NORD-LOCK GROUP

NORD-LOCK® WEDGE-LOCKING SOLUTIONS

PREVENT BOLTS FROM LOOSENING

NORD-LOCK®

WHEN SAFETY REALLY MATTERS

In the world of industry, where machinery, vehicles and equipment shape our civilization — details matter. Loosening bolts can lead to fatigue failure, unplanned downtime, production losses, significant maintenance needs or even injuries. Industries from oil and gas to railway, construction and power generation require a bolting solution that not only safeguards their people, projects and investments, but also equips them to go beyond the boundaries of everyday operations.

Developed in Sweden, in 1982, Nord-Lock washers prevent bolted connections from loosening — even under the most severe vibration and dynamic loads. With their unique wedge-locking technology and high-quality steel, Nord-Lock washers are the safest, most reliable bolt-securing solutions in the world.

With over 40 years of experience working under the harshest industrial conditions on earth, we have become experts at pushing the boundaries of manufacturing. From the design and production of our washers, to the rigorous testing in our technical laboratories and our personalized customer service — we will find the perfect solution for you.

This is one of the many billions of bolts that literally hold our modern society together. Due to its design, it has an unfortunate weakness.

When it is exposed to vibration it can loosen. Nord-Lock products prevent bolts from coming loose. Engineering will always challenge physical laws. For your applications and designs, Nord-Lock wedge-locking technology offers you total safety. Because just like bolted joints, vibration is everywhere.

NO MORE LOOSE BOLTS

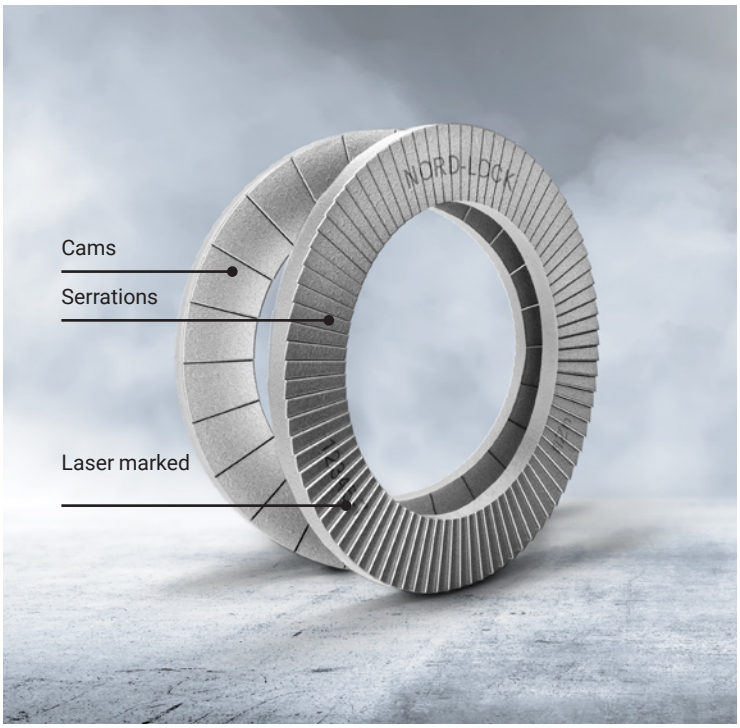
NO MORE LOOSE BOLTS

A pair of washers for maximum safety

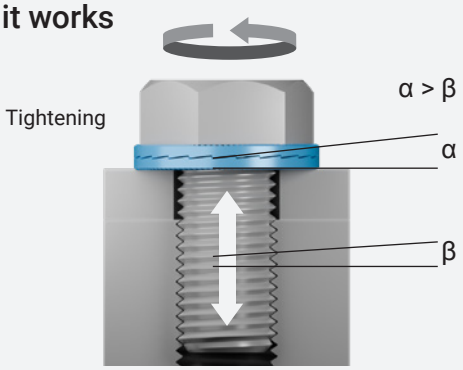
Nord-Lock bolt securing solutions consist of a pair of washers with cams facing each other and serrations gripping the mating surfaces. They use cam-geometry to effectively prevent the bolt from vibrating loose.

Tension prevents bolts from rotating loose

Think of the bolt as a spring. Turning the fastener during tightening stretches the bolt like a spring, creating the required clamp load to hold the parts together. Nord-Lock washers secure bolted joints by increasing this clamp load if the bolt tries to rotate loose.

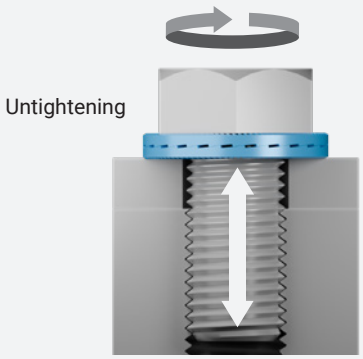


How it works



When the bolt and/or nut is tightened, the serrations grip and seat the mating surfaces. The Nord-Lock wedge-locking washer is locked in place, allowing movement only across the face of the cams.

Since the cam angle α, is larger than the thread pitch β, a wedge effect is created by the cams, preventing the bolt from rotating loose. Any attempt from the bolt/nut to rotate loose is blocked by the wedge effect of the cams.



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.

AN APPROVED SOLUTION

Tested and certified

Nord-Lock washers are produced to the highest specifications and quality standards. They are rigorously tested throughout our production process and they have been approved by independent institutes as well as certification authorities. Nord-Lock washers are laser marked to ensure our customers receive genuine products and to allow full traceability for every pair of washers.

High and consistent preload control

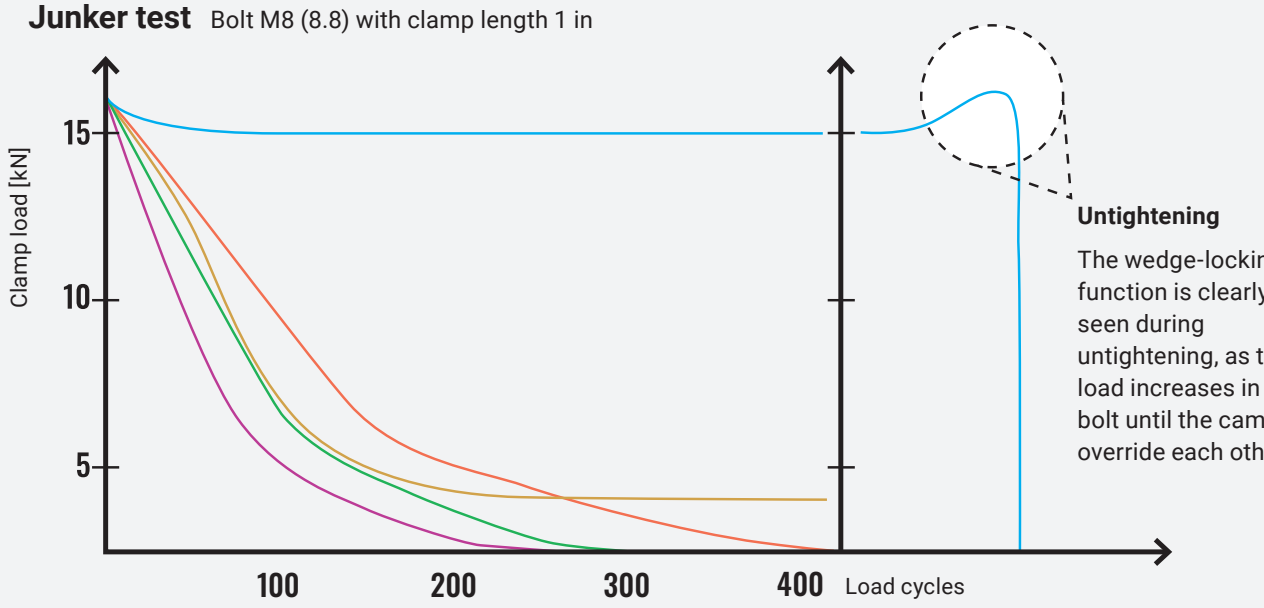
The Junker test is the most severe vibration test for bolted joints. It is used to compare how different locking methods behave under transverse vibrations between two construction parts, while continuously measuring the clamp load. Working load is normally axial, shear load is transversal load. Preload is vital to keeping parts together and preventing them from sliding—when it is lost, a bolted joint will fail.

During the Junker test (according to DIN 65151), the graph shows that the clamping load of all solutions drops dramatically apart from the Nord-Lock washers. All other solutions rely on friction, instead of geometry, to secure the bolted joint. Geometry is a more reliable locking method to control preload over time. This prevents costly downtime or accidents.

Scan QR-code to watch the Junker test

Watch the video! Go to www.youtube.com, search for the Nord-Lock Junker Test

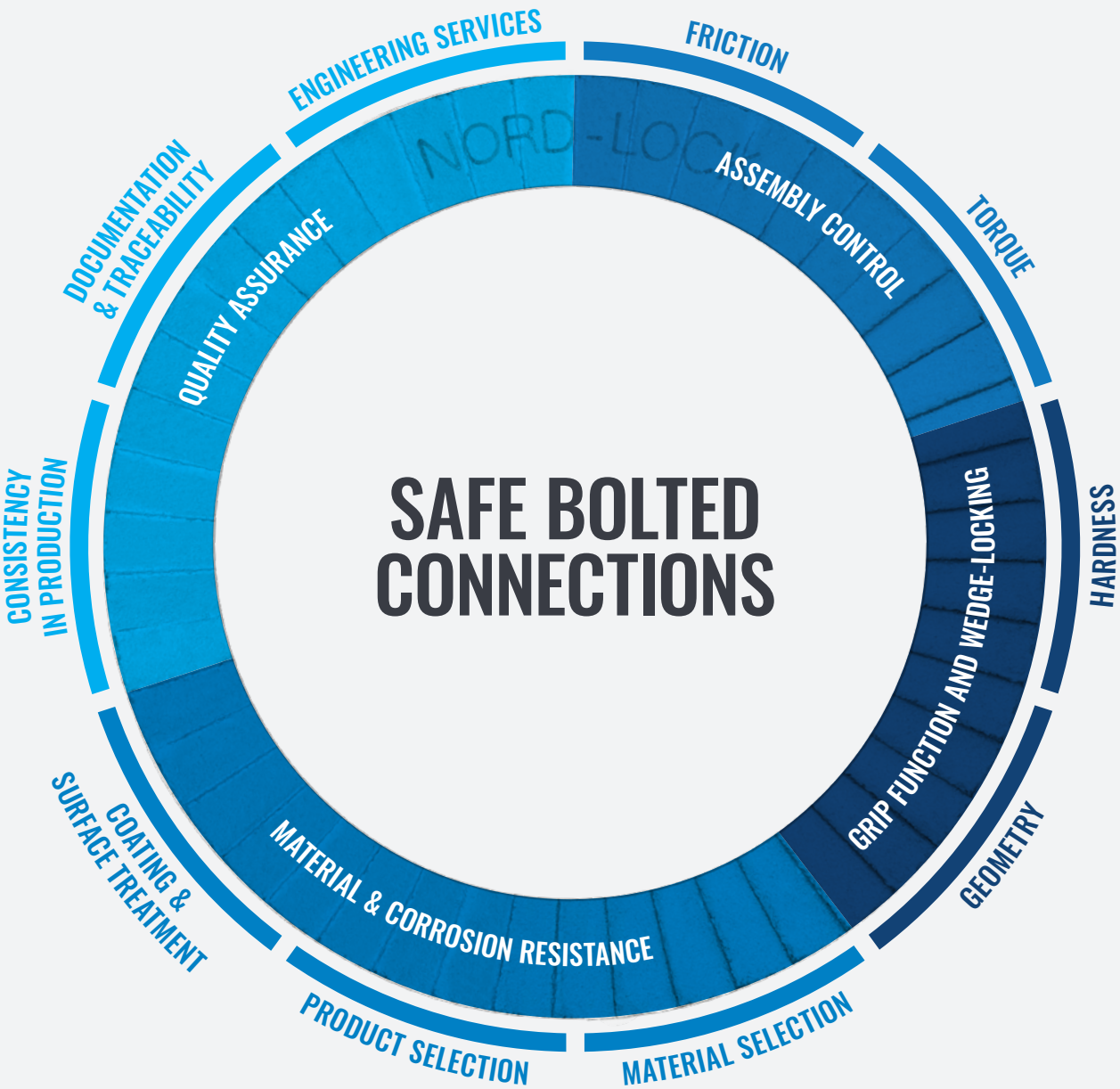
Junker test Bolt M8 (8.8) with clamp length 1 in



