USER MANUAL

Nord-Lock original washers

NORD-LOCK®

PART OF THE NORD-LOCK GROUP

THE SMART SYSTEM THAT PREVENTS YOUR BOLT FROM ROTATING LOOSE

Nord-Lock washers secure bolted joints with tension instead of friction. The system is comprised of a pair of washers with cams on one side and radial teeth on the opposite side. Since the cam angle 'α' is greater than the thread pitch 'β' a wedge effect is created by the cams, preventing the bolt from rotating loose.

Pre-glued

Nord-Lock washers are pre-glued in pairs upon delivery to facilitate first time mounting. The glue will no longer be effective after first use.

Reuse

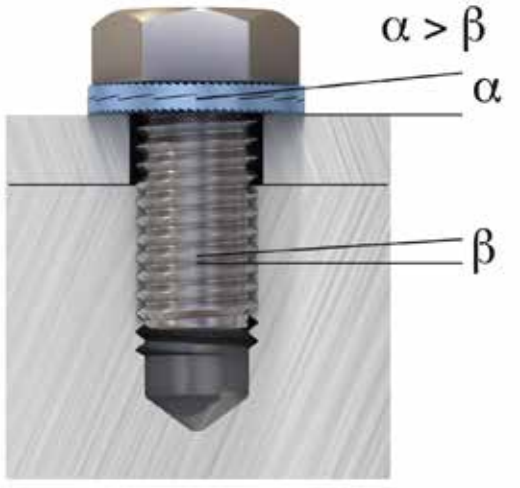
It is possible to reuse Nord-Lock washers. Visually inspect the cams and serrations for obvious defects before re-installation. Make sure the washers are installed in pairs, cam face to cam face. Reusability depends on conditions of use. Please note that the Lifetime Warranty is not applicable during reuse.

Thread

Nord-Lock washers are designed for Metric/UNC coarse pitch threads. They can also be used with fine pitch threads (Metric/UNC), but the increased difference in pitch between the thread and the washer needs to be considered. Higher difference in pitch leads to higher tension load and required torque during untightening. This can lead to exceeding the elastic limit of the bolt.

Traceability

Every box of Nord-Lock washers has a control number. Using the unique control number, every washer batch can be traced from the material certificate of the steel, through the entire production process to the finished washer. Nord-Lock washers are also laser marked with the Nord-Lock brand, control number and a type code. The laser-marking is only for identification and will not last if being re-used.



We are convinced that you are going to be satisfied with your locking product. Nord-Lock washers safely secure bolted joints that are subjected to extreme vibration and dynamic loads.

JOINT GUIDE

CORRECT USE OF NORD-LOCK WASHERS

Tapped holes

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

Counter bores

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

Through holes

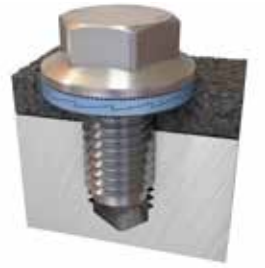
Through holes require two pairs of Nord-Lock washers - one pair for securing the bolt and one pair for securing the nut.

Stud bolts

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

Large slotted holes / soft underlying surfaces

To optimize the load distribution for applications with large / slotted holes or with soft underlying surface, use a flanged nut / 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.



NORD-LOCK ORIGINAL 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, e.g. wood, plastic
- ✘ For applications with extremely large settlements
- ✘ With non-preloaded joints

ASSEMBLY INSTRUCTIONS

IT´S EASY TO ASSEMBLE NORD-LOCK WASHERS

1. Put on 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 corresponding to the desired clamp load, using a calibrated torque wrench.

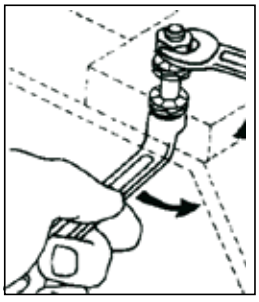
3. Ready!

Tightening of through holes

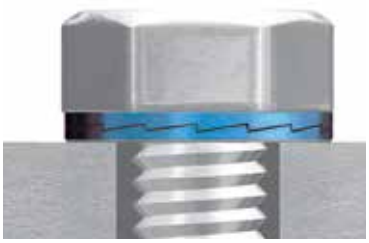
1. Turn both fasteners (bolt head/nut) in order to close the cams on both washers before tightening to minimize settlements.

