Nord-Lock Original Washers

USER MANUAL

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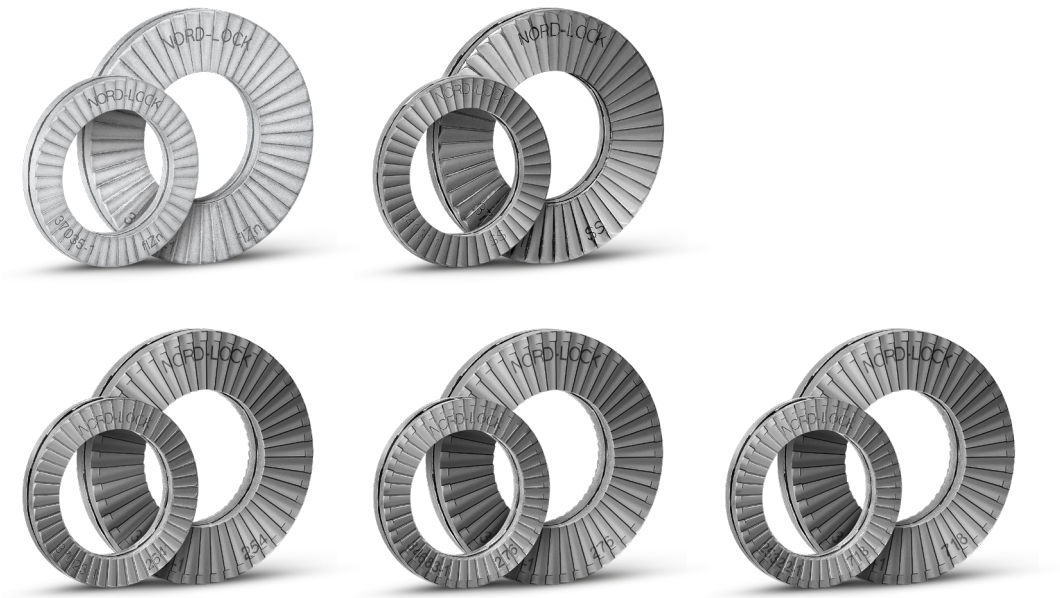

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NORD-LOCK®
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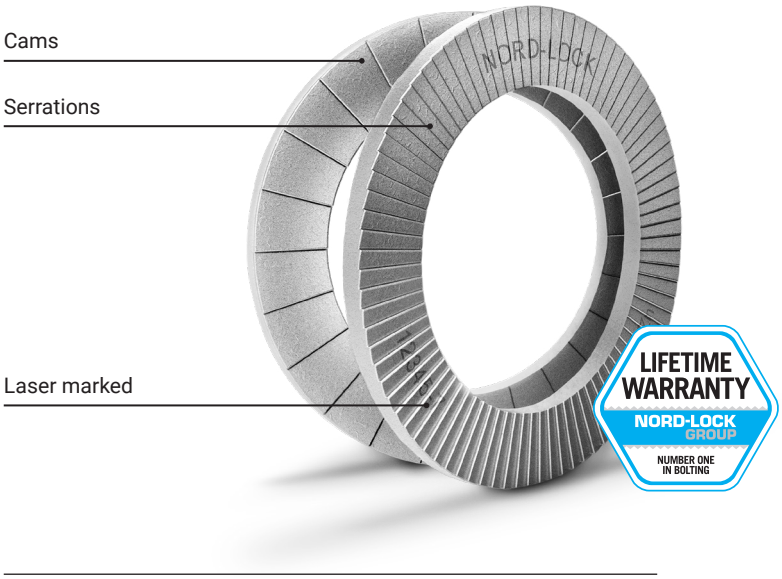
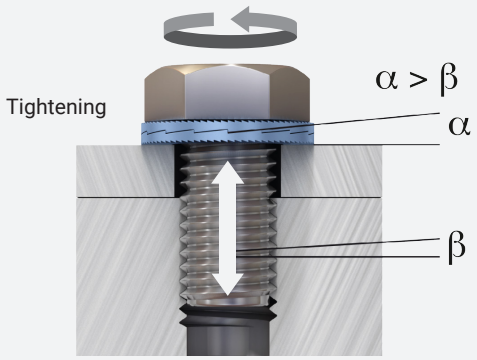
Prevents bolts from loosening



