Nord-Lock®
X-Series Washers

USER MANUAL

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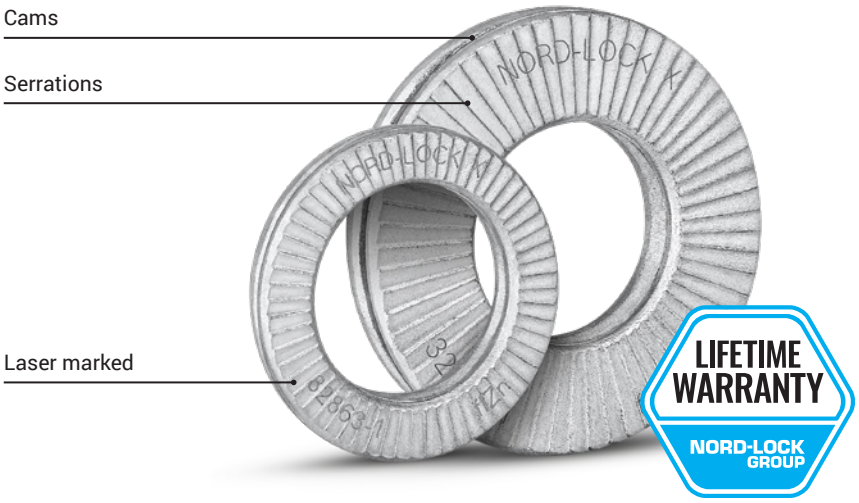
NORD-LOCK®
PART OF THE NORD-LOCK GROUP

Prevents bolts from loosening



One solution for multiple design challenges

Utilizing a unique multifunctional design, Nord-Lock X-series washers secure bolted joints against both spontaneous bolt loosening and slackening, thanks to their conical shape.

Applications

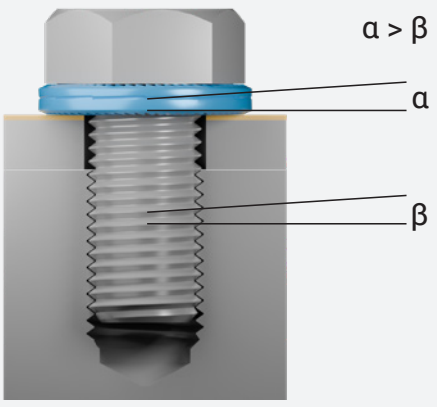
Nord-Lock X-series washers are the optimum choice when you are facing extreme challenges that require extra protection. Nord-Lock X-series washers keep bolted joints secure when facing multiple challenges, including:

- Material expansion and contraction during thermal cycling
- Settlements due to paint or powder-coating
- Intense relaxation on soft metals, composites and polymers
- Slackening due to multiple clamped parts
- Joints with short clamp length
- Loss of clamp load in gasketed joints.

How it works

Utilizing a unique multifunctional design, Nord-Lock X-series washers combine Nord-Lock wedge-locking technology with compensation against settlements.

Each washer pair has cam faces on one side and serrations on the other. When tightened, the serrations embed into the mating surfaces. As the cam angle (α) is greater than the thread pitch (β), a wedge effect is created, preventing bolt loosening caused by vibration and dynamic loads. The conical shape of the washers also compensates for settlements and reduces slackening, maintaining preload even under demanding conditions.



Joint Guide

Use this guide to help you use Nord-Lock X-series washers correctly. If you have an application that does not meet our design criteria, contact us and we will help you find a solution.

Tapped holes

Nord-Lock X-series washers safely lock the bolt against the underlying surface.

Through holes

Through holes require two pairs of Nord-Lock X-series washers - one pair for securing the bolt and a second pair for securing the nut. Turn both fasteners in order to close the cams on both washer pairs before tightening to minimize settlements. Keep the nut secure while tightening the bolt.

Stud bolts

Nord-Lock X-series washers safely lock the nut on stud bolts and eliminate the need for adhesives.

Counterbores

The outer diameter of regular Nord-Lock X-series washers is designed for counterbore holes according to DIN 974.

Applications with large / slotted holes or soft underlying surfaces

To optimize the load distribution for applications with large or slotted holes or with soft underlying surface, use a flanged nut or bolt together with Nord-Lock “sp” washers with enlarged outer diameter.

Left hand bolts/thread

Applications with left-hand bolts/threads requires customized washers.