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

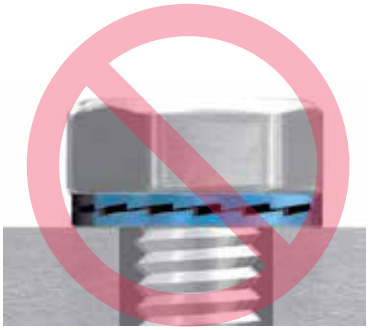
2. Keep the bolt/nut secured while tightening the other part (bolt/nut).



3. Ready!



Closed cams - correct



Open cams – not correct

MATERIAL GUIDE

APPLICATION PARAMETER	STEEL WASHERS	STAINLESS STEEL (SS) WASHERS	254 SMO® WASHERS
Steel type (EN)	1.7182 or equivalent	1.4404 or equivalent	1.4547 or equivalent
Examples of applications	General steel applications	General stainless steel applications. Non chlorine / acid environments	General salt water applications, pumps, chloride applications, heat exchangers, nuclear, desalination, food processing & medical equipment
Available for bolt sizes	M3-M130	M3-M80	M3-M39
Washer types	Regular outer diameter (NL3–NL130) Enlarged outer diameter (NL3,5sp–NL36sp)	Regular outer diameter (NL3ss–NL80ss) Enlarged outer diameter (NL3,5spss–NL30spss)	Regular outer diameter (NL3ss-254–NL39ss-254) Enlarged outer diameter (NL3,5spss-254–NL27spss-254)
Treatment	Through hardened	Surface hardened	Surface hardened
Surface coating	Delta Protekt® base coat (KL100) and top coat (VH302GZ)		
Washer hardness*	≥ 465 HV1	≥ 520HV0,05	≥ 600HV0,05
Corrosion resistance	Minimum 600 hours in salt spray test (according to IS09227)	PREN 27**	PREN 45**
Bolt grades	Up to 12.9	Up to A4-80	Up to A4-80
Temperature range***	-50°C to 200°C	-160°C to 500°C	-160°C to 500°C

* *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).*

** *PREN (Pitting Resistance Equivalent Number) = %Cr + 3,3x%Mo + 16x%N. Figures in table valid for base material. A higher PRE number indicates better corrosion resistance.*

*** *Temperature recommendations based on information from the raw material supplier and from tests. Locking function not affected within the specification.*

TORQUE GUIDE

The below torque values have been verified in test laboratories and represent a configuration example. The values are indicative and should not be seen as recommendations as varying conditions, joint designs and requirements apply. The Nord-Lock Group provides customized torque calculations to any standard, free of charge.

STEEL WASHERS - BOLT GRADE 8.8

Nord-Lock steel washers with electro zinc plated bolt

Washer size	Bolt 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]
NL3	M3	0,5	1,7	2,4	1,5	2,4	1,5	2,0
NL4	M4	0,7	3,8	4,2	3,6	4,2	3,5	3,5
NL5	M5	0,8	7,5	6,8	6,9	6,8	6,8	5,6
NL6	M6	1,0	13	9,7	12,1	9,7	12	8,0
NL8	M8	1,25	32	18	29	18	29	15
NL10	M10	1,5	62	28	57	28	56	23
NL12	M12	1,75	107	40	99	40	97	33
NL14	M14	2,0	170	55	157	55	155	46
NL16	M16	2,0	260	75	240	75	237	62
NL18	M18	2,5	364	92	336	92	331	76
NL20	M20	2,5	510	118	470	118	464	97
NL22	M22	2,5	696	146	642	146	634	120
NL24	M24	3,0	878	169	809	169	800	140
NL27	M27	3,0	1284	221	1183	221	1172	182
NL30	M30	3,5	1750	269	1613	269	1596	222
NL33	M33	3,5	2360	333	2173	333	2155	275
NL36	M36	4,0	3043	392	2803	392	2776	324
NL39	M39	4,0	3931	468	3619	468	3589	387
NL42	M42	4,5	4860	538	4476	538	4436	445

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

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.

