



TYPE APPROVAL CERTIFICATE

Certificate No:
TAD0000DS
Revision No:
1

This is to certify:

That the Locking Washers

with type designation(s)
Nord-Lock Locking Washers

Issued to
Nord-Lock AB
Mattmar, Sweden

is found to comply with
DNV GL standard DNVGL-ST-0378 – Standard for offshore and platform lifting appliances
DNVGL-OS-E101 – Drilling facilities, Edition January 2018
DNVGL-OS-E201 – Oil and gas processing systems, Edition July 2018
DNVGL-OS-C101 – Design of offshore steel structures, general – LRFD method, Edition July 2019
DNV GL rules for classification – Ships

Application :

Preloaded bolted assemblies subjected to dynamic, fatigue, impact and vibration induced loading

Issued at **Høvik** on **2021-06-27**

This Certificate is valid until **2026-06-26**.
DNV local station: **Sweden CMC**

Approval Engineer: **Pierre-Eric Moulia**

for **DNV**

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Inger-Helene Hals
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Product description

NORD-LOCK washers are designed to prevent or minimize dynamic-, vibration- and impact-induced loosening of fasteners.

Each NORD-LOCK locking washer consists of a pair of washers that have inclined cams on the internal mating faces and radial serrations on the washer external bearing faces. The washers' incline cam angle is greater than the lead angle of the fastener thread (i.e. the rise of the cams is greater than the pitch of the thread).

When the fastener is tightened, the serrations on the external surfaces of NORD-LOCK washers grip and penetrate in the mating surfaces of the bolt head, nut and joint material, and lock the washers in place. If the nut tries to turn loose, the mating cams have to climb upon each other; the pair of washers tends to expand and results in an increase tension in the fastener. This prevents further rotation of the nut and, hence, loosening of the fastener.

Two NORD-LOCK washers are normally glued together with cam face on cam face and supplied pre-assembled. A pair of pre-assembled NORD-LOCK washers is hereafter referred to simply as NORD-LOCK washer.

NORD-LOCK washers can be classified as free running, preload dependent locking devices. Bolted connections fitted with NORD-LOCK washers do not require use of any additional appliances such as a lock wire, cotter pins, welding, jam nuts, adhesives, etc. to mechanically or chemically lock the nut and bolt together. Neither do they require application of any offset or distorted threads, slotted nuts, nor use of any non-metallic inserts to prevent self-loosening of fasteners.

Application/Limitation

Bolting Sizes and Threads

This Type Approval Certificate covers regular and enlarged type of NORD-LOCK locking washers intended for use assembled with the following fastener sizes:

- M8 up to M42 coarse pitch metric thread fasteners according to ISO 898-1,
- M8 up to M42 fine pitch metric thread fasteners
- $\frac{5}{16}$ " up to $1\frac{1}{2}$ " UNC thread fasteners according to ANSI B1.1 1960.
- $\frac{5}{16}$ " up to $1\frac{1}{2}$ " UNF and UNEF thread fasteners

NORD-LOCK washers are designed for right-hand threaded fasteners as standard. Washers for left-hand threaded fasteners may be available upon request.

Bolting Material Grades

NORD-LOCK washers are manufactured of alloy steel and stainless steel, and designed to be assembled respectively with:

- alloy steel fasteners Property up to Class 12.9 according to ISO 898-1, and
- stainless steel fasteners up to Grade A2/A4/A7-80 .

Maximum Hardness of Mating Surfaces

The hardness of the mating surfaces of bolt head, nut and joint material shall be lower than that of the NORD-LOCK washers used in the bolt assembly, i.e.:

- < 465 HV 1 for alloy steels fasteners, and
- < 520 HV 0.05 for stainless steels fasteners
- < 600 HV 0.05 for fasteners fitted with 254 SMO Nord-Lock washers

Minimum Bolt Preload

To function satisfactory, NORD-LOCK washers require that a certain minimum magnitude of bolt preload be maintained in the fastener during the intended service life of the bolted joint. The following minimum values of residual bolt preload are recommended:

- 0.30 $f_y A_s$ for fasteners Property Class 8.8
- 0.40 $f_y A_s$ for fasteners Property Class 10.9
- 0.40 $f_y A_s$ for fasteners Property Class 12.9
- 0.30 $f_y A_s$ for stainless steel fasteners Grade A4-80.

where:

f_y is the nominal yield strength of the fastener

A_s is the fastener stress area

Design Temperatures

The design service temperature ranges from -50° C up to 200° C for the alloy steel washers and from -160° C up to 500° C for stainless steel washers.

Regulations

This Type Approval is valid only if use of the product is in compliance with Regulations, DNV Rules and Standards, and manufacturer's Specification and Instruction for assembling and tightening applicable for the intended service.