A pair of washers for maximum safety

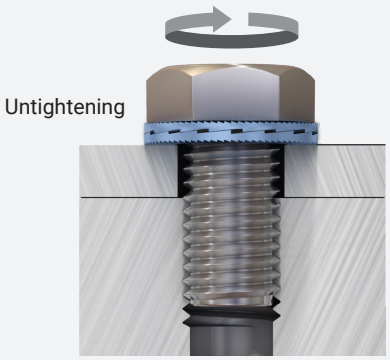
Nord-Lock bolt securing solutions consist of a pair of washers with cams facing each other and serrations gripping the mating surfaces. They use cam-geometry to effectively prevent the bolt from vibrating loose. A hot melt adhesive is used to assemble the washers in pairs. The ingredients of the adhesive meet the compositional requirements of the American Food & Drug Administration regulations 21 CFR 175.105 “Adhesives”.

How it works



When the fastener is tightened, the cams lock and the serrations on the outer faces of the washers grip into both the fastener and the clamped part, creating clear impression marks in both. Clamping load has been created by the bolt, keeping the assembly locked in place.

Because the cam angle ‘α’ is greater than the thread pitch ‘β’ a wedge-locking effect secures the fastener against rotational loosening, even under the most severe conditions.



When the fastener is untightened, sliding will occur between the two washers. The upper washer is locked to the nut or bolt head by the serrations. The lower washer does not rotate as its serrations are locked into the surface being clamped.

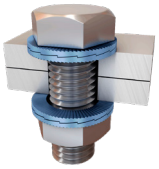
As the cams slide over each other, the clamping load from the bolt is first increased as the bolt stretches, before being released as the cams pass each other.

Joint Guide

Use this guide to help you use Nord-Lock original washers correctly. If you have an application that does not meet our design criteria, contact us and we will help you find a solution. Store dry the washer boxes at -15°C to 25°C (5°F to 77°F).

Tapped holes

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



Through holes

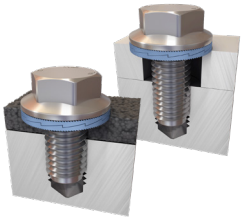
Through holes require two pairs of Nord-Lock washers — one pair for securing the bolt and one pair for securing the nut.

Stud bolts

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

Counterbores

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



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.

For soft underlying surfaces or materials with a lot of settlements, for example composite material, it is also recommended to use Nord-Lock X-series washers.

- 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
- For applications with extremely large settlements
- With non-preloaded joints

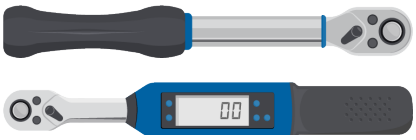
Assembly Instructions

Tightening of threaded holes

1.

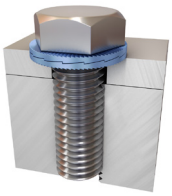
Place the pre-assembled washer pair on the bolt and (install) the bolt in the threaded hole.

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



2.

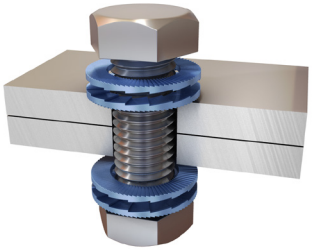
Tighten the bolt at a torque according to the Nord-Lock torque guidelines, using a calibrated torque wrench.



3.

Ready!

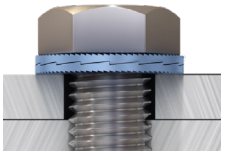
Tightening of through holes



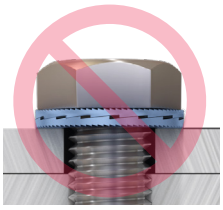
1.