Design where Nord-Lock X-series washers are not recommended

- When mating surfaces are not locked in place
- When mating surfaces are harder than the washers
- With very soft mating surfaces — for example, wood and plastic

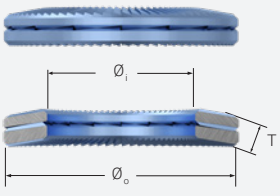
Product information

Applications	General steel applications
Material standard	Steel EN 1.7225 or equivalent
Hardening	Through hardened*
Corrosion resistance	Minimum 1,000 hours in salt spray test (according to ISO 9227)
Temperature range	-40°C to 150°C
Bolt grades	8.8 and 10.9
Product designation	NLX, NLXsp
Laser marking	Traceable batch number and type code flZn
Size range	M6-M27 (NLX6-NLX27, NLX6sp-NLX27sp)
Coating	Basecoat Delta Protekt® KL100, Topcoat VH 302 GZ

* Washer hardness must be greater than the hardness of the mating surfaces in order to assure its mechanical function.

NORD-LOCK X-SERIES WASHERS

DIMENSIONS



NLX6-NLX27sp
Ø$_i$ ±0.2 mm

NLX6-NLX27sp
Ø$_o$ ±0.2 mm

NLX6–NLX16sp
T +0.0/-0.2 mm

NLX3/4"–NLX20
T +0.0/-0.2 mm

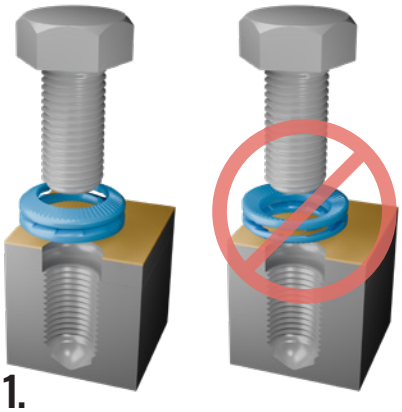
NLX20sp
T ±0,3 mm

NLX22-NLX27sp
T ±0,5 mm

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_o$ [mm]	Thickness T [mm]	Approx. weight kg/100 pairs	Min. Package [pairs]
M6		NLX6	6.3	10.8	1.60	0.08	200
M6		NLX6sp	6.3	13.5	2.00	0.16	200
M8	5/16"	NLX8	8.4	13.5	2.20	0.14	200
M8	5/16"	NLX8sp	8.4	16.6	2.20	0.25	200
	3/8"	NLX3/8"	10.0	16.6	2.60	0.26	200
M10		NLX10	10.5	16.6	2.80	0.27	200
M10		NLX10sp	10.5	21.0	3.30	0.62	200
M12		NLX12	12.5	19.5	3.40	0.43	200
M12		NLX12sp	12.5	25.4	4.00	1.12	100
	1/2"	NLX1/2"	13.2	19.5	3.50	0.41	200
M14	9/16"	NLX14	14.6	23.0	3.90	0.70	100
M16	5/8"	NLX16	16.6	25.4	4.60	0.98	100
M16	5/8"	NLX16sp	16.6	30.7	4.60	1.78	100
	3/4"	NLX3/4"	19.8	30.7	5.50	1.70	100
M20		NLX20	20.7	30.7	5.90	1.70	100
M20		NLX20sp	20.7	39.0	6.00	3.7	50
M22	7/8"	NLX22 (7/8")	23.3	34.5	6.80	2.4	50
M22	7/8"	NLX22sp (7/8"sp)	23.3	42.0	7.30	5.1	50
M24		NLX24	24.8	39.0	7.40	3.9	50
M24		NLX24sp	24.8	47.0	7.60	7.2	25
M27		NLX27	27.9	42.0	8.25	4.6	25
M27		NLX27sp	27.9	51.0	8.50	9.0	25

Assembly Instructions

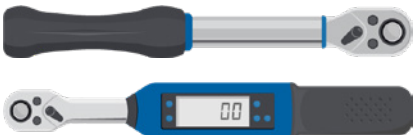
Tightening of threaded holes



1.

Put on the pre-assembled washer pair on the bolt and install the bolt in the threaded hole. The NLX washer shall be placed with the laser marking facing the nut or the bolts head.

We recommend the use of a lubricant. Lubricate the thread and the area under the head prior to installation.



2.

Tighten the bolt at a torque according to the Nord-Lock torque guidelines, using a calibrated torque wrench.

3.

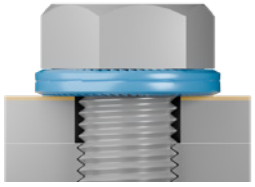
Ready!

Tightening of through holes

1.

Place one pair of Nord-Lock X-series washers underneath the head of the bolt and mount it in the through hole. Place the second pair of Nord-Lock X-series washers on the bolt and mount the nut.