Other Applications

On request, NORD-LOCK AB may supply locking washers for threaded fasteners of other dimensions, thread types, materials and material property classes and/or coated with other corrosion protective systems than those specified in this Certificate. Also, locking washers designed for other service temperatures may be supplied on request. Those special products, however, are not covered by this Type Approval Certificate but may be evaluated and approved on case to case basis.

Type Approval documentation

Generic Drawings and Technical Data

The washers' type identification, basic dimensions and tolerances are given in the following NORD-LOCK generic drawings:

- Dwg. No.: 4-100-08 – Zinc flake coated Nord-Lock washers, Edition B, Sheet 1/1, dated 2006-01-17
- Dwg. No.: 4-100-07– Stainless steel A4 Nord-Lock washers, Edition H, Sheet 1/1, dated 2006-01-17
- 254 SMO washers are manufactured according to the same generic drawings as those applied for the stainless steel washers.

Further technical data and information are given in the manufacturer's product catalogue. Reference: www.nord-lock.com

Material Specification

Alloy steel NORDLOCK washers are manufactured of EN 1.7182 material and hardened to min 465 HV 1 according to EN 10083-3:2006.

Stainless steel NORDLOCK washers are manufactured of EN 1.4404 material and surface hardened to 520 HV 0.05 by Kolsterising® – a proprietary surface treatment process for austenitic stainless steels by Bodycoate.

High alloy steel Nord-Lock washers are manufactured of 254 SMO ® material (equivalent to EN 1.4547) and surface hardened to 600 HV 0.05 by Kolsterising ®

Corrosion Protection

Alloy steel NORD-LOCK washers are supplied protected with an inorganic zinc-flake-system consisting of DELTA-PROTEKT KL 100 basecoat and DELTA-PROTEKT VH 302 GZ topcoat by Dörken MKS-Systeme GmbH & Co., Germany. Reference: www.doerken-mks.de.

Assembly Instruction

Examples of correct and incorrect assembly of NORD-LOCK washers in bolted joints of different types are given in the manufacturer's product catalogue. Reference: www.nord-lock.com.

Guidance on selection of tightening torque is provided in the manufacturer's product catalogue. Reference: www.nord-lock.com. When in doubt, the required torque shall be determined by test at the job site using as-received bolts, nuts, NORD-LOCK washers and lubricant.

Quality Control System

NORD-LOCK AB holds the following Quality Control Certificates:

- Quality Management System certified in accordance with the requirements of EN ISO 9001-2015. Certificate No.: 27072 issued by Intertek Certification AB of Sweden on 21 March 2021
- Environmental Management System certified in accordance with the requirements of EN ISO 14 001 2015. Certificate No.: 1417752, issued by Intertek Certification AB of Sweden on 21 March 2021
- DNV audit visit to Mattmar factory on 2012-02-23. Reference audit report: Project No.: 419 81 027

Tests carried out

- Vibration Tests of a range of NORD-LOCK washer sizes, materials and corrosion protection coatings were carried out in Junker test apparatus (according to DIN 65151) at NORD-LOCK AB premises in Malmö, Sweden in November 2005 and in October 2010. The tests were witnessed by DNV surveyor.
- Vibration Tests are reported in two DNV Technical Reports: No. 2007-0997, "Accelerated Vibration Test of NORD-LOCK Locking Washers", Rev. 02, December 2007 and No. 12QT6G7-8 "Vibration testing of Nord-Lock locking washers", Rev. 01 , 2011-04-01.
- Deformation testing of washers with fractography, ref "13683", date 2017-02-03
- Test report DNV Type Approval renewal for Nord-Lock washers, ref " 1542, 1570, 1573, 1576" date 2021-04-29 rev 1
- Vibration Tests of a range of NORD-LOCK washer sizes were carried out in Junker test apparatus (according to DIN 25201-4:2010) at NORD-LOCK AB premises in Mattmar, Sweden in April 2021.

Marking of product

Standard NORD-LOCK washers are supplied pre-assembled as a pair of washers glued together with cam face on cam face. The washers are delivered in boxes containing 25 to 200 pieces of pre-assembled pairs dependent of the washer size. For traceability to this Type Approval Certificate each box shall be marked as follows:

- Manufacturer's name and trademark
- Washer Identification No. as per Technical Data Sheet/Catalogue (washer/bolt size, material, washer type regular/enlarged, corrosion protection system applied)
- Number of glued washer pairs in the box
- Item Control No. and/or Lot No.
- Maximum allowable surface hardness of mating bolt, nut and joint material
- Reference to this Type Approval Certificate: TAD00000DS

Periodical assessment

For retention of this Type Approval, a DNV surveyor shall perform a periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days). The objective of the periodical assessment is to verify that the conditions for the Type Approval have not been altered. (Ref DNVGL-CP-0338 Type approval scheme).