

BOLTED

SNCF

**WORLD'S FASTEST
TRAINS RUN SAFE
WITH NORD-LOCK**

4

**NORD-LOCK
SECURITY
SOLUTIONS**

EDF

**SECURING
NUCLEAR
PLANTS**

ROTECH SUBSEA

**NO MORE
VIBRATION
WORRIES**

**TIGHTENING
- A TRICKY BUSINESS**





SPREADING THE LOAD WITH NORD-LOCK SP

A high concentration of load can cause cracking or permanent deformation. In bolt design, an increased load supporting area can improve applications with a soft underlying material or a large/slotted hole. For painted or varnished applications, an increased load area can be more gentle and protective for the surface.

Nord-Lock washers are available with enlarged outer diameter to spread load concentrations when needed. Washers with enlarged outer diameter are referred to as special (SP). Use Nord-Lock SP washers with flanged bolts or nuts for optimum results.



NORD-LOCK[®]
Bolt securing system



BolTED magazine is published by Nord-Lock, and strives to increase knowledge about bolt assemblies. Nord-Lock offers a unique bolt securing system for demanding applications. The system makes bolted joints self-locking and does not rely on friction. Nord-Lock withstands vibration and dynamic loads. For more information on Nord-Lock, visit www.nord-lock.com

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NORD-LOCK®

Safety is our favourite word!

OPTIMISED JOINTS have many aspects. At Nord-Lock, we firmly believe in the importance of controlling all parameters that can affect a critical joint. This issue of BolTED takes up the topic of tightening. Choosing an adequate tightening method leads to better control and thereby improved safety. Read more in our cover story about tightening and some of the methods used on page 8.

With our strong focus on bolt securing our know-how is constantly expanding. One of our aims as a company is to share our experience and knowledge with our clients and partners. This has, in turn, resulted in Nord-Lock working particularly closely with certain industries such as the offshore industry, which is paying more attention to safety than ever. Nord-Lock's Global Industry Manager for Offshore, Gösta Rydén, is involved in various safety forums and networks to share our safety expertise in bolting with international oil companies (page 19).

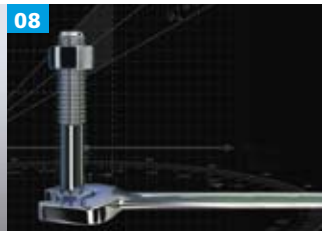
I THINK MY COLLEAGUES would agree that in our line of work we use the word safety a lot. But we can never get tired of it! On page 15 we have an interview with Philippe Nouaille at EDF's engineering centre for nuclear power stations. Nuclear power is a much discussed topic,

and when it comes to this industry no one can dispute that safety is of utmost importance. That is why we at Nord-Lock are happy to learn that power plants are moving away from traditional bolt securing towards modern and effective solutions like Nord-Lock.

TRANSPORTATION SAFETY is another topic close to our hearts, whether it be safety on the track (page 12), on two wheels (page 4) up to ten wheels (page 17), or a sky-lift on the side of the Globe in central Stockholm (page 6). You see, we believe safety is a beautiful word and in our everyday work we cannot focus on it enough.

In what industries or areas in bolting would you like to learn more about safety and optimisations? BolTED aims to address the topics you want to read about. Please send us your ideas and input.

CARIN ESBERG
MARKETING MANAGER



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WORDS: NIC TOWNSEND

ENGINEERING WITH A BITE

| | |
|--|---|
| CUSTOMER: VIPER MOTORCYCLE COMPANY | MAX TORQUE: 159 FT LBS/210 NM |
| MODEL: 2011MY DIAMONDBACK | MAXIMUM SPEED: 170 MPH/270 KM/H |
| HORSEPOWER: 116 HP | ¼ MILE TIME: APPROX. 10.5 SEC |

FOR THE PAST EIGHT YEARS the Viper Motorcycle Company have created unique custom-made Super-Cruiser motorcycles that combine first-class engineering with elegant design. Over 80% of their motorcycles are made from proprietary parts, designed and created by Viper themselves, using the most advanced 21st century technology.