Untightening

The wedge-locking function is clearly seen during untightening, as the load increases in the bolt until the cams override each other.

WHEN FAILURE IS NOT AN OPTION



ASSEMBLY CONTROL

Preload in a bolted connection is crucial as this is what prevents parts in the assembly from opening and losing their function. Friction plays an important role in achieving the correct preload. Nord-Lock torque guidelines are based on the testing and evaluation of our products' friction value variations. Thanks to our modern in-house production, we provide consistent friction values. This ensures that you as our customer always achieve the correct preload.

GRIP FUNCTION & WEDGE-LOCKING

The wedge-locking function is activated when the two washers grip their respective mating surfaces. This ensures that movement can only occur between the washers. This is achieved by well-designed serrations and a correct hardness profile.

Our products are produced in a highly controlled environment with very tight tolerances. This ensures that each pair of washers performs equally well.

Once the assembly is tightened, the correct cam geometry effectively prevents the bolt from vibrating loose by increasing the clamping load in case rotation occurs. This is referred to as the wedge-locking effect and is what separates our washers from friction-based locking washers. Even in the most critical application, you can rely on the Nord-Lock wedge-locking technology to sustain the preload in your application.

MATERIAL & CORROSION RESISTANCE

To make every washer fulfill the demands from the bolted joint applications and the environment it operates in, our washers are based on a patented combination of high-spec materials and advanced production processes. With our range of materials, designs and coating options, there is a solution for every application.

QUALITY ASSURANCE

Nord-Lock washers are produced to the very highest quality standards and are rigorously tested throughout the production process to ensure consistency and reliability. Furthermore, they have been approved by independent institutes and certification authorities. With over 40 years of experience producing wedge-locking washers, Nord-Lock guarantees a safe solution for each of your bolted connections — a pledge cemented by our lifetime warranty.

Each pair of washers is laser marked with a control number to ensure that you receive genuine products and to allow for full traceability.

Nord-Lock engineering services include on-site visits by our sales engineers as well as advanced testing and verification capabilities at our state-of-the-art technical centers. If a suitable solution does not already exist, our product development team will work with you to customize a solution to suit your unique requirements.

NORD-LOCK® ORIGINAL WASHERS

WIDE RANGE & MANY MATERIALS

ORIGINAL WASHERS SP WASHERS

Nord-Lock original washers are recognized around the world for their ability to secure bolted joints exposed to severe vibration and dynamic loads. The washers increase operational reliability and lower your maintenance costs, while significantly reducing the risks of unplanned production stops, accidents and warranty claims.

Applications

Nord-Lock washers cannot loosen unintentionally as a wedge-effect is created underneath the bolt head/nut. Our extensive range includes washers in various materials and sizes. Nord-Lock washers are available in two outer diameters — standard and enlarged. Washers with an enlarged outer diameter (SP washers) are designed to be used together with flanged bolts and nuts (ISO 4161,4162) on oversized and slotted holes, and on sensitive surfaces and soft materials.

Black wedge-locking washers

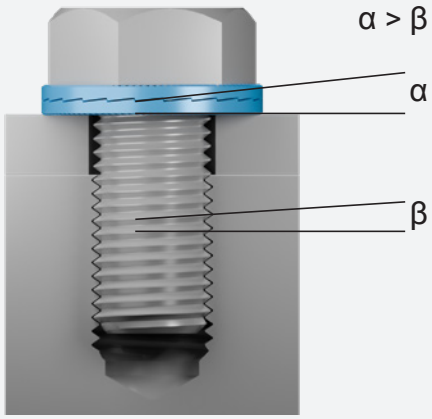
Nord-Lock washers are also available in black. Stocked range M6-M24 excluding SP Expect the same unmatched safety, corrosion resistance, and reliability, but with a black finish that can be crucial in specific critical mission environments.

Advantages

- Nord-Lock original washers secure bolted joints exposed to severe vibration and dynamic loads
- Available in a wide range of materials to suit use in general steel and stainless steel applications, and in corrosive, acidic and high-temperature environments
- Locking function not affected by lubrication
- Achieves accurate preload with defined and uniform friction
- Available in a wide range of sizes (metric and imperial)
- Designed for bolts up to and including property class 12.9 (steel) and A4-80 (stainless steel)
- High corrosion resistance (minimum 1,000 hours in salt spray test according to ISO 9227) for steel washers
- Reusable (depending on conditions of use)
- Custom sizes available upon request

How it works

When tightening, the bolt's serrations are embedded into the mating surfaces. As the cam angle α is greater than the thread pitch β, a wedge-effect is created.



NORD-LOCK® X-SERIES WASHERS

ONE SOLUTION FOR MULTIPLE DESIGN CHALLENGES

X-SERIES WASHERS X-SERIES SP WASHERS

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. Combining the unrivaled Nord-Lock wedge-effect with compensation against settlements, the X-series washers provide the extra level of security you need for applications that operate in extreme conditions.

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
- 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

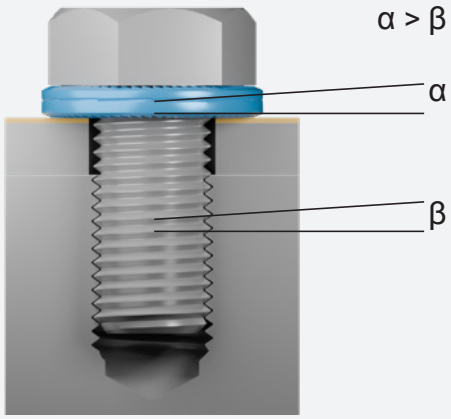
Advantages

- Nord-Lock X-Series washers secure bolted joints exposed to severe vibration and dynamic loads, reduces slackening and compensates against loss of preload
- Reliable locking, even for joints with short clamp length
- Locking function not affected by lubrication
- Achieves accurate preload with defined and uniform friction
- High corrosion resistance (minimum 1,000 hours in salt spray test according to ISO 9227, corresponding to C4 high or C5 medium according to ISO 12944-6)
- Reusable (depending on conditions of use)
- One solution to cover multiple design challenges

How it works

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

The wedge effect prevents bolt loosening caused by vibration and dynamic loads while the washer also reduces slackening and compensates against loss of preload, thanks to its conical shape.



NORD-LOCK® SC-WASHERS

DESIGNED FOR STEEL CONSTRUCTION

SC-WASHERS

Nord-Lock steel construction (SC) washers are wedge-locking washers specially designed for use on steel construction applications and to fit HV/HR sets bolts and nuts in accordance with the European standard EN 14399-3 /EN 14399-4 / EN 14399-8.

Applications

Nord-Lock SC-washers can easily replace a standard plain washer as well as chamfered washer to prevent the bolt from rotating loose. The SC-washers are suitable for a wide variety of applications across the construction and bridge-building industry.

They are safe to use with high-strength structural bolting assemblies for preloading and are confirmed for HV-assemblies by the European Technical Assessment ETA-20/0010 issued by the German Institute for Construction Technology (DIBt).

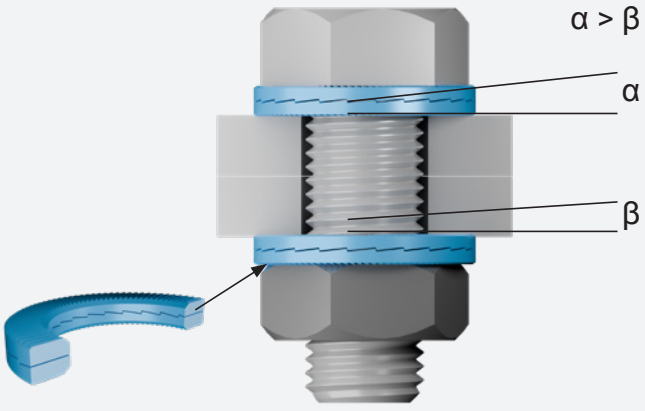
SC-washers, NLO, NLSS and 254 SMO® are safe to use in non-preloaded structural bolting assemblies according EN 15048 and confirmed by the ETA-19/0813 issued by the DIBt.

Advantages

- Nord-Lock SC-washers secure bolted joints exposed to severe vibration, dynamic loads, shockloads or thermal movement
- Secures bolted joints in structural steelwork
- Designed and approved for use with HV and HR bolting assemblies
- Locking function not affected by lubrication
- Available in steel material with sizes from M12–M36
- High corrosion resistance (minimum 1,000 hours in salt spray test according to ISO 9227) corresponds to C4 high or C5 medium according to ISO 12944-6
- Withstand temperatures between -50°C and 150°C
- CE marked (ETA-19/0813, ETA-20/0010)

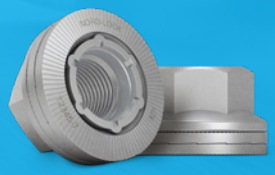
How it works

The system consists of a pair of washers that use Nord-Lock wedge-locking technology. Each washer has cam faces on one side and serrations on the other. They also have chamfers on the inner diameter which ensures optimal fit with HV bolts. Since the chamfer is present on both sides of each pair, it also eliminates the risk of incorrect installation.



