0,8	9,1	10,9	7,7	11,5
NL6	M6	1,0	15,8	15,4	13,5	16,3
NL8	M8	1,25	38	28	32	30
NL10	M10	1,5	75	44	64	47
NL12	M12	1,75	128	65	109	68
NL14	M14	2,0	204	89	174	94
NL16	M16	2,0	311	120	263	127
NL18	M18	2,5	437	148	370	156
NL20	M20	2,5	610	188	515	198
NL22	M22	2,5	831	233	699	246
NL24	M24	3,0	1052	270	887	286
NL27	M27	3,0	1533	352	1288	372
NL30	M30	3,5	2091	430	1761	454
NL33	M33	3,5	2815	532	2362	562
NL36	M36	4,0	3633	626	3053	662
NL39	M39	4,0	4683	748	3925	790
NL42	M42	4,5	5799	860	4866	908

# NORD-LOCK washer dimensions METRIC - preassembled pairs

## STAINLESS STEEL A4 (according to EN 1.4404, AISI 316L)

Washer size	Bolt size		$\varnothing_i$ [mm]	$\varnothing_o$ [mm]	Thickness T [mm]	Min. package [pairs]	Approx. weight kg/100 pairs
	Metric	UNC					
NL3ss	M3	#5	3,4	7,0	2,2	200	0,04
NL3,5ss	M3,5	#6	3,9	7,6	2,2	200	0,04
NL3,5spss	M3,5	#6	3,9	9,0	2,2	200	0,07
NL4ss	M4	#8	4,4	7,6	2,2	200	0,04
NL4spss	M4	#8	4,4	9,0	2,2	200	0,07
NL5ss	M5	#10	5,4	9,0	2,2	200	0,06
NL5spss	M5	#10	5,4	10,8	2,2	200	0,11
NL6ss	M6		6,5	10,8	2,2	200	0,09
NL6spss	M6		6,5	13,5	2,2	200	0,16
NL1 1/4"ss		1/4"	7,2	11,5	2,2	200	0,09
NL1 1/4"spss		1/4"	7,2	13,5	2,2	200	0,15
NL8ss	M8	5/16"	8,7	13,5	2,2	200	0,12
NL8spss	M8	5/16"	8,7	16,6	2,2	200	0,24
NL3/8"ss		3/8"	10,3	16,6	2,2	200	0,17
NL3/8"spss		3/8"	10,3	21,0	2,2	200	0,38
NL10ss	M10		10,7	16,6	2,2	200	0,16
NL10spss	M10		10,7	21,0	2,2	200	0,37
NL11ss	M11	7/16"	11,4	18,5	2,2	200	0,26
NL12ss	M12		13,0	19,5	2,2	200	0,25
NL12spss	M12		13,0	25,4	3,2	100	0,81
NL1 1/2"ss		1/2"	13,5	19,5	2,2	200	0,24
NL1 1/2"spss		1/2"	13,5	25,4	3,2	100	0,80
NL14ss	M14	9/16"	15,2	23,0	3,2	100	0,55
NL14spss	M14	9/16"	15,2	30,7	3,2	100	1,31
NL16ss	M16	5/8"	17,0	25,4	3,2	100	0,61
NL16spss	M16	5/8"	17,0	30,7	3,2	100	1,29
NL18ss	M18		19,5	29,0	3,2	100	0,80
NL18spss	M18		19,5	34,5	3,2	100	1,56
NL3/4"ss		3/4"	20,0	30,7	3,2	100	0,96
NL3/4"spss		3/4"	20,0	39,0	3,2	100	2,10
NL20ss	M20		21,4	30,7	3,2	100	0,89
NL20spss	M20		21,4	39,0	3,2	100	2,06
NL22ss	M22	7/8"	23,4	34,5	3,2	100	1,23
NL22spss	M22	7/8"	23,4	42,0	3,2	50	2,23
NL24ss	M24		25,3	39,0	3,2	100	1,52
NL24spss	M24		25,3	48,5	3,2	50	3,50
NL1"ss		1"	27,9	39,0	3,2	100	1,42
NL1"spss		1"	27,9	48,5	3,2	50	3,22
NL27ss	M27		28,4	42,0	6,8	50	3,45
NL27spss	M27		28,4	48,5	6,8	25	5,85
NL30ss	M30	1 1/8"	31,4	47,0	6,8	50	4,43
NL30spss	M30	1 1/8"	31,4	58,5	6,8	25	9,53
NL33ss	M33	1 1/4"	34,4	48,5	6,8	25	4,25
NL36ss	M36	1 3/8"	37,4	55,0	6,8	25	5,96
NL39ss	M39	1 1/2"	40,4	58,5	6,8	25	6,74
NL42ss	M42		43,2	63,0	6,8	25	7,96
NL45ss	M45	1 3/4"	46,2	70,0	9,0	25 *	10,20
NL48ss	M48		49,6	75,0	9,0	25 *	12,00
NL52ss	M52	2"	53,6	80,0	9,0	1 *	20,10
NL56ss	M56	2 1/4"	59,1	85,0	9,0	1 *	21,30
NL60ss	M60		63,1	90,0	9,0	1 *	23,50
NL64ss	M64	2 1/2"	67,1	95,0	9,0	1 *	25,80
NL68ss	M68		71,1	100,0	9,0	1 *	28,20
NL72ss	M72		75,1	105,0	9,0	1 *	30,70
NL76ss	M76	3"	79,1	110,0	9,0	1 *	33,30
NL80ss	M80		83,1	115,0	9,0	1 *	36,00