Last June Viper released their superbly crafted 2011MY motorcycle as an evolution to their 2009/2010MY line. The new bike is not only a high performing vehicle with Viper's trademark proprietary parts and new Viper/Ilmor engine, but also beautifully designed with a keen sense of style.

While striving for the highest standards of engineering, Viper decided to implement Nord-Lock washers in eight locations, including turn-signal stalks and brake rotors. By using Nord-Lock with zinc-based plated bolts instead of thread-lock and chrome-plated bolts, Viper avoids chrome build-up and binding, which can damage well-engineered joints and significantly reduce the torque applied.

The Nord-Lock bolt securing system allows for quick and easy torque checking without breaking a thread locking material, which is a huge advantage when servicing and maintaining critical fasteners. No fastener using Nord-Lock has ever lost any clamp load. □



MAINTAINING STANDARDS

Viper have used Nord-Lock washers in eight locations, which allow for quick and easy torque checking without compromising well-engineered joints.

PHOTO: VIPER MOTORCYCLE COMPANY



NUTS AND BOLTS
 Nord-Lock components have helped Mitsui significantly reduce assembly and repair time when building their ship engines.

PHOTO: MES

CONQUERING THE SEAS

CUSTOMER:
 MITSUI ENGINEERING AND SHIPBUILDING (MES).

| | | |
|---|--|--------------------------------------|
| MODEL: BRASIL MARU | LENGTH: 340 M | WIDTH: 60 M |
| MAXIMUM CARRYING CAPACITY: 327,180 DEADWEIGHT TONS (DWT). | | TOTAL WEIGHT: 160,774 TONS |
| SPEED: 15 KNOTS | MAXIMUM CONTINUOUS RATING: 23,640 KW AT 66 RPM | |

MITSUI ENGINEERING AND SHIPBUILDING (MES) have been manufacturing marine diesel engines for over eighty years, and have become one of the leading engine manufacturers in Japan.

With a total length of 340 metres and a width of 60 metres, Mitsui's remarkable ship the Brasil Maru is one of the biggest cargo ships in the world. It uses state-of-the-art technologies and engineering capabilities. In 2007, Mitsui received the "Ship of the year" prize in the big cargo ships category from the Japan Society of Naval Architects and Ocean Engineers (JASNAOE).

Notably, Mitsui's marine diesel engine has almost 50% share of the market in Japan.

Mitsui recently began using Nord-Lock components in their marine diesel engines.

Because Nord-Lock components are comparatively light and small, they are effective in making assembly and tightening quicker and safer especially in poorly-accessible or confined places. What's more, dependable tightening is possible regardless of a fitter's individual skill level. Thanks to these Nord-Lock advantages, Mitsui is able to deliver safer, more reliable engines. □



ON TOP OF THE GLOBE

| | | | |
|---|--------------------------------|--|--------------------------------------|
| CUSTOMER: LIFTBYGGARNA AB | | PRODUCT: STOCKHOLM SKYVIEW | GLOBE DIAMETER: 110 METRES |
| GLOBE HEIGHT: 130 METRES ABOVE SEAWATER | | GLOBE VOLUME: 605,000 CUBIC METRES | |
| RAIL LENGTH: 100 METRES | RAIL WEIGHT: 70 TONS | GONDOLA WEIGHT: 7 TONS | |

THE FUTURISTIC ERICSSON GLOBE has come to dominate the Stockholm skyline with its distinctive golf-ball structure being visible for miles around. Now it offers panoramic views of Stockholm from the roof, courtesy of the new Skyview elevator.

Consisting of two round glass gondolas, the Stockholm Skyview

travels along the outside of the building's circumference to the top like a moon orbiting a planet. The superb unobstructed views will no doubt make the Ericsson Globe one of the Stockholm's must-see destinations.