NORD-LOCK® WHEEL NUTS

SAFE WHEELS SAVE LIVES



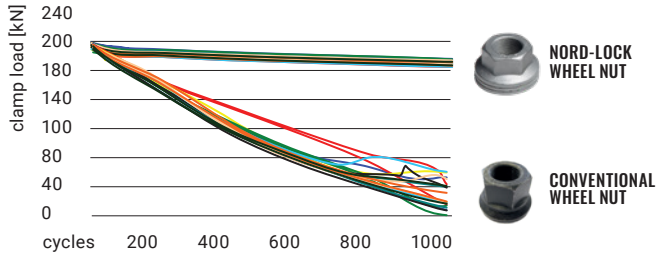
WHEEL NUTS

Nord-Lock wheel nuts safely secure wheels on commercial vehicles by maintaining a high clamp force, even under extreme operating conditions. They represent a simple and cost-effective way to make wheels safe and secure for more productive and efficient operations.

Applications

Nord-Lock wheel nuts are designed for flat-faced steel rims. Each nut is permanently attached to a pair of Nord-Lock wedge-locking washers. The wheel nut is suitable for:

- Heavy on-road vehicles (buses, trucks, trailers, etc.)
- Off-road vehicles (tractors, farming equipment, mining equipment, forestry machinery, military vehicles, etc.)



Advantages

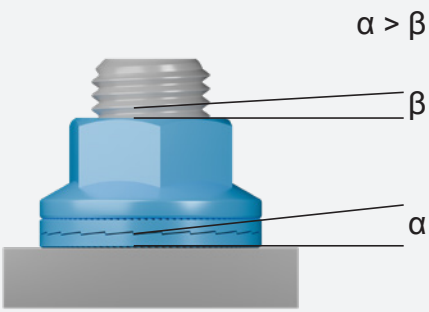
- The Nord-Lock wheel nut safely secures wheels on both on-road and off-road heavy vehicles
- Improves driver productivity while reducing operating and service costs
- Minimizes risk of accidents and injury
- Easy to install and remove using hand tools
- Pre-lubricated
- Suits flat-faced steel rims
- Available in sizes M16–M24
- High corrosion resistance (minimum 600 hours in salt spray test according to ISO 9227)
- Reusable (depending on conditions of use)

In tests, the Nord-Lock wheel nuts prove superior in securing wheel joints and maintaining clamp load.
The graphs display products tightened to 200 kN and the change in clamp load during 1000 load cycles.

How it works

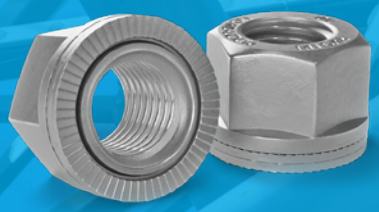
When tightening, the bolt's serrations are embedded into the mating surfaces. As the cam angle α is greater than the thread pitch β, a wedge-effect is created.

The washer's serrations are embedded into the mating surfaces, allowing movement only across the cam faces while the wedge effect prevents rotation of the nut.



NORD-LOCK® COMBI NUTS

FASTER AND SAFER ASSEMBLY



COMBI NUTS

Expect simpler assembly, fewer errors, and optimized efficiency with our combi nuts, combining a nut with a pair of captivated Nord-Lock original washers.

Applications

Combi nuts are ideal when there is a lack of accessibility or when loose parts make assembling and maintenance difficult. The advantages of the combi nut will streamline production for any manufacturer using serial assembly.

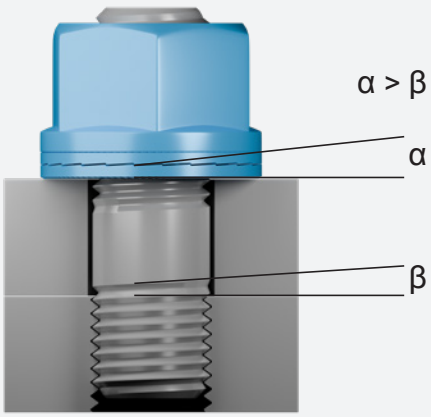
Advantages

- Faster assembly
- Reduced risk of incorrect assembly
- Lower risk of parts coming loose
- Easier disassembly and reassembly during maintenance
- Less time required to maintain production
- Cost savings through improved productivity

How it works

Each combi nut combines a nut with a pair of captivated Nord-Lock Original washers, with cam faces on one side and serrations on the other, giving rise to the wedge effect.

With movement only occurring across the cam faces, any rotation of the combi nut is blocked by the wedge effect of the cams.



CUSTOMIZED SOLUTIONS

TRUE CUSTOMIZATION

As pioneers in bolt-securing technology, it is in our nature to find new ways to overcome bolting challenges. Whatever the bolting issue, you can turn to us for a customized solution.

Need a custom solution for a unique challenge?

Customized dimensions, coatings, labels, laser marking, certification, geometry, materials, from pre-designed solutions or combining several technologies – customized washers know few limits.

At Nord-Lock, we share our experience, knowledge, and creativity to help our customers achieve the outstanding results they require. All Nord-Lock products are manufactured with the highest quality materials and undergo rigorous testing to ensure that they perform to your specifications.

Possible customization options:

- Coatings with improved corrosion resistance
- Colored coatings
- Custom inner and outer diameter
- Left-handed washers
- Custom thickness
- Custom materials
- Added chamfers
- Customer-unique laser marking

Combi products

To prevent the washers from falling off the bolt, the outer diameter of the threads must be larger than the inner diameter of the washers. To achieve this, the washer is installed on the bolt bank before thread rolling. This assembly process is usually utilized when producing larger volumes (around 30,000). For smaller volumes, we have developed a process of retaining the washer in a glueing process, which drastically reduces lead times.

Recommended sizes are M6 to M27, and 150 millimeters long, and standard materials.

CONSISTENCY IS WHAT SETS OUR WASHERS APART

Our attention to detail ensures the products you receive are consistently excellent, so you can expect exceptional performance with every use.

LIFETIME WARRANTY
NORD-LOCK GROUP

WHEN YOU'RE MOVING AT 320 KM/H, WE WON'T MOVE AT ALL

Fast delivery

We ship our standard range of washers globally. Nord-Lock products are supplied through distribution centers in North America, Europe and Asia, ensuring that they are available anytime, anywhere.

Traceability

All Nord-Lock standard washers are laser marked with the Nord-Lock brand name, control number and a type code. This ensures that all our customers receive genuine washers and allows full traceability down to the raw material charge at the steel mill.

The industry's first full Lifetime Warranty

You can trust our products, which is why we introduced the industry's first full lifetime warranty. This guarantees that our washers will stay in place and fulfill their function for the entire lifetime of the bolted connection.

Quality and environmental assurance

We offer premium washers with documented success in industries where safe, reliable bolting is critical. Numerous industry standards and international certification authorities approve of our product's quality and performance promises.

- ISO 9001:2015
- ISO 14001:2015
- RoHS, ELV and Reach compliant
- Licensed by Dörken to perform Delta Protekt® zink flake coating in-house

Certificates and approvals

- DIBt (Deutsches Institut für Bautechnik)
- DNV GL (Det Norske Veritas Germanischer Lloyd)
- EBA (Eisenbahn-Bundesamt)
- TÜV (Technischer Überwachungs-Verein)
- LR (Lloyd's Register)
- CE marked

For more information or a complete list of certificates and approvals, please visit nord-lock.com or contact your nearest Nord-Lock representative.

YOUR PARTNER IN SECURE BOLTING SOLUTIONS

At Nord-Lock, we understand that your projects are bigger than a single product, which is why we offer you a range of technical expertise and services to make your job easier. Whatever your challenge, our in-house experts will combine their product and industry knowledge to offer you a bolting solution that is quick and easy to install, without the need for frequent checks and retightening.

WE WORK CLOSELY WITH YOU

Analysis

Our highly specialized application engineers can perform bolted joint calculations and verifications — including Finite Element Method, macro and microscopic analysis, VDI 2230:2015 calculation, NF E 25030-1 and -2, ASME code, RCC-M code and more.

Tests

Our technical centers are equipped with state-of-the-art testing equipment. These are at your disposal for Junker tests according to DIN 65151, DIN 25201-4 and ISO 16130, torque-tensile tests, joint failure analysis and more.

Engineering Expertise

Our engineers can help you solve your bolting challenges to improve safety and reduce costs. We provide training, offer installation support and even customized technical guidelines.

MORE SUPPORT FOR YOU

- **On-site training**
  We share our knowledge and experience of best bolting practices with your team.

- **E-learning**
  Courses are available for anyone working with Nord-Lock washers. Courses cover general bolting knowledge as well as in-depth technical information about our products.

- **Technical centers and seminars**
  You are welcome to visit our offices and technical centers for a tour, or to attend seminars about bolted joints. For more information contact your local Nord-Lock representative.

- **Technical guides, user manuals and CAD files**
  We provide supporting materials such as technical guides, user manuals and CAD files to help you use our products. If you are looking for custom materials, please contact your local Nord-Lock representative.
  www.nord-lock.com/download
  www.nord-lock.com/cad

2D/3D CAD models

Torque guidelines

- **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.

BUILD CONNECTIONS THAT LAST

NORD-LOCK GROUP

Nord-Lock Group is a global leader in bolting and engineering solutions. From deep subsea to outer space, our promise to build connections that last goes beyond manufacturing the best bolting technologies. Our people are experts in the lifecycle of secure bolted joints, innovators at the forefront of digital solutions and committed to doing business with respect for people and planet.

Our technology brands are all the original inventors of their respective technologies: Nord-Lock® wedge-locking washers, Superbolt® mechanical tensioners, Boltight® hydraulic tensioners and Expander® System pivot pins.

Nord-Lock Group is owned by the Nasdaq OMX Stockholm quoted company Investment AB Latour.

NORD-LOCK®

Creator of the original wedge-locking washer technology and global leader in safe bolted connections.

SUPERBOLT®

Original inventor of Multi-Jackbolt Tensioning technology, a revolutionary mechanical solution engineered to replace unsafe bolting methods with the use of simple hand tools.

BOLTIGHT®

Pioneer in innovative bolt tensioning with industry-leading hydraulic solutions, including the fastest auto-return tensioner on the market.

Expander®

Leader in pivot pin technology, on a mission to end lug wear on heavy-duty machines everywhere.

