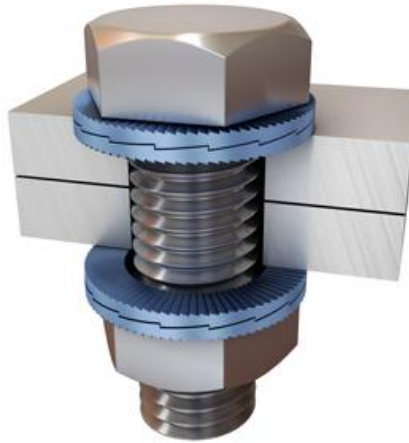


Reliable Securing of Bolted Joints

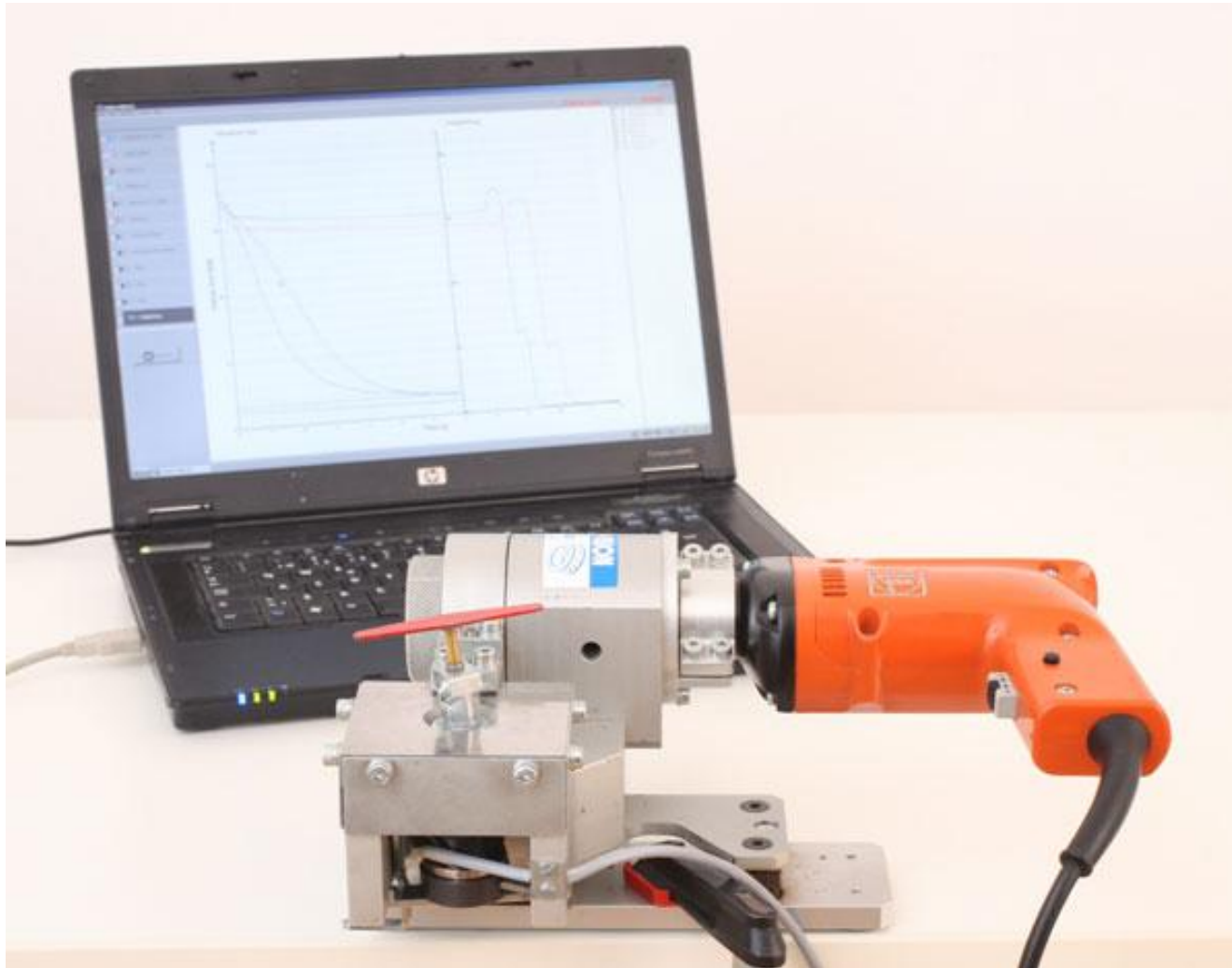
NORD-LOCK®
Bolt securing systems



Problem.....what problem?