Creating a funicular railway to the top of the largest spherical building in the world has its logistical problems. Swedish company Liftbyggarna, who ordinarily manufacture ski lifts, have had to be inventive, even using mountain climbers and helicopters. Construction has required over 40 tons of reinforced steel, while the Skyview rail itself weighs 70 tons and each gondola weighs 7 tons.

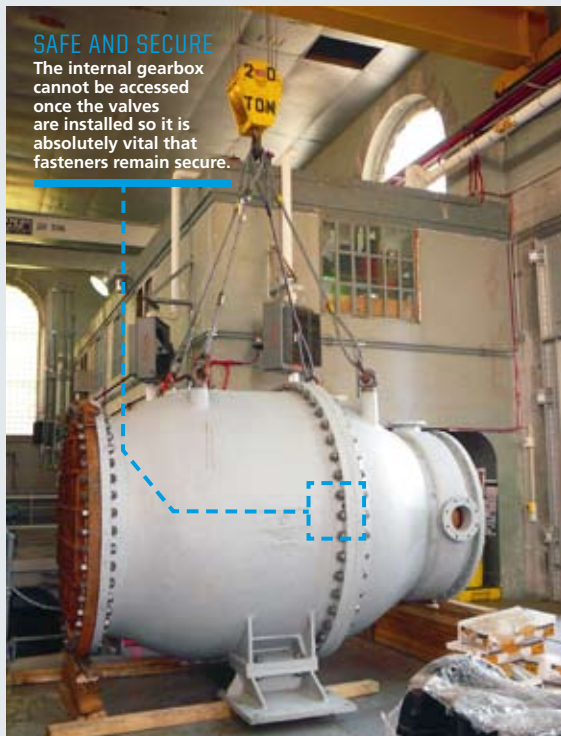
Locking it all in place are over 10,000 bolts and Nord-Lock washers. From past experiences, Liftbyggarna have tremendous confidence in the security and sturdiness of Nord-Lock's tight locking products – vital in a project where safety considerations are absolutely paramount. □

SAFE JOURNEY

Over 10,000 Nord-Lock washers ensure a safe, smooth ride to the top of the Ericsson Globe.



PHOTO: SÖREN ANDERSSON



SAFE AND SECURE

The internal gearbox cannot be accessed once the valves are installed so it is absolutely vital that fasteners remain secure.

GOING WITH THE FLOW

| | | |
|---|--|---------------------------|
| CUSTOMER: BLACKHALL ENGINEERING | MODEL: LARNER JOHNSON VALVES | WEIGHT: 17 TONS |
| FLOW RATE: 19 CUBIC METRES PER SECOND | WATER THROUGHPUT PER DAY: 450 MILLION GALLONS (1.7 BILLION LITRES) | |
| NEW YORK WATER THROUGHPUT: 60% | | |

A HEAVING METROPOLIS like New York needs a lot of water. It may be the city that never sleeps but it certainly drinks, bathes and cleans. Assisting in the mammoth task of supplying water for over eight million people is British company Blackhall Engineering, who have just produced four 60" bore Larner-Johnson valves for the city.

The valves will control the flow of water from New York's deepest reservoir, the Ashokan Reservoir in the Catskills Mountains. Each valve weighs a massive 17 tons and has a flow rate of 19 tons per second. When fully operational 450 million gallons of water will gush through the valves every day, supplying 60% of New York's water.

In constructing the valves' internal gearboxes, Blackhall elected to use Nord-Lock washers because of their superior anti-loosening properties. Once the valves are in place the internal gearbox cannot be accessed, so it is absolutely vital that all fasteners remain secure. Due to the sheer volume of water that will pass through the valves, even the smallest failure can be critical. After seeing a demonstration of Nord-Lock's capabilities, Blackhall knew they had found their ideal fastener retention system. □



LENA KALMYKOVA
APPLICATIONS
ENGINEER



CSABA MADRU
MANAGER,
TVC



DAMIEN THOMAS
FIELD APPLICATIONS
ENGINEER

Email your questions about bolt securing to experts@nord-lock.com



ASK THE EXPERTS

Do you have a question about bolt securing? Put the Nord-Lock experts to the test.