NL3ss–NL8ss

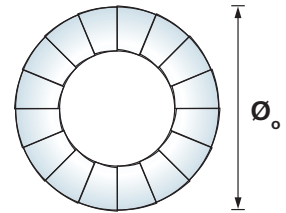
$\varnothing_i \pm 0,1$  mm

NL10ss–NL42ss

$\varnothing_i \pm 0,2$  mm

NL45ss–NL80ss

$\varnothing_i +0,5/-0$  mm



NL3ss–NL24ss

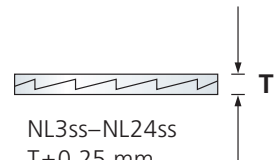
$\varnothing_o \pm 0,2$  mm

NL27ss–NL42ss

$\varnothing_o \pm 0,3$  mm

NL45ss–NL80ss

$\varnothing_o +0/-2,0$  mm



NL3ss–NL24ss

$T \pm 0,25$  mm

NL27ss–NL42ss

$T +0/-0,5$  mm

NL45ss–NL80ss

$T \pm 0,75$  mm

\* NL45ss–NL80ss

upon inquiry

Materials and dimensions are subject to change without prior notice.

Please consult our website for current dimensions:

[www.nord-lock.com](http://www.nord-lock.com)

NL3 to NL20 available upon request in other steel alloys, e.g. 254SMO, Inconel® 718 and Inconel®/Hastelloy® C-276.

# Torque guidelines

NORD-LOCK stainless steel (A4) washers with **stainless steel bolt**, lubricated with GTP600

Washer size	Bolt size	Pitch [mm]	A4-70, $G_f=0,65$ $\mu_g=0,14, \mu_w=0,15$		A4-80, $G_f=0,65$ $\mu_g=0,14, \mu_w=0,15$	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
NL3 ss	M3	0,5	0,9	1,5	1,2	2,0
NL4 ss	M4	0,7	2,0	2,6	2,7	3,4
NL5 ss	M5	0,8	3,9	4,1	5,3	5,5
NL6 ss	M6	1,0	6,9	5,9	9,2	7,8
NL8 ss	M8	1,25	17	11	22	14
NL10 ss	M10	1,5	33	17	43	23
NL12 ss	M12	1,75	56	25	75	33
NL14 ss	M14	2,0	89	34	119	45
NL16 ss	M16	2,0	136	46	181	61
NL18 ss	M18	2,5	191	56	254	75
NL20 ss	M20	2,5	267	72	356	95
NL22 ss	M22	2,5	364	89	485	118
NL24 ss	M24	3,0	460	103	613	137
NL27 ss	M27	3,0	671	134	895	179
NL30 ss	M30	3,5	915	164	1220	219
NL33 ss	M33	3,5	1233	203	1644	270
NL36 ss	M36	4,0	1591	239	2121	319
NL39 ss	M39	4,0	2053	285	2737	381
NL42 ss	M42	4,5	2540	328	3386	437



GTP600 = graphite lubricant

$G_f$  = ratio of yield point

$\mu_g$  = thread friction

$\mu_w$  = washer friction

1ft = 0,3048 m

1lb = 0,4536kg = 4,450 N

1ftlb = 0,3048 x 0,4536 x 9,81 = 1,356 Nm

## Lubrication

NORD-LOCK recommends the use of a good lubricant (e.g. GTP600 or Molykote® 1000) in order to reduce friction, minimize preload deviation and protect against corrosion.

## Reuse

NORD-LOCK washers can normally be reused. However, for high temperature applications, reuse is not recommended. Always lubricate fasteners before reusing!

## Temperatures

NORD-LOCK washers have similar temperature characteristics as bolts/nuts of corresponding material. The hardness of NORD-LOCK steel washers decreases at temperatures above 200°C. Stainless steel (A4) washers start to degrade at temperatures above 500°C. For applications up to 700°C we recommend our Inconel® 718 washers.

## Calculation of load area

The load area [mm<sup>2</sup>] under the washer must be larger than the clamp load [N] divided by the yield point [N/mm<sup>2</sup>] of the material.

$$\text{Load area [mm}^2\text{]} > \frac{\text{Clamp load [N]}}{\text{Yield point [N/mm}^2\text{]}}$$

## Design

2D & 3D models of all NORD-LOCK products can be found through [www.nord-lock.com](http://www.nord-lock.com)



**NORD-LOCK®**  
*Bolt securing system*

AUTHORIZED DISTRIBUTOR

[www.nord-lock.com](http://www.nord-lock.com)