Junker vibration test



Follow-up to Reliable Bolting presentation and FAQ's

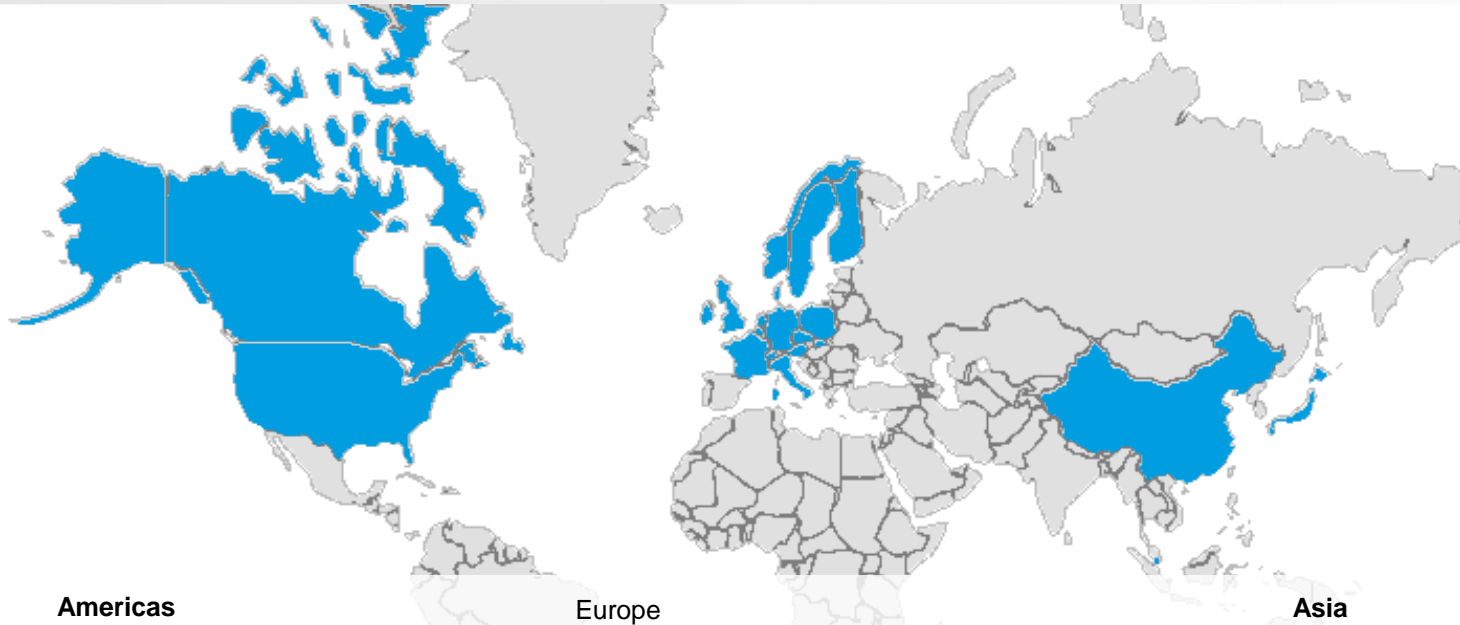
**Can you provide
training?**



**Can you present for
our office in Stavanger,
Houston, Singapore?**

The Nord-Lock Group

NORD-LOCK®
Bolt securing systems



Americas

Nord-Lock Inc, USA & Canada
Superbolt Inc, USA

Europe

Nord-Lock s.r.o., Czech Republic & Slovakia
Nord-Lock GmbH, Germany & Austria
Nord-Lock Poland Sp. z o.o.
Nord-Lock AG, Switzerland
Nord-Lock Benelux B.V.
Nord-Lock Ltd, UK
Nord-Lock International AB
Nord-Lock Finland OY
Nord-Lock AS, Norway
Nord-Lock France S.A.R.L.
Nord-Lock Srl, Italy