65+
COUNTRIES

32+
OFFICES WORLDWIDE

700+
EMPLOYEES

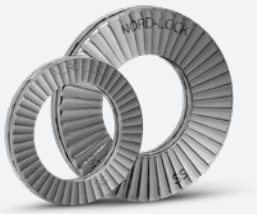
6
PRODUCTION PLANTS

10
TECHNICAL CENTERS

NORD-LOCK® ORIGINAL WASHERS

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
Applications	General steel application	General stainless steel applications Non chlorine / acid environments
Material Standard	EN 1.7182	EN 1.4404
Size Range	M3–M130 #5 to 5"	M3–M80 #5 to 3 1/8"
Corrosion Resistance**	Minimum 1,000 hours in salt spray test according to ISO 9227	PREN 27
Hardening	Through hardened	Surface hardened
Washer Hardness*	≥ 465HV1	≥ 520HV0.05
Coating	Base coat: Delta Protekt® KL100 zinc flake coating Top coat: VH 302 GZ Standard products in range M6-M24 are available with Delta Seal GZ Black top coat (SP items not included)	–
Bolt Grades	Up to 12.9	Up to A4-80
Temperature Range***	-50°C to 200°C	-160°C to 500°C
Product Designation	NL NLsp	NLss NLspss
Laser Marking Type Code	Traceable batch number and type code flZn	SS

*
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.

254 SMO®

ALLOY C-276

ALLOY 718

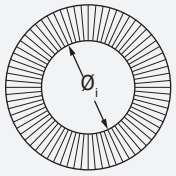
Applications	General salt water applications, pumps, chloride applications, heat exchangers, nuclear, desalination, food processing & medical equipment	General acidic environments, process and chemical industry, evaporators, offshore downhole tooling	High temperatures – gas turbines, turbo charges, incinerators
Material Standard	EN 1.4547	EN 2.4819 or equivalent	EN 2.4668 or equivalent
Size Range	M3–M39 #5 to 1 1/2"	M4–M20 #8 to 1 1/2"	M4–M20 #8 to 1 1/2"
Corrosion Resistance**	PREN 45	PREN 68	PREN 29
Hardening	Surface hardened	Surface hardened	Surface hardened
Washer Hardness*	≥ 600HV0.05	≥ 520HV0.05	≥ 620HV0.05
Coating	–	–	–
Bolt Grades	–	–	–
Temperature Range***	-160°C to 500°C	-160°C to 500°C	-160°C to 700°C
Product Designation	NLss-254 NLspss-254	NLss-276 NLspss-276	NLss-718 NLspss-718
Laser Marking Type Code	254	276	718

NORD-LOCK ORIGINAL STEEL WASHERS

DIMENSIONS

Delta Protekt® Zinc Flake Coating
Delta Seal GZ top coat

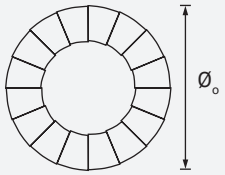
Through hardened EN 1.7182



NL3–NL8sp
Ø$_i$ ±0.1 mm

NL3/8"–NL42
Ø$_i$ ±0.2 mm

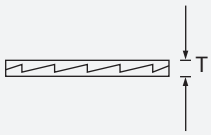
NL45–NL130
Ø$_i$ +0.5 / -0.0 mm



NL3–NL1"sp
Ø$_o$ ±0.2 mm

NL27–NL42
Ø$_o$ ±0.3 mm

NL45–NL130
Ø$_o$ +0.0 / -2.0 mm



NL3–NL42
T ±0.25 mm

NL45–NL130
T ±0.75 mm

Note that washers with thickness 6.6 mm have a thickness tolerance +0.0 / -0.5 mm

Nord-Lock steel washers in sizes NL3–NL52 with zinc flake coating are standard stock items.

Torque guidelines

2D/3D CAD models

- Torque guidelines web app: www.nord-lock.com/nord-lock/torquelator

- 2D/3D CAD models: www.nord-lock.com/nord-lock/cad

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M3	#5	NL3	3.4	0.134	7.0	0.276	1.8	0.071	200
M3.5	#6	NL3.5	3.9	0.154	7.6	0.299	1.8	0.071	200
M3.5	#6	NL3.5sp	3.9	0.154	9.0	0.354	1.8	0.071	200
M4	#8	NL4	4.4	0.173	7.6	0.299	1.8	0.071	200
M4	#8	NL4sp	4.4	0.173	9.0	0.354	1.8	0.071	200
M5	#10	NL5	5.4	0.213	9.0	0.354	1.8	0.071	200
M5	#10	NL5sp	5.4	0.213	10.8	0.425	1.8	0.071	200
M6		NL6	6.5	0.256	10.8	0.425	1.8	0.071	200
M6		NL6sp	6.5	0.256	13.5	0.531	2.5	0.098	200
	1/4"	NL1/4"	7.2	0.283	11.5	0.453	2.5	0.098	200
	1/4"	NL1/4"sp	7.2	0.283	13.5	0.531	2.5	0.098	200
M8	5/16"	NL8	8.7	0.343	13.5	0.531	2.5	0.098	200
M8	5/16"	NL8sp	8.7	0.343	16.6	0.654	2.5	0.098	200
	3/8"	NL3/8"	10.3	0.406	16.6	0.654	2.5	0.098	200
	3/8"	NL3/8"sp	10.3	0.406	21.0	0.827	2.5	0.098	200
M10		NL10	10.7	0.421	16.6	0.654	2.5	0.098	200
M10		NL10sp	10.7	0.421	21.0	0.827	2.5	0.098	200
M11	7/16"	NL11	11.4	0.449	18.5	0.728	2.5	0.098	200
M12		NL12	13.0	0.512	19.5	0.768	2.5	0.098	200
M12		NL12sp	13.0	0.512	25.4	1.000	3.4	0.134	100
	1/2"	NL1/2"	13.5	0.531	19.5	0.768	2.5	0.098	200
	1/2"	NL1/2"sp	13.5	0.531	25.4	1.000	3.4	0.134	100
M14	9/16"	NL14	15.2	0.598	23.0	0.906	3.4	0.134	100
M14	9/16"	NL14sp	15.2	0.598	30.7	1.209	3.4	0.134	100
M16	5/8"	NL16	17.0	0.669	25.4	1.000	3.4	0.134	100
M16	5/8"	NL16sp	17.0	0.669	30.7	1.209	3.4	0.134	100
M18		NL18	19.5	0.768	29.0	1.142	3.4	0.134	100
M18		NL18sp	19.5	0.768	34.5	1.358	3.4	0.134	100
	3/4"	NL3/4"	20.0	0.787	30.7	1.209	3.4	0.134	100
	3/4"	NL3/4"sp	20.0	0.787	39.0	1.535	3.4	0.134	100
M20		NL20	21.4	0.843	30.7	1.209	3.4	0.134	100
M20		NL20sp	21.4	0.843	39.0	1.535	3.4	0.134	100
M22	7/8"	NL22	23.4	0.921	34.5	1.358	3.4	0.134	100
M22	7/8"	NL22sp	23.4	0.921	42.0	1.654	4.6	0.181	50
M24		NL24	25.3	0.996	39.0	1.535	3.4	0.134	100
M24		NL24sp	25.3	0.996	48.5	1.909	4.6	0.181	50
	1"	NL1"	27.9	1.098	39.0	1.535	3.4	0.134	100
	1"	NL1"sp	27.9	1.098	48.5	1.909	4.6	0.181	50
M27		NL27	28.4	1.118	42.0	1.654	5.8	0.228	50
M27		NL27sp	28.4	1.118	48.5	1.909	5.8	0.228	25
M30	1 1/8"	NL30	31.4	1.236	47.0	1.850	5.8	0.228	50
M30	1 1/8"	NL30sp	31.4	1.236	55.0	2.165	5.8	0.228	25
M33	1 1/4"	NL33	34.4	1.354	48.5	1.909	5.8	0.228	25
M33	1 1/4"	NL33sp	34.4	1.354	58.5	2.303	5.8	0.228	25
M36	1 3/8"	NL36	37.4	1.472	55.0	2.165	5.8	0.228	25
M36	1 3/8"	NL36sp	37.4	1.472	63.0	2.480	5.8	0.228	25
M39	1 1/2"	NL39	40.4	1.591	58.5	2.303	5.8	0.228	25
M42		NL42	43.2	1.701	63.0	2.480	5.8	0.228	25
M45	1 3/4"	NL45	46.2	1.819	70.0	2.756	7.0	0.276	25
M48		NL48	49.6	1.953	75.0	2.953	7.0	0.276	25
M52	2"	NL52	53.6	2.110	80.0	3.150	7.0	0.276	25
M56	2 1/4"	NL56	59.1	2.327	85.0	3.346	7.0	0.276	10
M60		NL60	63.1	2.484	90.0	3.543	7.0	0.276	10
M64	2 1/2"	NL64	67.1	2.642	95.0	3.740	7.0	0.276	10
M68		NL68	71.1	2.799	100.0	3.937	9.5	0.374	1
M72		NL72	75.1	2.957	105.0	4.134	9.5	0.374	1
M76	3"	NL76	79.1	3.114	110.0	4.331	9.5	0.374	1
M80	3 1/8"	NL80	83.1	3.272	115.0	4.528	9.5	0.374	1
M85		NL85	88.1	3.469	120.0	4.724	9.5	0.374	1
M90		NL90	92.4	3.638	130.0	5.118	9.5	0.374	1
M95		NL95	97.4	3.835	135.0	5.315	9.5	0.374	1
M100	4"	NL100	103.4	4.071	145.0	5.709	9.5	0.374	1
M105		NL105	108.4	4.268	150.0	5.906	9.5	0.374	1
M110		NL110	113.4	4.465	155.0	6.102	9.5	0.374	1
M115		NL115	118.4	4.661	165.0	6.496	9.5	0.374	1
M120		NL120	123.4	4.858	170.0	6.693	9.5	0.374	1
M125		NL125	128.4	5.055	173.0	6.811	9.5	0.374	1
M130	5"	NL130	133.4	5.252	178.0	7.008	9.5	0.374	1

TORQUE GUIDELINES

Nord-Lock original steel washers with electro zinc plated bolt grade 8.8

Bolt size	Washer size	Pitch [in]	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	0.020	1.7	2.4	1.5	2.4	1.5	2.0
M4	NL4	0.028	3.8	4.2	3.6	4.2	3.5	3.5
M5	NL5	0.031	7.5	6.8	6.9	6.8	6.8	5.6
M6	NL6	0.039	13.0	9.7	12.1	9.7	12.0	8.0
M8	NL8	0.049	32.0	18.0	29.0	18.0	29.0	15.0
M10	NL10	0.059	62.0	28.0	57.0	28.0	56.0	23.0
M12	NL12	0.069	107.0	40.0	99.0	40.0	97.0	33.0
M14	NL14	0.079	170.0	55.0	157.0	55.0	155.0	46.0
M16	NL16	0.079	260.0	75.0	240.0	75.0	237.0	62.0
M18	NL18	0.098	364.0	92.0	336.0	92.0	331.0	76.0
M20	NL20	0.098	510.0	118.0	470.0	118.0	464.0	97.0
M22	NL22	0.098	696.0	146.0	642.0	146.0	634.0	120.0
M24	NL24	0.118	878.0	169.0	809.0	169.0	800.0	140.0
M27	NL27	0.118	1284.0	221.0	1183.0	221.0	1172.0	182.0
M30	NL30	0.138	1750.0	269.0	1613.0	269.0	1596.0	222.0
M33	NL33	0.138	2360.0	333.0	2173.0	333.0	2155.0	275.0
M36	NL36	0.157	3043.0	392.0	2803.0	392.0	2776.0	324.0
M39	NL39	0.157	3931.0	468.0	3619.0	468.0	3589.0	387.0
M42	NL42	0.177	4860.0	538.0	4476.0	538.0	4436.0	445.0

Cu/C paste - Nord-Lock steel washers with stainless 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.