We recommend the use of a lubricant. Lubricate the thread and the area under the head prior to installation.

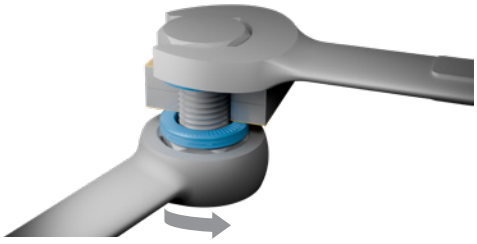


Closed cams - correct

Open cams – not correct

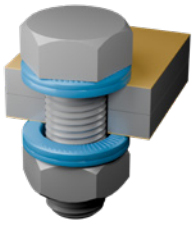
2.

Turn both fasteners (bolt head/nut) in order to close the cams on both washers before tightening to minimize settlements.



3.

Keep the bolt/nut secured while tightening the other part (bolt/nut). For guidance on which torque to tighten with, check the Nord-Lock torque guidelines.



4.

Ready!

Torque Guidelines

Nord-Lock X-series washers bolt grade 8.8

Bolt size	Washer size	Pitch [mm]	Oil, G_F=75% μ_{th}=0.15, μ_h=0.19		Cu/C paste, G_F=75% μ_{th}=0.13, μ_h=0.18		Dry, G_F=62% μ_{th}=0.18, μ_h=0.2	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M6	NLX6	1.00	13.0	9.7	12.0	9.7	12.0	8.0
M8	NLX8	1.25	32.0	18.0	29.0	18.0	29.0	15.0
M10	NLX10	1.50	62.0	28.0	57.0	28.0	56.0	23.0
M12	NLX12	1.75	107.0	40.0	99.0	40.0	97.0	33.0
M14	NLX14	2.00	170.0	55.0	157.0	55.0	155.0	46.0
M16	NLX16	2.00	260.0	75.0	240.0	75.0	237.0	62.0
M20	NLX20	2.50	522.0	121.0	482.0	121.0	476.0	100.0
M22	NLX22	2.50	713.0	150.0	657.0	150.0	650.0	124.0
M24	NLX24	3.00	900.0	174.0	830.0	174.0	821.0	144.0
M27	NLX27	3.00	1323.0	227.0	1219.0	227.0	1207.0	188.0

Nord-Lock X-series washers bolt grade 10.9

Bolt size	Washer size	Pitch [mm]	Oil, G_F=71% μ_{th}=0.15, μ_h=0.15		Cu/C paste, G_F=75% μ_{th}=0.13, μ_h=0.15	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M6	NLX6	1.00	15.5	12.9	15.5	13.6
M8	NLX8	1.25	37.0	23.0	37.0	25.0
M10	NLX10	1.50	73.0	37.0	73.0	39.0
M12	NLX12	1.75	126.0	54.0	126.0	57.0
M14	NLX14	2.00	201.0	74.0	201.0	78.0
M16	NLX16	2.00	307.0	100.0	306.0	106.0
M20	NLX20	2.50	602.0	156.0	600.0	165.0
M22	NLX22	2.50	815.0	194.0	812.0	205.0
M24	NLX24	3.00	1032.0	225.0	1029.0	238.0
M27	NLX27	3.00	1513.0	294.0	1508.0	310.0

Table legend

Cu/C paste = Nord-Lock X-series washers with steel bolt, lubricated with copper/graphite paste (Molykote® 1000).

Oil = WD40 has been used.
G_F = Ratio of yield point. When tightening according to guidelines and with no deviation, this is the pre-stress achieved expressed as % of yield point.

μ_{th} = thread friction coefficient
μ_h = under head friction coefficient
1 N = 0.225 lb
1 Nm = 0.738 ft-lb

Thread friction coefficients have theoretical values but are verified through testing. Under head friction coefficients have been established by tests.

The calculations are based on Kellerman & Klein formula.

Torque guidelines for other bolt grades are available through your local Nord-Lock representative.

- Fastener Dimension Guide

Gather fastener data while performing bolted joint calculations. Enter the size and length of a bolt and find all the dimensions that conform to ISO standards.

Use the app at
nord-lock.com/nord-lock/fastener-dimension-guide/

The Fastener Dimension Guide was developed by Nord-Lock Group in cooperation with the Swedish Standards Institute (SIS).

- Torquelator by Nord-Lock

Calculate the required preload and corresponding torque of Nord-Lock washers quickly, easily and accurately.

Use the app at
torquelator.nord-lock.com

For help with more complex torque calculations, contact your nearest Nord-Lock representative.

Torque guidelines

2D/3D CAD models