STEEL WASHERS - BOLT GRADE 10.9

Nord-Lock steel washers with non-plated bolt

Washer size	Bolt 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]
NL3	M3	0,5	2,0	3,2	2,0	3,4
NL4	M4	0,7	4,5	5,6	4,5	5,9
NL5	M5	0,8	8,9	9,1	8,9	9,6
NL6	M6	1,0	15,5	12,9	15,5	13,6
NL8	M8	1,25	37	23	37	25
NL10	M10	1,5	73	37	73	39
NL12	M12	1,75	126	54	126	57
NL14	M14	2,0	201	74	201	78
NL16	M16	2,0	307	100	306	106
NL18	M18	2,5	430	123	429	130
NL20	M20	2,5	602	156	600	165
NL22	M22	2,5	821	194	818	205
NL24	M24	3,0	1036	225	1034	238
NL27	M27	3,0	1514	294	1509	310
NL30	M30	3,5	2064	358	2058	378
NL33	M33	3,5	2782	443	2772	468
NL36	M36	4,0	3589	522	3576	551
NL39	M39	4,0	4632	624	4613	659
NL42	M42	4,5	5731	716	5709	757

STEEL WASHERS - BOLT GRADE 12.9

Nord-Lock steel washers with non-plated bolt

Washer size	Bolt 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]
NL3	M3	0,5	2,2	3,9	2,3	4,1
NL4	M4	0,7	5,1	6,7	5,3	7,1
NL5	M5	0,8	10,0	10,9	10,3	11,5
NL6	M6	1,0	17,4	15,4	18	16,3
NL8	M8	1,25	42	28	43	30
NL10	M10	1,5	82	44	85	47
NL12	M12	1,75	142	65	146	68
NL14	M14	2,0	226	89	233	94
NL16	M16	2,0	345	120	355	127
NL18	M18	2,5	483	148	498	156
NL20	M20	2,5	676	188	696	198
NL22	M22	2,5	921	233	948	246
NL24	M24	3,0	1165	270	1199	286
NL27	M27	3,0	1700	352	1749	372
NL30	M30	3,5	2316	430	2386	454
NL33	M33	3,5	3124	532	3213	562
NL36	M36	4,0	4029	626	4145	662
NL39	M39	4,0	5199	748	5346	790
NL42	M42	4,5	6434	860	6617	908

TORQUE GUIDE

STAINLESS STEEL (SS) WASHERS

Washer size	Bolt 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]
NL3ss	M3	0,5	0,8	1,5	1,1	2,0
NL4ss	M4	0,7	1,8	2,6	2,4	3,4
NL5ss	M5	0,8	3,6	4,1	4,8	5,5
NL6ss	M6	1,0	6,3	5,9	8,4	7,8
NL8ss	M8	1,25	15	11	20	14
NL10ss	M10	1,5	30	17	39	23
NL12ss	M12	1,75	51	25	68	33
NL14ss	M14	2,0	81	34	108	45
NL16ss	M16	2,0	124	46	165	61
NL18ss	M18	2,5	173	56	231	75
NL20ss	M20	2,5	243	72	323	95
NL22ss	M22	2,5	330	89	440	118
NL24ss	M24	3,0	418	103	557	137
NL27ss	M27	3,0	609	134	812	179
NL30ss	M30	3,5	831	164	1108	219
NL36ss	M36	4,0	1444	239	1925	319

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

254 SMO® WASHERS

Washer size	Bolt 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]
NL3ss-254	M3	0,5	0,8	1,5	1,1	2,0
NL4ss-254	M4	0,7	1,8	2,6	2,4	3,4
NL5ss-254	M5	0,8	3,6	4,1	4,8	5,5
NL6ss-254	M6	1,0	6,3	5,9	8,4	7,8
NL8ss-254	M8	1,25	15	11	20	14
NL10ss-254	M10	1,5	30	17	39	23
NL12ss-254	M12	1,75	51	25	68	33
NL14ss-254	M14	2,0	81	34	108	45
NL16ss-254	M16	2,0	124	46	165	61
NL18ss-254	M18	2,5	173	56	231	75
NL20ss-254	M20	2,5	243	72	323	95
NL22ss-254	M22	2,5	330	89	440	118
NL24ss-254	M24	3,0	418	103	557	137
NL27ss-254	M27	3,0	609	134	812	179
NL30ss-254	M30	3,5	831	164	1108	219
NL36ss-254	M36	4,0	1444	239	1925	319

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

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
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.