Nord-Lock original steel washers with non-plated bolt grade 10.9

Bolt size	Washer size	Pitch [in]	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]
M3	NL3	0.020	2.0	3.2	2.0	3.4
M4	NL4	0.028	4.5	5.6	4.5	5.9
M5	NL5	0.031	8.9	9.1	8.9	9.6
M6	NL6	0.039	15.5	12.9	15.5	13.6
M8	NL8	0.049	37.0	23.0	37.0	25.0
M10	NL10	0.059	73.0	37.0	73.0	39.0
M12	NL12	0.069	126.0	54.0	126.0	57.0
M14	NL14	0.079	201.0	74.0	201.0	78.0
M16	NL16	0.079	307.0	100.0	306.0	106.0
M18	NL18	0.098	430.0	123.0	429.0	130.0
M20	NL20	0.098	602.0	156.0	600.0	165.0
M22	NL22	0.098	821.0	194.0	818.0	205.0
M24	NL24	0.118	1036.0	225.0	1034.0	238.0
M27	NL27	0.118	1514.0	294.0	1509.0	310.0
M30	NL30	0.138	2064.0	358.0	2058.0	378.0
M33	NL33	0.138	2782.0	443.0	2772.0	468.0
M36	NL36	0.157	3589.0	522.0	3576.0	551.0
M39	NL39	0.157	4632.0	624.0	4613.0	659.0
M42	NL42	0.177	5731.0	716.0	5709.0	757.0

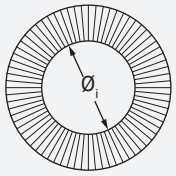
Nord-Lock original steel washers with non-plated bolt grade 12.9

Bolt size	Washer size	Pitch [in]	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	0.020	2.2	3.9	2.3	4.1
M4	NL4	0.028	5.1	6.7	5.3	7.1
M5	NL5	0.031	10.0	10.9	10.3	11.5
M6	NL6	0.039	17.4	15.4	18.0	16.3
M8	NL8	0.049	42.0	28.0	43.0	30.0
M10	NL10	0.059	82.0	44.0	85.0	47.0
M12	NL12	0.069	142.0	65.0	146.0	68.0
M14	NL14	0.079	226.0	89.0	233.0	94.0
M16	NL16	0.079	345.0	120.0	355.0	127.0
M18	NL18	0.098	483.0	148.0	498.0	156.0
M20	NL20	0.098	676.0	188.0	696.0	198.0
M22	NL22	0.098	921.0	233.0	948.0	246.0
M24	NL24	0.118	1165.0	270.0	1199.0	286.0
M27	NL27	0.118	1700.0	352.0	1749.0	372.0
M30	NL30	0.138	2316.0	430.0	2386.0	454.0
M33	NL33	0.138	3124.0	532.0	3213.0	562.0
M36	NL36	0.157	4029.0	626.0	4145.0	662.0
M39	NL39	0.157	5199.0	748.0	5346.0	790.0
M42	NL42	0.177	6434.0	860.0	6617.0	908.0

NORD-LOCK ORIGINAL STAINLESS STEEL WASHERS

DIMENSIONS

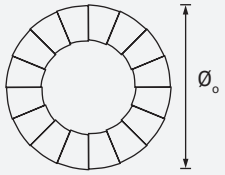
Surface hardened EN 1.4404 (AISI 316L)



NL3ss–NL8spss
Ø$_i$ ±0.1 mm

NL3/8"ss–NL42ss
Ø$_i$ ±0.2 mm

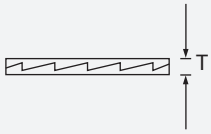
NL45ss–NL80ss
Ø$_i$ +0.5 / -0.0 mm



NL3ss–NL1"spss
Ø$_o$ ± 0.2 mm

NL27ss–NL42ss
Ø$_o$ ± 0.3 mm

NL45 ss–NL80ss
Ø$_o$ +0.0 / -2.0 mm



NL3ss–NL1"spss
T ± 0.25 mm

NL27ss–NL42ss
T+0.0 / -0.5 mm

NL45ss–NL80ss
T ± 0.75 mm

EN 1.4404 is an austenitic chromium-nickel stainless steel containing molybdenum. EN 1.4404 is one of the most commonly used stainless steel grades. This stainless steel also has extra-low carbon content in order to reduce the risk of chromium-carbide precipitation.

Nord-Lock washers made of EN 1.4404 are suitable for most applications where no chlorides or acids are present.

Nord-Lock washers made of stainless steel are standard stock items, yet subject to prior sale.

Bolt size Metric	Bolt size UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M3	#5	NL3ss	3.4	0.134	7.0	0.276	2.2	0.087	200
M3.5	#6	NL3.5ss	3.9	0.154	7.6	0.299	2.2	0.087	200
M3.5	#6	NL3.5spss	3.9	0.154	9.0	0.354	2.2	0.087	200
M4	#8	NL4ss	4.4	0.173	7.6	0.299	2.2	0.087	200
M4	#8	NL4spss	4.4	0.173	9.0	0.354	2.2	0.087	200
M5	#10	NL5ss	5.4	0.213	9.0	0.354	2.2	0.087	200
M5	#10	NL5spss	5.4	0.213	10.8	0.425	2.2	0.087	200
M6		NL6ss	6.5	0.256	10.8	0.425	2.2	0.087	200
M6		NL6spss	6.5	0.256	13.5	0.531	2.1	0.083	200
	1/4"	NL1/4"ss	7.2	0.283	11.5	0.453	2.2	0.087	200
	1/4"	NL1/4"spss	7.2	0.283	13.5	0.531	2.2	0.087	200
M8	5/16"	NL8ss	8.7	0.343	13.5	0.531	2.0	0.079	200
M8	5/16"	NL8spss	8.7	0.343	16.6	0.654	2.2	0.087	200
	3/8"	NL3/8"ss	10.3	0.406	16.6	0.654	2.0	0.079	200
	3/8"	NL3/8"spss	10.3	0.406	21.0	0.827	2.0	0.079	200
M10		NL10ss	10.7	0.421	16.6	0.654	2.0	0.079	200
M10		NL10spss	10.7	0.421	21.0	0.827	2.3	0.091	200
M11	7/16"	NL11ss	11.4	0.449	18.5	0.728	2.2	0.087	200
M12		NL12ss	13.0	0.512	19.5	0.768	2.1	0.083	200
M12		NL12spss	13.0	0.512	25.4	1.000	3.0	0.118	100
	1/2"	NL1/2"ss	13.5	0.531	19.5	0.768	2.0	0.079	200
	1/2"	NL1/2"spss	13.5	0.531	25.4	1.000	3.2	0.126	100
M14	9/16"	NL14ss	15.2	0.598	23.0	0.906	3.0	0.118	100
M14	9/16"	NL14spss	15.2	0.598	30.7	1.209	3.2	0.126	100
M16	5/8"	NL16ss	17.0	0.669	25.4	1.000	3.0	0.118	100
M16	5/8"	NL16spss	17.0	0.669	30.7	1.209	3.2	0.126	100
M18		NL18ss	19.5	0.768	29.0	1.142	3.2	0.126	100
M18		NL18spss	19.5	0.768	34.5	1.358	3.2	0.126	100
	3/4"	NL3/4"ss	20.0	0.787	30.7	1.209	3.2	0.126	100
	3/4"	NL3/4"spss	20.0	0.787	39.0	1.535	3.2	0.126	100
M20		NL20ss	21.4	0.843	30.7	1.209	3.0	0.118	100
M20		NL20spss	21.4	0.843	39.0	1.535	3.2	0.126	100
M22	7/8"	NL22ss	23.4	0.921	34.5	1.358	3.2	0.126	100
M22	7/8"	NL22spss	23.4	0.921	42.0	1.654	3.2	0.126	50
M24		NL24ss	25.3	0.996	39.0	1.535	3.2	0.126	100
M24		NL24spss	25.3	0.996	48.5	1.909	4.5	0.177	50
	1"	NL1"ss	27.9	1.098	39.0	1.535	3.2	0.126	100
	1"	NL1"spss	27.9	1.098	48.5	1.909	3.2	0.126	50
M27		NL27ss	28.4	1.118	42.0	1.654	6.8	0.268	50
M27		NL27spss	28.4	1.118	48.5	1.909	6.8	0.268	25
M30	1 1/8"	NL30ss	31.4	1.236	47.0	1.850	6.8	0.268	50
M30	1 1/8"	NL30spss	31.4	1.236	58.5	2.303	6.8	0.268	25
M33	1 1/4"	NL33ss	34.4	1.354	48.5	1.909	6.8	0.268	25
M36	1 3/8"	NL36ss	37.4	1.472	55.0	2.165	6.8	0.268	25
M39	1 1/2"	NL39ss	40.4	1.591	58.5	2.303	6.8	0.268	25
M42		NL42ss	43.2	1.701	63.0	2.480	6.8	0.268	25
M45	1 3/4"	NL45ss	46.2	1.819	70.0	2.756	6.8	0.268	25
M48		NL48ss	49.6	1.953	75.0	2.953	6.8	0.268	25
M52	2"	NL52ss	53.6	2.110	80.0	3.150	9.0	0.354	1
M56	2 1/4"	NL56ss	59.1	2.327	85.0	3.346	9.0	0.354	1
M60		NL60ss	63.1	2.484	90.0	3.543	9.0	0.354	1
M64	2 1/2"	NL64ss	67.1	2.642	95.0	3.740	9.0	0.354	1
M68		NL68ss	71.1	2.799	100.0	3.937	9.0	0.354	1
M72		NL72ss	75.1	2.957	105.0	4.134	9.0	0.354	1
M76	3"	NL76ss	79.1	3.114	110.0	4.331	9.0	0.354	1
M80	3 1/8"	NL80ss	83.1	3.272	115.0	4.528	9.0	0.354	1

TORQUE GUIDELINES

Nord-Lock original stainless steel (ss) washers

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	1108.0	219.0
M36	NL36ss	4.00	1444.0	239.0	1925.0	319.0

Cu/C paste - Nord-Lock stainless steel washers with stainless steel bolt, lubricated with 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

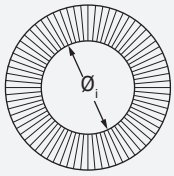
Thread friction coefficients have theoretical values but are verified through testing. Under head friction coefficients have been established by tests.