Asia

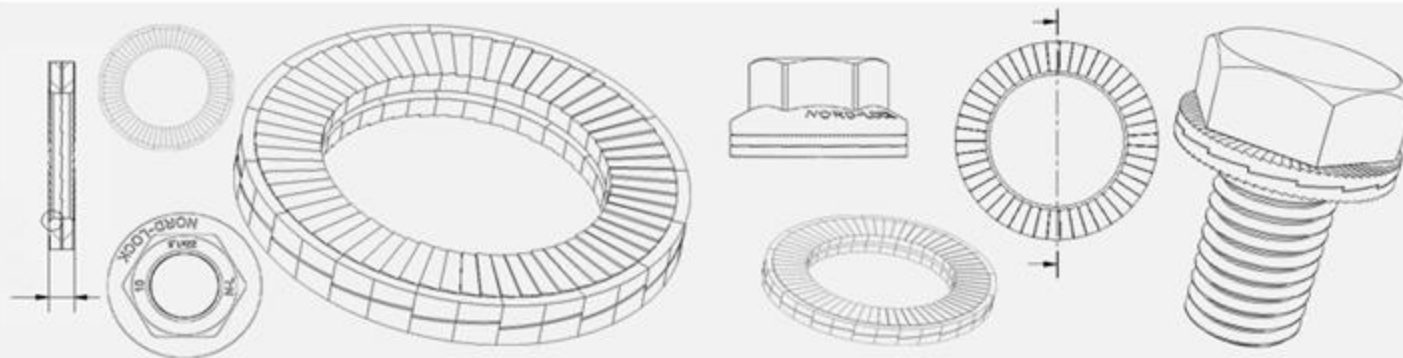
Nord-Lock Co., Ltd., Japan
Nord-Lock Pte Ltd, Singapore
Nord-Lock Shanghai, China

**What about training
for those working
offshore?**



Welcome to Nord-Lock E-learning

Here you will find product training, technical information, final exam, frequently asked questions (FAQ) and other important information. This information will be very useful for everyone who comes in contact with Nord-Lock as a fitter, engineer or sales person.





Nord-Lock principle/Chapter 2/How Nord-Lock acts in a bolted joint

☺ Nord-Lock principle

⊕ Chapter 1

☺ Chapter 2

☑

Tightening and untightening
Nord-Lock washers

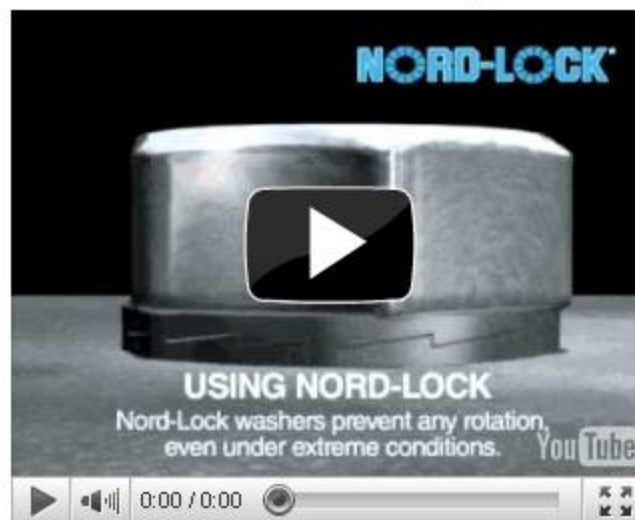
How Nord-Lock acts in
a bolted joint

☑ Benefit from lubrication
when using Nord-Lock!

⊕ ☑ Final examination

☑ Visited page

How Nord-Lock acts in a bolted joint



The animation shows how Nord-Lock washers act in a bolted joint

When a joint secured by Nord-Lock washers is tightened, rotation takes place between the upper washer and the bolt head/nut. The serrations of the bottom washer are not rotating or moving against the mating surface, they are simply pressed down into the material. The applied torque creates a clamp load in the joint.

In order for Nord-Lock to provide safe locking a minimum of 30% of the bolt's capacity must be utilized.

Once tightened, Nord-Lock washers provide safe locking. Rotation of the bolt/nut is prevented by the wedge effect of the cams and the preload is maintained, even when exposed to extreme vibration and dynamic loads.

During untightening the clamp load in the joint increases as a result of the so-called "wedge effect". When dismantling the cams slide against each other, thereby increasing the distance between the washers. This stretches the bolt and creates an increase in clamp load. This is the reason why the clamp load is higher when dismantling than when tightening. The fourth...

**Can we have copies of
your approval certificates
& audit documents?**

NORD-LOCK®
Bolt securing systems



ISO 9001



**We would like you to
present for our client /
supplier.**

Linking up the industry

NORD-LOCK®
Bolt securing systems



HALLIBURTON



Schlumberger



We had a joint fail.

**Can you investigate the
cause and offer a solution?**



Performance Services

Sourcing

Life Cycle
Profitability



Cost savings generated by optimized bolted joints.

Design / Production

Nord-Lock Technical
Verification Center



Joint calculation, theoretic testing
and real life validation.

Aftermarket

On-site and remote
product training



Increasing the knowledge of
bolted connections for both
operators and engineers.