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



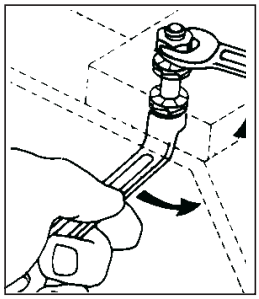
Closed cams - correct



Open cams – not correct

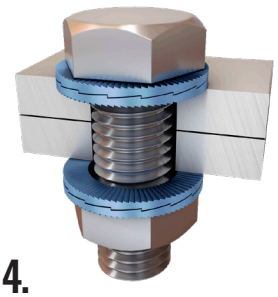
2.

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!

Product Selection

Nord-Lock offers products in a wide range of sizes, shapes and materials. They are developed to suit even the toughest environments. If you need support selecting the most appropriate product, please contact your closest Nord-Lock sales representative.

	STEEL	STAINLESS STEEL	254 SMO®	ALLOY C-276	ALLOY 718
Applications	General steel application	General stainless steel application Non chlorine / acid environments	Corrosive environment — chloride rich environments, pumps, heat exchangers, nuclear, food, medical, processing	Acidic environment — chemical industry, evaporators, offshore, downhole tooling	High temperatures — gas turbines, turbo charges, incinerators
Material Standard	EN 1.7182	EN 1.4404	EN 1.4547	EN 2.4819 or equivalent	EN 2.4668 or equivalent
Hardening	Through hardened	Surface hardened	Surface hardened	Surface hardened	Surface hardened
Hardness*	≥ 465HV1	≥ 520HV0.05	≥ 600HV0.05	≥ 520HV0.05	≥ 620HV0.05
Corrosion Resistance**	Minimum 1,000 hours in salt spray test according to ISO 9227	PREN 27	PREN 45	PREN 68	PREN 29
Temperature Range***	-50°C to 200°C	-160°C to 500°C	-160°C to 500°C	-160°C to 500°C	-160°C to 700°C
Bolt Grades	Up to 12.9	Up to A4-80	Up to A4-80	—	—
Product Designation	NL NLsp	NLss NLspss	NLss-254 NLspss-254	NLss-276 NLspss-276	NLss-718 NLspss-718
Laser Marking Type Code	flZn	SS	254	276	718
Size Range	M3–M130 #5 to 5"	M3–M80 #5 to 3 1/8"	M3–M39 #5 to 1 1/2"	M4–M20 #5 to 1 1/2"	M4–M20 #5 to 1 1/2"
Coating	Base coat: Delta Protekt® KL100 zinc flake coating Top coat: VH 302 GZ	—	—	—	—

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

**
Corrosion resistance is known as PREN. PREN, or Pitting Resistance Equivalent Number, is a theoretical number calculated from the chemical composition of the raw material. The formula is:
PREN = %Cr + 3.3x%Mo + 16x%N.

***
Temperature recommendations are based on information from the raw material supplier and testing. The locking function is not affected within the specified range.

Torque Guidelines

The below torque values have been verified in test laboratories and represent a configuration example. The values are indicative and should only be used as general guidelines as varying conditions, joint designs and requirements apply. The Nord-Lock Group provides customized torque calculations to any standard, free of charge.