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

NORD-LOCK ORIGINAL
254 SMO® WASHERS

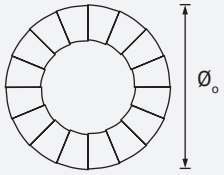
DIMENSIONS

Surface hardened EN 1.4547



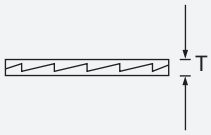
NL3ss-354
–NL8spss-254
Ø$_i$ ±0.1 mm

NL3/8"ss-254
–NL39ss-254
Ø$_i$ ±0.2 mm



NL3ss-254
–NL1"spss-254
Ø$_o$ ±0.2 mm

NL27ss-254
– NL39ss-254
Ø$_o$ ±0.3 mm



NL3ss-254
–NL39ss-254
T ±0.25 mm

254 SMO® is an austenitic stainless steel designed for maximum resistance to pitting and crevice corrosion. With high levels of chromium, molybdenum, and nitrogen, washers made from 254 SMO® are especially suited for:

- High chloride environments
- Salt water solutions/atmospheres
- Environments where stainless steel washers made of 1.4404 are not adequate

Nord-Lock washers made of 254 SMO® quality are standard stock items, yet subject to prior sale.

- Torque guidelines:
  Web app: torquelator.nord-lock.com
  www.nord-lock.com/torque

- 2D/3D CAD models:
  www.nord-lock.com/cad

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M3	#5	NL3ss-254	3.4	0.134	7.0	0.276	2.2	0.087	200
M3.5	#6	NL3.5ss-254	3.9	0.154	7.6	0.299	2.2	0.087	200
M3.5	#6	NL3.5spss-254	3.9	0.154	9.0	0.354	2.2	0.087	200
M4	#8	NL4ss-254	4.4	0.173	7.6	0.299	2.2	0.087	200
M4	#8	NL4spss-254	4.4	0.173	9.0	0.354	2.2	0.087	200
M5	#10	NL5ss-254	5.4	0.213	9.0	0.354	2.2	0.087	200
M5	#10	NL5spss-254	5.4	0.213	10.8	0.425	2.2	0.087	200
M6		NL6ss-254	6.5	0.256	10.8	0.425	2.2	0.087	200
M6		NL6spss-254	6.5	0.256	13.5	0.531	2.0	0.079	200
	1/4"	NL1/4"ss-254	7.2	0.283	11.5	0.453	2.2	0.087	200
	1/4"	NL1/4"spss-254	7.2	0.283	13.5	0.531	2.2	0.087	200
M8	5/16"	NL8ss-254	8.7	0.343	13.5	0.531	2.0	0.079	200
M8	5/16"	NL8spss-254	8.7	0.343	16.6	0.654	2.2	0.087	200
	3/8"	NL3/8"ss-254	10.3	0.406	16.6	0.654	2.0	0.079	200
	3/8"	NL3/8"spss-254	10.3	0.406	21.0	0.827	2.2	0.087	200
M10		NL10ss-254	10.7	0.421	16.6	0.654	2.0	0.079	200
M10		NL10spss-254	10.7	0.421	21.0	0.827	2.2	0.087	200
M11	7/16"	NL11ss-254	11.4	0.449	18.5	0.728	2.2	0.087	200
M12		NL12ss-254	13.0	0.512	19.5	0.768	2.0	0.079	200
M12		NL12spss-254	13.0	0.512	25.4	1.000	3.2	0.126	100
	1/2"	NL1/2"ss-254	13.5	0.531	19.5	0.768	2.0	0.079	200
	1/2"	NL1/2"spss-254	13.5	0.531	25.4	1.000	3.2	0.126	100
M14	9/16"	NL14ss-254	15.2	0.598	23.0	0.906	3.0	0.118	100
M14	9/16"	NL14spss-254	15.2	0.598	30.7	1.209	3.2	0.126	100
M16	5/8"	NL16ss-254	17.0	0.669	25.4	1.000	3.0	0.118	100
M16	5/8"	NL16spss-254	17.0	0.669	30.7	1.209	3.2	0.126	100
M18		NL18ss-254	19.5	0.768	29.0	1.142	3.2	0.126	100
M18		NL18spss-254	19.5	0.768	34.5	1.358	3.2	0.126	100
	3/4"	NL3/4"ss-254	20.0	0.787	30.7	1.209	3.2	0.126	100
	3/4"	NL3/4"spss-254	20.0	0.787	39.0	1.535	3.2	0.126	100
M20		NL20ss-254	21.4	0.843	30.7	1.209	3.0	0.118	100
M20		NL20spss-254	21.4	0.843	39.0	1.535	3.2	0.126	100
M22	7/8"	NL22ss-254	23.4	0.921	34.5	1.358	3.2	0.126	100
M22	7/8"	NL22spss-254	23.4	0.921	42.0	1.654	3.2	0.126	50
M24		NL24ss-254	25.3	0.996	39.0	1.535	3.2	0.126	100
M24		NL24spss-254	25.3	0.996	48.5	1.909	4.5	0.177	50
	1"	NL1"ss-254	27.9	1.098	39.0	1.535	3.2	0.126	100
	1"	NL1"spss-254	27.9	1.098	48.5	1.909	5.6	0.220	50
M27		NL27ss-254	28.4	1.118	42.0	1.654	5.8	0.228	50
M27		NL27spss-254	28.4	1.118	48.5	1.909	5.8	0.228	25
M30	1 1/8"	NL30ss-254	31.4	1.236	47.0	1.850	5.8	0.228	50
M33	1 1/4"	NL33ss-254	34.4	1.354	48.5	1.909	5.8	0.228	25
M36	1 3/8"	NL36ss-254	37.4	1.472	55.0	2.165	5.8	0.228	25
M39	1 1/2"	NL39ss-254	40.4	1.591	58.5	2.303	5.8	0.228	25

TORQUE GUIDELINES

Nord-Lock original 254 SMO® washers

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-254	0.50	0.8	1.5	1.1	2.0
M4	NL4ss-254	0.70	1.8	2.6	2.4	3.4
M5	NL5ss-254	0.80	3.6	4.1	4.8	5.5
M6	NL6ss-254	1.00	6.3	5.9	8.4	7.8
M8	NL8ss-254	1.25	15.0	11.0	20.0	14.0
M10	NL10ss-254	1.50	30.0	17.0	39.0	23.0
M12	NL12ss-254	1.75	51.0	25.0	68.0	33.0
M14	NL14ss-254	2.00	81.0	34.0	108.0	45.0
M16	NL16ss-254	2.00	124.0	46.0	165.0	61.0
M18	NL18ss-254	2.50	173.0	56.0	231.0	75.0
M20	NL20ss-254	2.50	243.0	72.0	323.0	95.0
M22	NL22ss-254	2.50	330.0	89.0	440.0	118.0
M24	NL24ss-254	3.00	418.0	103.0	557.0	137.0
M27	NL27ss-254	3.00	609.0	134.0	812.0	179.0
M30	NL30ss-254	3.50	831.0	164.0	1108.0	219.0
M36	NL36ss-254	4.00	1444.0	239.0	1925.0	319.0

Cu/C paste - Nord-Lock 254 SMO® washers with stainless steel bolt, lubricated with 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

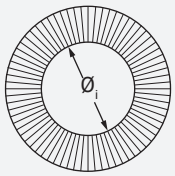
Thread friction coefficients have theoretical values but are verified through testing. Under head friction coefficients have been established by tests.

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

NORD-LOCK ORIGINAL ALLOY C-276 WASHERS

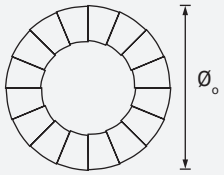
DIMENSIONS

Surface hardened EN 2.4819
or equivalent

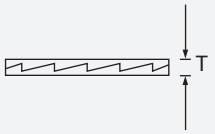


NL4ss-276
–NL8spss-276
Ø$_i$ ±0.1 mm

NL10ss-276
–NL20ss-276
Ø$_i$ ±0.2 mm



NL4ss-276
–NL20ss-276
Ø$_o$±0.2 mm



NL4ss-276
–NL12ss-276
T ±0.4 mm

NL12spss-276
–NL20ss-276
T ±0.5 mm

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M4	#8	NL4ss-276	4.4	0.173	7.6	0.299	2.3	0.091	200
M5	#10	NL5ss-276	5.4	0.213	9.0	0.354	2.3	0.091	200
M6		NL6ss-276	6.5	0.256	10.8	0.425	2.3	0.091	200
M8	5/16"	NL8ss-276	8.7	0.343	13.5	0.531	2.3	0.091	200
M8	5/16"	NL8spss-276	8.7	0.343	16.6	0.654	2.3	0.091	200
M10		NL10ss-276	10.7	0.421	16.6	0.654	2.3	0.091	200
M10		NL10spss-276	10.7	0.421	21.0	0.827	2.3	0.091	200
M12		NL12ss-276	13.0	0.512	19.5	0.768	2.3	0.091	200
M12		NL12spss-276	13.0	0.512	25.4	1.000	3.0	0.118	100
M16	5/8"	NL16ss-276	17.0	0.669	25.4	1.000	3.0	0.118	100
M20		NL20ss-276	21.4	0.843	30.7	1.209	3.0	0.118	100

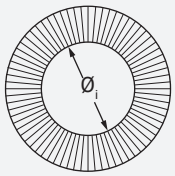
Washers made from Alloy C-276 are extremely corrosion resistant and are perfect for use in situations that demand protection from aggressive corrosion and localized corrosion attack. Therefore they are very suitable for use in chemical plants. Important features of this washer include its resistance to oxidizers such as:

- Ferric and cupric chlorides
- Organic and inorganic hot contaminated media
- Chlorine (wet chlorine gas)
- Acids
- Hypochlorite
- Chlorine dioxide