Nord-Lock Group, Technical Centres

Americas

Pittsburgh, PA
Chicago, IL

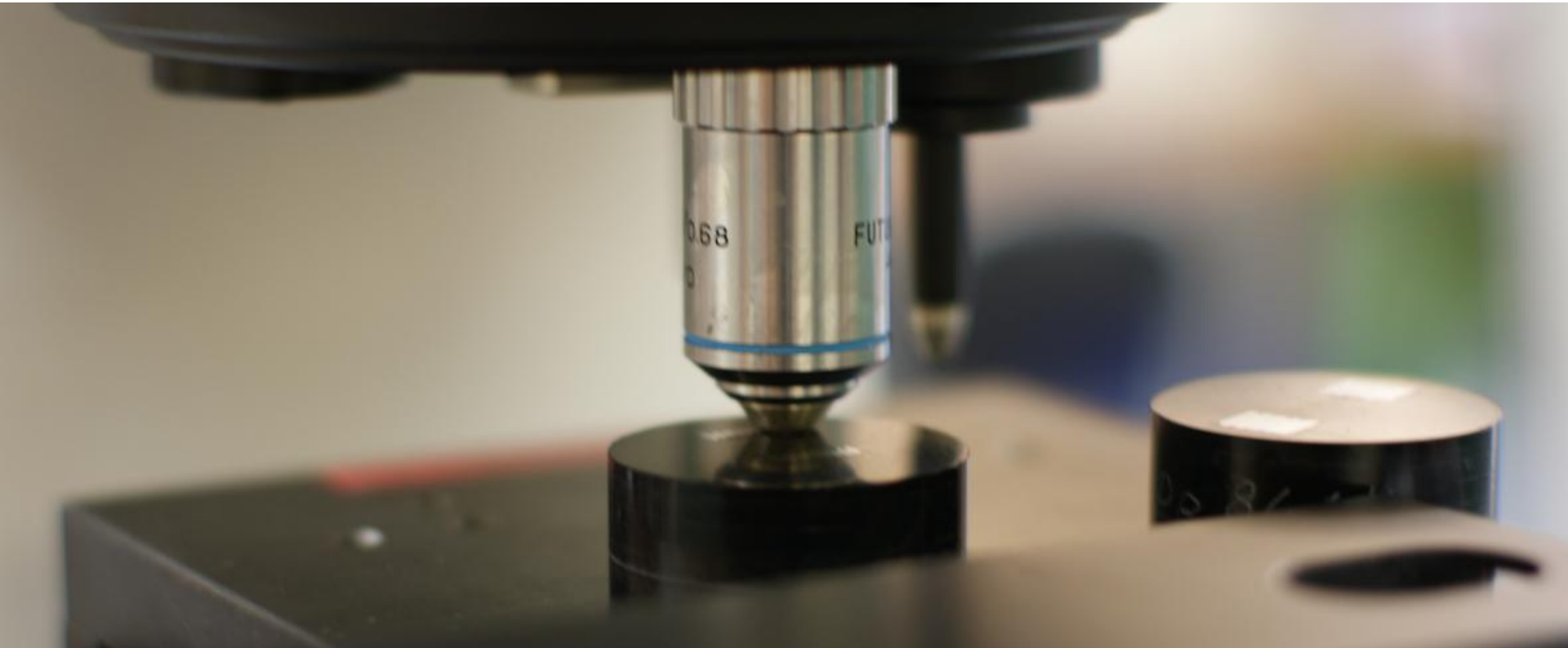
Europe

St Gallenkappel, Switzerland
Lyon, France
Malmö, Sweden
Mattmar, Sweden

Asia

Osaka, Japan

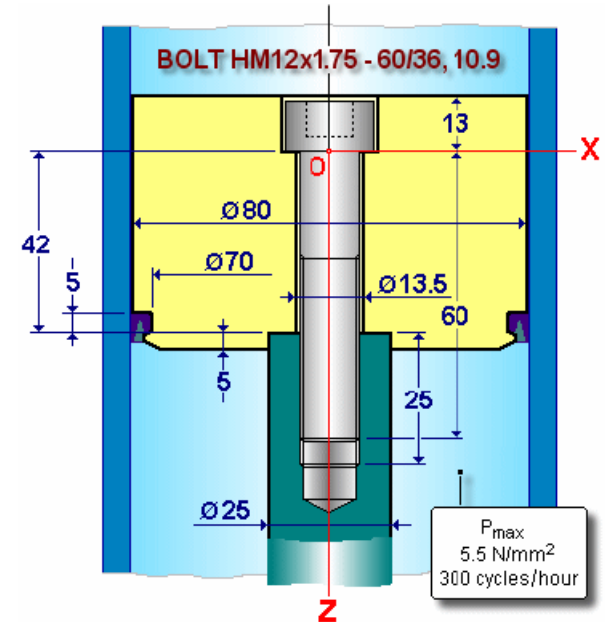
Hardness testing



**Can you do some
design calculations
for us?**

Calculation of load factor λ

$$\lambda = \beta \times \frac{\delta_p}{\delta_b + \delta_p}$$



Materials

Screw : Steel, grade 10.9
 $E_b = 205\,000\text{ N/mm}^2$

Piston : Steel C45V
 $E_{p1} = 205\,000\text{ N/mm}^2$
 $R_{ecmin} = 700\text{ N/mm}^2$

Rod : Steel C45V
 $E_{p2} = 205\,000\text{ N/mm}^2$
 $R_{ecmin} = 700\text{ N/mm}^2$

Calculation of torque values

Friction test standard: DIN 946

Calculation formula: Basic formula in DIN 946.

NL16, 8.8 bolt, MoS₂, Gf=75%

$$F_M = 75\% * 100\text{kN} = 75[\text{kN}]$$

$$P = 2.0[\text{mm}]$$

$$d = 16.0[\text{mm}]$$

$$d_2 = d - 0.6495 * P = 14.70[\text{mm}]$$

$$\mu_G = 0,11$$

$$D_{Km} = (ID + OD) / 2 = (17 + 22) / 2 = 19.5[\text{mm}]$$

$$\mu_K = 0,12$$

$$M_A = F_M * (0.159 * P + 0.578 * d_2 * \mu_G + (D_{Km} / 2) * \mu_K) = \mathbf{182,6[Nm]}$$

Calculation of load factor λ

$$X = \sqrt[3]{\frac{42 \times 17,23}{(42 + 17,23)^2}} = 0,5909$$