Nord-lock steel washers with electro zinc plated 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]
M3	NL3	0.50	1.7	2.4	1.5	2.4	1.5	2.0
M4	NL4	0.70	3.8	4.2	3.6	4.2	3.5	3.5
M5	NL5	0.80	7.5	6.8	6.9	6.8	6.8	5.6
M6	NL6	1.00	13.0	9.7	12.1	9.7	12.0	8.0
M8	NL8	1.25	32.0	18.0	29.0	18.0	29.0	15.0
M10	NL10	1.50	62.0	28.0	57.0	28.0	56.0	23.0
M12	NL12	1.75	107.0	40.0	99.0	40.0	97.0	33.0
M14	NL14	2.00	170.0	55.0	157.0	55.0	155.0	46.0
M16	NL16	2.00	260.0	75.0	240.0	75.0	237.0	62.0
M18	NL18	2.50	364.0	92.0	336.0	92.0	331.0	76.0
M20	NL20	2.50	510.0	118.0	470.0	118.0	464.0	97.0
M22	NL22	2.50	696.0	146.0	642.0	146.0	634.0	120.0
M24	NL24	3.00	878.0	169.0	809.0	169.0	800.0	140.0
M27	NL27	3.00	1,284.0	221.0	1,183.0	221.0	1,172.0	182.0
M30	NL30	3.50	1,750.0	269.0	1,613.0	269.0	1,596.0	222.0
M33	NL33	3.50	2,360.0	333.0	2,173.0	333.0	2,155.0	275.0
M36	NL36	4.00	3,043.0	392.0	2,803.0	392.0	2,776.0	324.0
M39	NL39	4.00	3,931.0	468.0	3,619.0	468.0	3,589.0	387.0
M42	NL42	4.50	4,860.0	538.0	4,476.0	538.0	4,436.0	445.0

Nord-lock steel washers with non-plated bolt grade 10.9

Bolt size	Washer size	Pitch [mm]	Oil, G_F=71% μ_{th}=0.15, μ_h=0.13		Cu/C paste, G_F=75% μ_{th}=0.13, μ_h=0.14	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M3	NL3	0.50	2.0	3.2	2.0	3.4
M4	NL4	0.70	4.5	5.6	4.5	5.9
M5	NL5	0.80	8.9	9.1	8.9	9.6
M6	NL6	1.00	15.5	12.9	15.5	13.6
M8	NL8	1.25	37.0	23.0	37.0	25.0
M10	NL10	1.50	73.0	37.0	73.0	39.0
M12	NL12	1.75	126.0	54.0	126.0	57.0
M14	NL14	2.00	201.0	74.0	201.0	78.0
M16	NL16	2.00	307.0	100.0	306.0	106.0
M18	NL18	2.50	430.0	123.0	429.0	130.0
M20	NL20	2.50	602.0	156.0	600.0	165.0
M22	NL22	2.50	821.0	194.0	818.0	205.0
M24	NL24	3.00	1,036.0	225.0	1,034.0	238.0
M27	NL27	3.00	1,514.0	294.0	1,509.0	310.0
M30	NL30	3.50	2,064.0	358.0	2,058.0	378.0
M33	NL33	3.50	2,782.0	443.0	2,772.0	468.0
M36	NL36	4.00	3,589.0	522.0	3,576.0	551.0
M39	NL39	4.00	4,632.0	624.0	4,613.0	659.0
M42	NL42	4.50	5,731.0	716.0	5,709.0	757.0

Cu/C paste = 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.

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

Nord-lock steel washers with non-plated bolt grade 12.9

Bolt size	Washer size	Pitch [mm]	Oil, G_F=71% μ_{th}=0.15, μ_h=0.13		Cu/C paste, G_F=75% μ_{th}=0.13, μ_h=0.14	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M3	NL3	0.50	2.2	3.9	2.3	4.1
M4	NL4	0.70	5.1	6.7	5.3	7.1
M5	NL5	0.80	10.0	10.9	10.3	11.5
M6	NL6	1.00	17.4	15.4	18.0	16.3
M8	NL8	1.25	42.0	28.0	43.0	30.0
M10	NL10	1.50	82.0	44.0	85.0	47.0
M12	NL12	1.75	142.0	65.0	146.0	68.0
M14	NL14	2.00	226.0	89.0	233.0	94.0
M16	NL16	2.00	345.0	120.0	355.0	127.0
M18	NL18	2.50	483.0	148.0	498.0	156.0
M20	NL20	2.50	676.0	188.0	696.0	198.0
M22	NL22	2.50	921.0	233.0	948.0	246.0
M24	NL24	3.00	1,165.0	270.0	1,199.0	286.0
M27	NL27	3.00	1,700.0	352.0	1,749.0	372.0
M30	NL30	3.50	2,316.0	430.0	2,386.0	454.0
M33	NL33	3.50	3,124.0	532.0	3,213.0	562.0
M36	NL36	4.00	4,029.0	626.0	4,145.0	662.0
M39	NL39	4.00	5,199.0	748.0	5,346.0	790.0
M42	NL42	4.50	6,434.0	860.0	6,617.0	908.0