NORD-LOCK ORIGINAL ALLOY 718 WASHERS

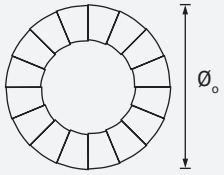
DIMENSIONS

Surface hardened EN 2.4668
or equivalent

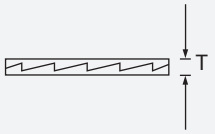


NL4ss-718
–NL8spss-718
Ø$_i$ +/-0.1 mm

NL3/8"ss-718
–NL20ss-718
Ø$_i$ +/-0.2 mm



NL4ss-718
–NL20ss-718
Ø$_o$+/-0.2 mm



NL4ss-718
–NL12ss-718
(+ NL1/2"ss)
T +/-0.4 mm

NL12spss-718
–NL20ss-718
T +/-0.5 mm

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M4	#8	NL4ss-718	4.4	0.173	7.6	0.299	2.3	0.091	200
M5	#10	NL5ss-718	5.4	0.213	9.0	0.354	2.3	0.091	200
M6		NL6ss-718	6.5	0.256	10.8	0.425	2.3	0.091	200
	1/4"	NL1/4"ss-718	7.2	0.283	11.5	0.453	2.3	0.091	200
M8	5/16"	NL8ss-718	8.7	0.343	13.5	0.531	2.3	0.091	200
M8	5/16"	NL8spss-718	8.7	0.343	16.6	0.654	2.3	0.091	200
	3/8"	NL3/8"ss-718	10.3	0.406	16.6	0.654	2.3	0.091	200
M10		NL10ss-718	10.7	0.421	16.6	0.654	2.3	0.091	200
M10		NL10spss-718	10.7	0.421	21.0	0.827	2.3	0.091	200
M12		NL12ss-718	13.0	0.512	19.5	0.768	2.3	0.091	200
M12		NL12spss-718	13.0	0.512	25.4	1.000	3.2	0.126	100
	1/2"	NL1/2"ss-718	13.5	0.531	19.5	0.768	2.3	0.091	200
M16	5/8"	NL16ss-718	17.0	0.669	25.4	1.000	3.2	0.126	100
	3/4"	NL3/4"ss-718	20.0	0.787	30.7	1.209	3.2	0.126	100
M20		NL20ss-718	21.4	0.843	30.7	1.209	3.2	0.126	100

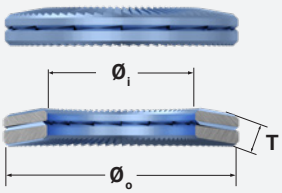
Washers made from Alloy 718 have exceptional high yield, tensile and creep-rupture properties at elevated temperatures, as well as corrosion resistance. Therefore these washers are the best choice for high temperature applications including:

- Jet engines
- Gas turbines
- Nuclear reactors
- Pumps


NORDLOCK
GROU

NORD-LOCK X-SERIES WASHERS

DIMENSIONS



NLX6sp–NLX20
Ø$_i$ ±0.2 mm

NLX6sp–NLX20
Ø$_o$ ±0.2 mm

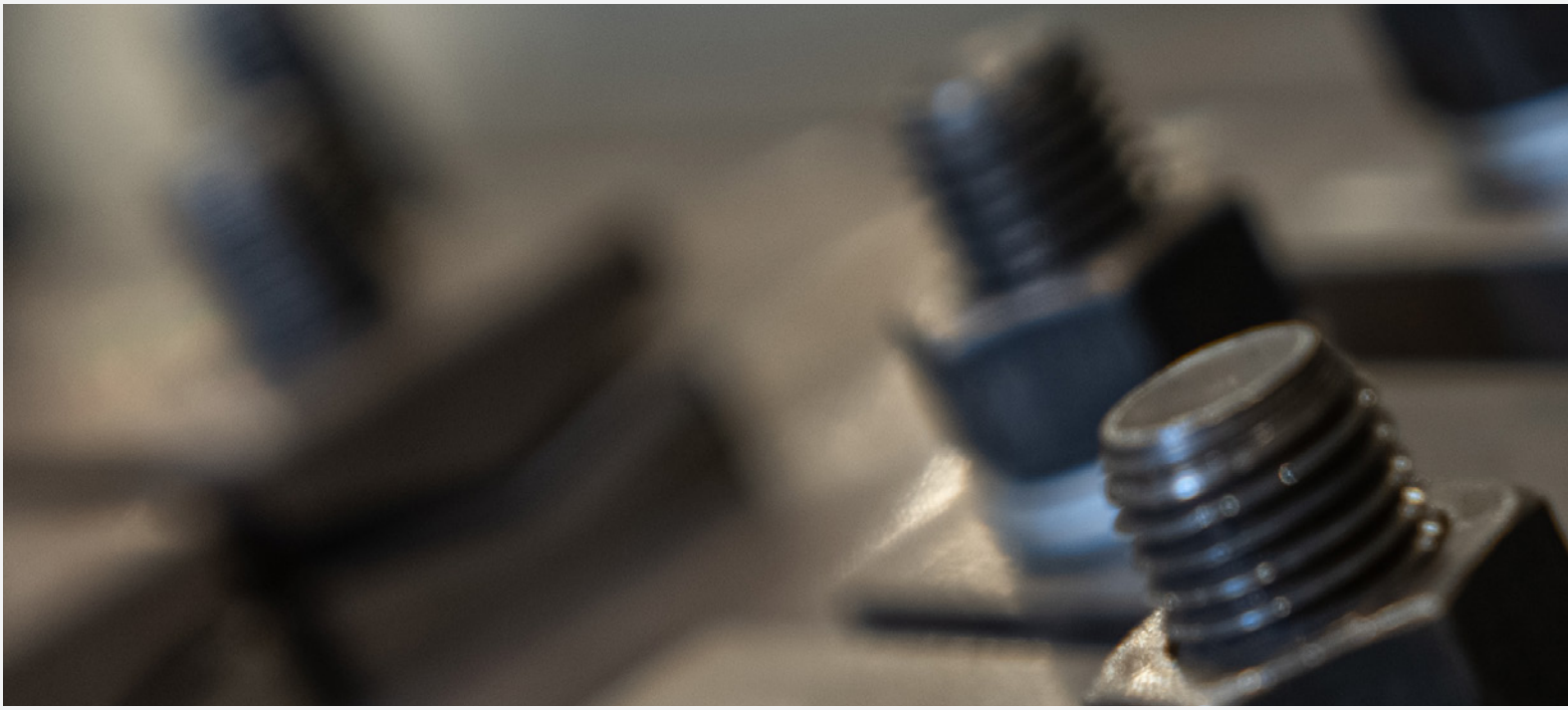
NLX6sp–NLX16sp
T +0.0/-0.2 mm

NLX3/4"–NLX20
T +0.0/-0.2 mm

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickness T [mm]	Thickness T [inch]	Min. Package [pairs]
M6		NLX6	6.3	0.248	10.8	0.425	1.60	0.063	200
M6		NLX6sp	6.3	0.248	13.5	0.531	2.00	0.079	200
M8	5/16"	NLX8	8.4	0.331	13.5	0.531	2.20	0.087	200
M8	5/16"	NLX8sp	8.4	0.331	16.6	0.654	2.20	0.087	200
	3/8"	NLX3/8"	10.0	0.394	16.6	0.654	2.60	0.102	200
M10		NLX10	10.5	0.413	16.6	0.654	2.80	0.110	200
M10		NLX10sp	10.5	0.413	21.0	0.827	3.30	0.130	200
M12		NLX12	12.5	0.492	19.5	0.768	3.40	0.134	200
M12		NLX12sp	12.5	0.492	25.4	1.000	4.00	0.157	100
	1/2"	NLX1/2"	13.2	0.520	19.5	0.768	3.50	0.138	200
M14	9/16"	NLX14	14.6	0.575	23.0	0.906	3.90	0.154	100
M16	5/8"	NLX16	16.6	0.654	25.4	1.000	4.60	0.181	100
M16	5/8"	NLX16sp	16.6	0.654	30.7	1.209	4.60	0.181	100
	3/4"	NLX3/4"	19.8	0.780	30.7	1.209	5.50	0.217	100
M20		NLX20	20.7	0.815	30.7	1.209	5.90	0.232	100

- In order to assure the unique mechanical locking function of Nord-Lock X-Series washers, the hardness of the mating surfaces must be lower than the hardness of the Nord-Lock X-Series washers.

Material standard	Hardening	Coating	Corrosion resistance	Temperature range
Steel EN 1.7225	Through hardened	Base coat: Delta Protekt® KL100 zinc flake coating Top coat: VH 302 GZ	Minimum 1,000 hours in salt spray test (according to IS0 9227)	-40°C to 150°C



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	510.0	118.0	470.0	118.0	464.0	97.0

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

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

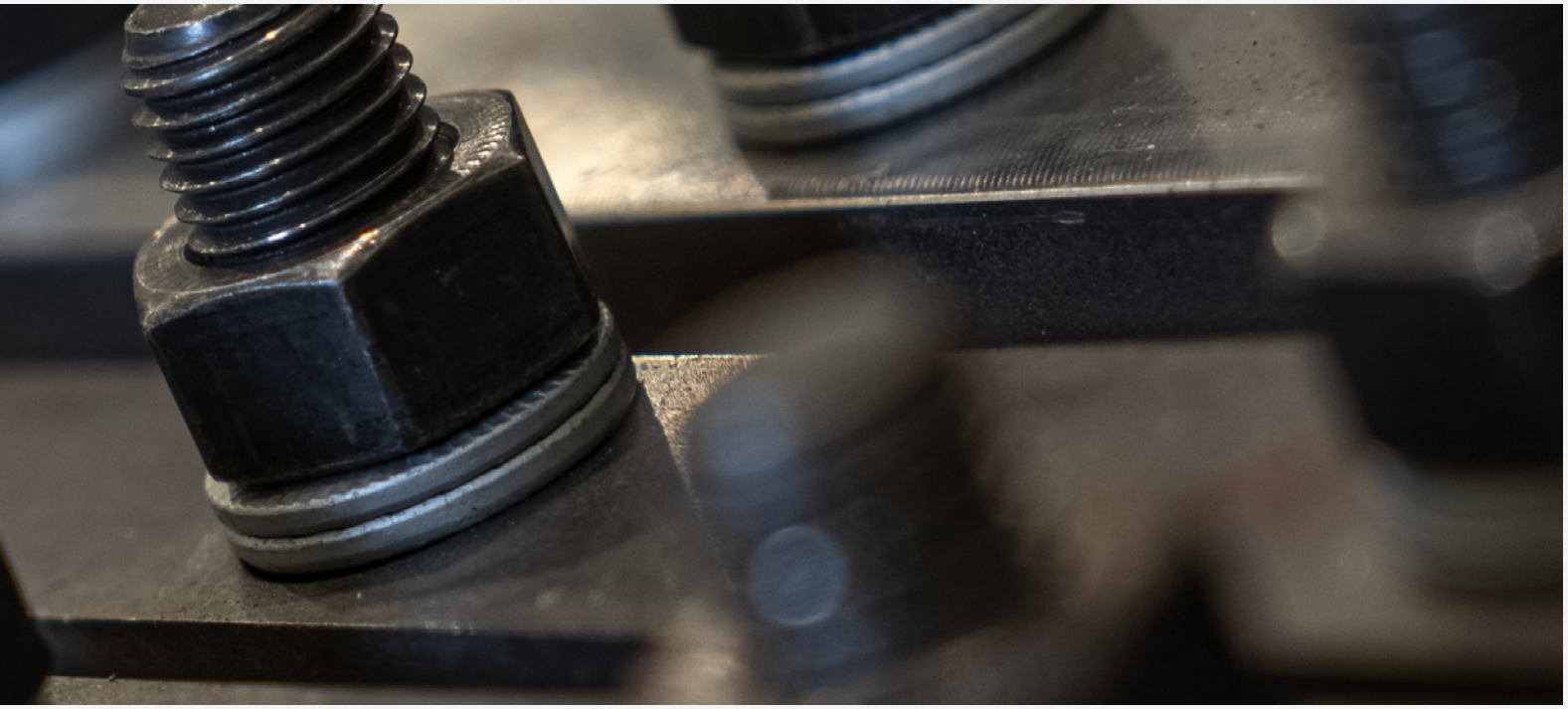
Oil = WD40 has been used.
G_F = Ratio of yield point. When tightening according to guidelines and with no deviation, this is the pre-stress achieved expressed as % of yield point.