$$S_{equ} = \frac{\pi}{4} \times (17,23^2 - 13,5^2) + \frac{\pi}{8} \times 17,23 \times 42 \times (0,5909 + 2) \times 0,5909$$

$$S_{equ} = 526,4 [mm^2]$$

$$\delta_p = \frac{L_p}{E_p \times S_{equ}}$$

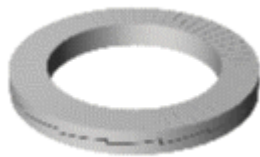
$$\delta_p = \frac{42}{205000 \times 526,4} = 0,389 \times 10^{-6} [mm / N]$$

We design using CAD.

**Do you have CAD drawings of
your washers?**

2D – 3D CAD Drawings Online

PDF files can be generated for each product, always specify date and item number.



Link through our front page or directly through: www.nord-lock.com/cad

Formats available

SolidWorks

IGES

STEP

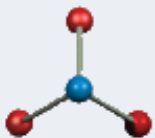
Parasolid

SAT

Pro/E

DGW

DXF



Our CAD-library

2D & 3D CAD models of NORD-LOCK washers can be found at **Solid Components™**.

Support available at every stage

DESIGN



ASSEMBLY



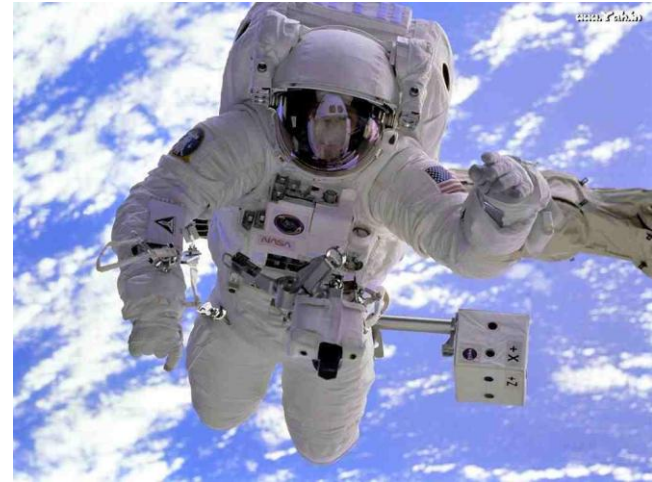
OPERATIONS



MAINTENANCE



Dropped in space



- The tool bag weighed about 14 kg and was about the size of a small backpack.
- Dropped from a height of 370 kilometers
- Travelling at approximately 27,700 km/h
- “A former NASA astronaut lost the bag during a spacewalk as part of a NASA shuttle mission”