Cu/C paste = 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
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- 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
fastener-standards.nord-lock.com

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

Stainless steel (SS) washers

Nord-Lock stainless steel washers with stainless steel bolt, lubricated with copper/graphite paste (Molykote® 1000).

Bolt size	Washer size	Pitch [mm]	A4-70 Cu/C paste, G_F=65%, μ_{th}=0.13, μ_h=0.13		A4-80 Cu/C paste, G_F=65%, μ_{th}=0.13, μ_h=0.13	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M3	NL3ss	0.50	0.8	1.5	1.1	2.0
M4	NL4ss	0.70	1.8	2.6	2.4	3.4
M5	NL5ss	0.80	3.6	4.1	4.8	5.5
M6	NL6ss	1.00	6.3	5.9	8.4	7.8
M8	NL8ss	1.25	15.0	11.0	20.0	14.0
M10	NL10ss	1.50	30.0	17.0	39.0	23.0
M12	NL12ss	1.75	51.0	25.0	68.0	33.0
M14	NL14ss	2.00	81.0	34.0	108.0	45.0
M16	NL16ss	2.00	124.0	46.0	165.0	61.0
M18	NL18ss	2.50	173.0	56.0	231.0	75.0
M20	NL20ss	2.50	243.0	72.0	323.0	95.0
M22	NL22ss	2.50	330.0	89.0	440.0	118.0
M24	NL24ss	3.00	418.0	103.0	557.0	137.0
M27	NL27ss	3.00	609.0	134.0	812.0	179.0
M30	NL30ss	3.50	831.0	164.0	1,108.0	219.0
M36	NL36ss	4.00	1,444.0	239.0	1,925.0	319.0

254 SMO® washers

Nord-Lock 254 SMO® washers with stainless steel bolt, lubricated with copper/graphite paste (Molykote® 1000).

Bolt size	Washer size	Pitch [mm]	A4-70 Cu/C paste, G_F=65%, μ_{th}=0.13, μ_h=0.13		A4-80 Cu/C paste, G_F=65%, μ_{th}=0.13, μ_h=0.13	
			Torque [Nm]	Clamp load [kN]	Torque [Nm]	Clamp load [kN]
M3	NL3ss	0.50	0.8	1.5	1.1	2.0
M4	NL4ss	0.70	1.8	2.6	2.4	3.4
M5	NL5ss	0.80	3.6	4.1	4.8	5.5
M6	NL6ss	1.00	6.3	5.9	8.4	7.8
M8	NL8ss	1.25	15.0	11.0	20.0	14.0
M10	NL10ss	1.50	30.0	17.0	39.0	23.0
M12	NL12ss	1.75	51.0	25.0	68.0	33.0
M14	NL14ss	2.00	81.0	34.0	108.0	45.0
M16	NL16ss	2.00	124.0	46.0	165.0	61.0
M18	NL18ss	2.50	173.0	56.0	231.0	75.0
M20	NL20ss	2.50	243.0	72.0	323.0	95.0
M22	NL22ss	2.50	330.0	89.0	440.0	118.0
M24	NL24ss	3.00	418.0	103.0	557.0	137.0
M27	NL27ss	3.00	609.0	134.0	812.0	179.0
M30	NL30ss	3.50	831.0	164.0	1,108.0	219.0
M36	NL36ss	4.00	1,444.0	239.0	1,925.0	319.0

Cu/C paste = Copper/graphite paste (Molykote® 1000)
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
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