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.

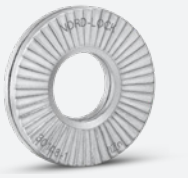
The calculations are based on Kellerman & Klein formula.

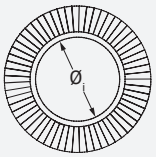
Torque guidelines for other bolt grades are available through your local Nord-Lock representative.



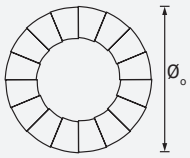
NORD-LOCK SC-WASHERS

DIMENSIONS

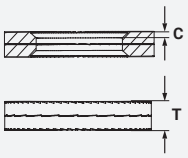




NL12SC–NL16SC
Ø$_i$ +0.17/-0.1 mm
NL20SC–NL36SC
Ø$_i$ ±0.2 mm



NL12SC–NL16SC
Ø$_o$ +0.3/-0.2 mm
NL20SC–NL24SC
Ø$_o$ ±0.3 mm
NL27SC
Ø$_o$ ±0.5 mm
NL30SC–NL36SC
Ø$_o$ ±0.6 mm



NL12SC–NL30SC
T ±0.25 mm
NL36SC
T ±0.6 mm

Bolt size Metric	UNC	Product designation	Ø$_i$ [mm]	Ø$_i$ [inch]	Ø$_o$ [mm]	Ø$_o$ [inch]	Thickn. T [mm]	Thickn. T [inch]	Chamfer C [mm]	Cham. C [inch]	Min. Pckg. [pairs]
M12		NL12SC	13.1	0.516	23.7	0.933	4.6	0.181	1.2	0.047	100
M16	5/8"	NL16SC	17.1	0.673	29.7	1.169	4.6	0.181	1.2	0.047	100
M20		NL20SC	21.4	0.843	36.7	1.445	4.6	0.181	1.5	0.059	100
M22	7/8"	NL22SC	23.4	0.921	38.7	1.524	4.6	0.181	1.5	0.059	50
M24		NL24SC	25.3	0.996	43.7	1.720	4.6	0.181	1.5	0.059	50
M27		NL27SC	28.4	1.118	49.5	1.949	5.8	0.228	1.8	0.071	25
M30	1 1/8"	NL30SC	31.4	1.236	55.4	2.181	5.8	0.228	1.8	0.071	25
M36	1 3/8"	NL36SC	37.4	1.472	65.4	2.575	6.0	0.236	1.6	0.063	25

Material standard	Hardening	Coating	Corrosion resistance	Temperature range
Steel EN 1.7182	Through hardened	Delta Protekt® KL100 zinc flake coating	Minimum 1,000 hours in salt spray test (according to IS0 9227)	-50°C to 150°C

- Torque guidelines:
  Web app: torquelator.nord-lock.com
  www.nord-lock.com/torque

- 2D/3D CAD models:
  www.nord-lock.com/cad

TORQUE GUIDELINES

Nord-Lock SC-washers

Bolt size	Washer size	Torque method[1]			Combined method[1]		Securing Torque[2]
		Tightening torque $M_{TM,SC}$ [Nm]	Preloading force[3] without retightening $F_{p,C,red*}$ [kN] (90%)	Preloading force $F_{p,C*}$ [kN]	Pretightening torque $M_{CM,SC}$ [Nm]	Preloading force $F_{p,C}$ [kN]	$M_{T,SC,sec}$ [Nm]
M12	NL12SC	165	45	50	120	59	80
M16	NL16SC	400	90	100	290	110	200
M20	NL20SC	800	144	160	510	172	360
M22	NL22SC	1.100	171	190	720	212	520
M24	NL24SC	1.300	198	220	880	247	640
M27	NL27SC	1.900	261	290	1300	321	1000
M30	NL30SC	2.300	315	350	1700	393	1320
M36	NL36SC	4.050	459	510	2700	572	2240

All given values are only valid for bolting assemblies of property class 10.9 that originally correspond to k-class K1 (usually System HV according to EN 14399-4 /-8)

[1]According to EN 1090-2

[2]Minimum tightening torque to achieve a securing effect.

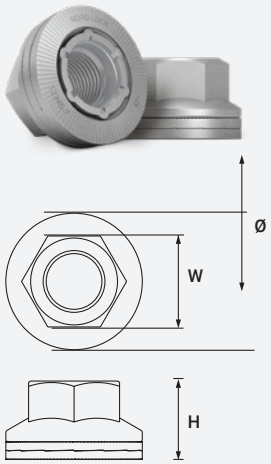
[3]Differentation between $F_{p,C,red*}$ and $F_{p,C*}$ is only relevant for bolting categories B and C acc. to EN 1993-1-8

Additional rotation for the second step in the combined method[1]

Total nominal thickness "t" of parts to be connected (including all packs and washers) d = bolt diameter	Further rotation to be applied, during the second step of tightening	
	Degrees	Part turn
t > 2d	60	1/6
2d ≤ t < 6d	90	1/4
6d ≤ t ≤ 10d	120	1/3
10d < t	No recomendations	

Tightening angles when using the combined method varies depending on the clamp length, (t), in relation to bolt diameter, (d).

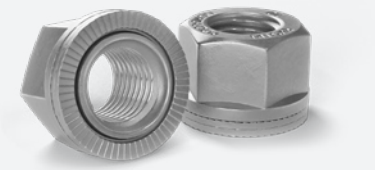
NORD-LOCK
WHEEL NUTS
DIMENSIONS

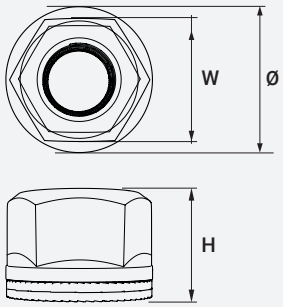


Thread	Product designation	Width W [mm]	Width W [inch]	Ø [inch]	Ø [mm]	Height H [inch]	Height H [mm]	Tightening torque [Nm]	Tightening torque [ftlb]	Clamping force [kN]	Clamping force [lb]
M16x1.5	NLWN M16	24.0	0.945	34.5	1.358	22.0	0.866	280	205	~100	~22,500
M18x1.5	NLWN M18	27.0	1.063	40.0	1.575	24.0	0.945	400	295	~130	~29,200
M20x1.5	NLWN M20	30.0	1.181	45.0	1.772	26.0	1.024	550	405	~160	~36,000
M22x1.5	NLWN M22	32.0	1.260	46.0	1.811	27.0	1.063	650	480	~180	~40,500
7/8"-11 BSF	NLWN 7/8"-11	32.0	1.260	46.0	1.811	27.0	1.063	650	480	~170	~38,200
M24x1.5	NLWN M24	36.0	1.417	48.0	1.890	33.0	1.299	950	700	~240	~54,000

Coating	Corrosion resistance	Lubrication	Property class
Base coat: Delta Protekt® KL100 zinc flake coating Top coat: VH 302 GZ	Minimum 600 hours in salt spray test (according to IS0 9227)	Anti-corrosive wax Dry film lubricant/ lubricating paste	Class 10

NORD-LOCK
COMBI NUTS
DIMENSIONS





Washer size	Product designation	W [mm]	W [mm]	Ø [mm]	Ø [mm]	H [mm]	H [mm]
NLCN6	M6x1.0	10.0	0.394	12.5	0.492	8.7	0.343
NLCN8	M8x1.25	13.0	0.512	15.9	0.626	10.7	0.421
NLCN10	M10x1.5	15.0	0.591	18.1	0.713	13.4	0.528
NLCN12	M12x1.75	18.0	0.709	21.5	0.846	15.4	0.606
NLCN16	M16x2.0	24.0	0.945	28.2	1.110	19.4	0.764

NLCN6–NLCN16
Ø ±0.6 mm

NLCN6
H +0/-0.8 mm

NLCN8–NLCN12
H +0/-0.9 mm

NLCN16–NLCN12
H +0/-1.2 mm

TORQUE GUIDELINES

Nord-Lock combi nuts bolt grade 8.8

		Metric			Imperial	
Bolt size	Washer size	Pitch [mm]	Torque [Nm]	Clamp load [kN]	Torque [ft·lb]	Clamp load [lb]
M6	NLCN6	1.00	10.4	8.8	7.7	1,978
M8	NLCN8	1.25	31.0	16.0	23.0	3,597
M10	NLCN10	1.50	57.0	25.0	42.0	5,62
M12	NLCN12	1.75	102.0	37.0	75.0	8,318
M16	NLCN16	2.00	218.0	68.0	161.0	15,287

Delivery condition
G_F = 68%

Nord-Lock combi nuts bolt grade 10.9

		Metric			Imperial	
Bolt size	Washer size	Pitch [mm]	Torque [Nm]	Clamp load [kN]	Torque [ft·lb]	Clamp load [lb]
M6	NLCN6	1.00	15.3	12.9	11.3	2,900
M8	NLCN8	1.25	46.0	23.0	34.0	5,171
M10	NLCN10	1.50	83.0	37.0	61.0	8,318
M12	NLCN12	1.75	150.0	54.0	111.0	12,140
M16	NLCN16	2.00	320.0	100.0	236.0	22,481

Delivery condition
G_F = 68%

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.

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 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 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.

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.

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.

Design where Nord-Lock 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
- For applications with extremely large settlements

WHEN SAFETY REALLY MATTERS

Whatever the clamp load, environment or extent of vibration on your application, we will work together to optimize safety and minimize maintenance.

Over 40 years of experience in the world's diverse industries has given us unprecedented expertise in bolted connections.

No matter what your bolting or engineering challenge is — Nord-Lock has the perfect solution for you.

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