Should I choose fine or coarse thread?



Q: What is the difference between fine and coarse threaded bolts?

A: Coarse threads have larger pitch (fewer threads per axial distance) compared to fine threads. A coarse thread is specified for most applications unless there is an overriding reason to use a fine thread (e.g. thorough thread adjustment is crucial for the application). Furthermore fine thread fasteners are more difficult to obtain.

Negative sides of fine threaded fasteners:

1. Fine threads are more susceptible to galling than coarse threads.
2. They need longer thread engagements and are more prone to damage and thread fouling.
3. They are also less suitable for high speed assembly since they are more likely to seize when being tightened.

The potential benefits of fine threads are:

1. Size for size a fine thread is stronger than a coarse thread. This is both in tension (because of the larger stress area) and shear (because of their larger minor diameter).
2. Because of the smaller pitch they allow finer adjustments in applications that need such a feature.
3. Fine threads can be more easily tapped into hard materials and thin walled tubes.
4. Fine threads require less torque to develop equivalent bolt preloads.
5. Fine threads have less tendency to loosen since the thread incline is smaller and hence so is the off torque.

LK

Do Nord-Lock washers work with fibre composites?

Q: Can Nord-Lock washers be used on fibre composite materials?

A: Yes! However, since fibre composite materials crack and delaminate easily it is important to optimise load distribution and to calculate the correct preload and the corresponding tightening torque in order to avoid damage. Since sliding occurs between the fastener and upper washer during tightening and between the cam faces of the washers during untightening, the surface is not scratched.

Exceeding the compressive and delaminating strength of the composite material around the hole can be avoided, for example, by using adhesively bonded metallic inserts. A metallic insert (Pic. 1&2) can act as a threaded hole or as a durable contact surface which also improves the behaviour of a bolted connection in composite material.



1. By using a bushing, a higher preload can be utilised and the composite material is relieved from most stress and the contact surface becomes suitable for serrated washers.

2. Threaded inserts can be used as threaded holes.

3. By using a NORD-LOCK sp washer with increased outside diameter together with a flanged fastener the load is distributed over a larger surface.



4. In order to distribute load and protect a sensitive surface, a metal washer covering multiple holes can be used.



5. Nord-Lock washers must not be placed on a washer which is free to rotate.

An existing design without inserts can be protected by using a metal

washer covering two holes or a pattern of holes (Pic. 4). **CM**

Should I change my tightening torque with Nord-Lock?

Q: Does the use of Nord-Lock washers affect my tightening routines? How?

A: When a tightening torque is applied to create a clamp load in a joint, friction under the bolt head

(or nut) and in the threads must be overcome before any torque goes to achieving the clamp load.

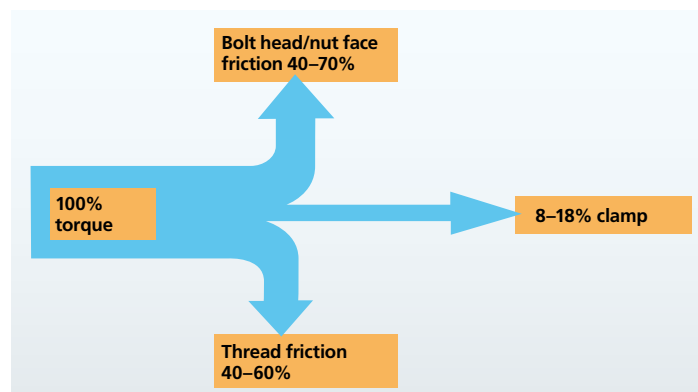
Since the Nord-Lock washers feature serrations, the coefficient of friction under the bolt head (or nut) will be slightly increased.

The thread friction remains unchanged. A slightly higher tightening torque is therefore required to achieve the same clamp load as for a flat faced joint.

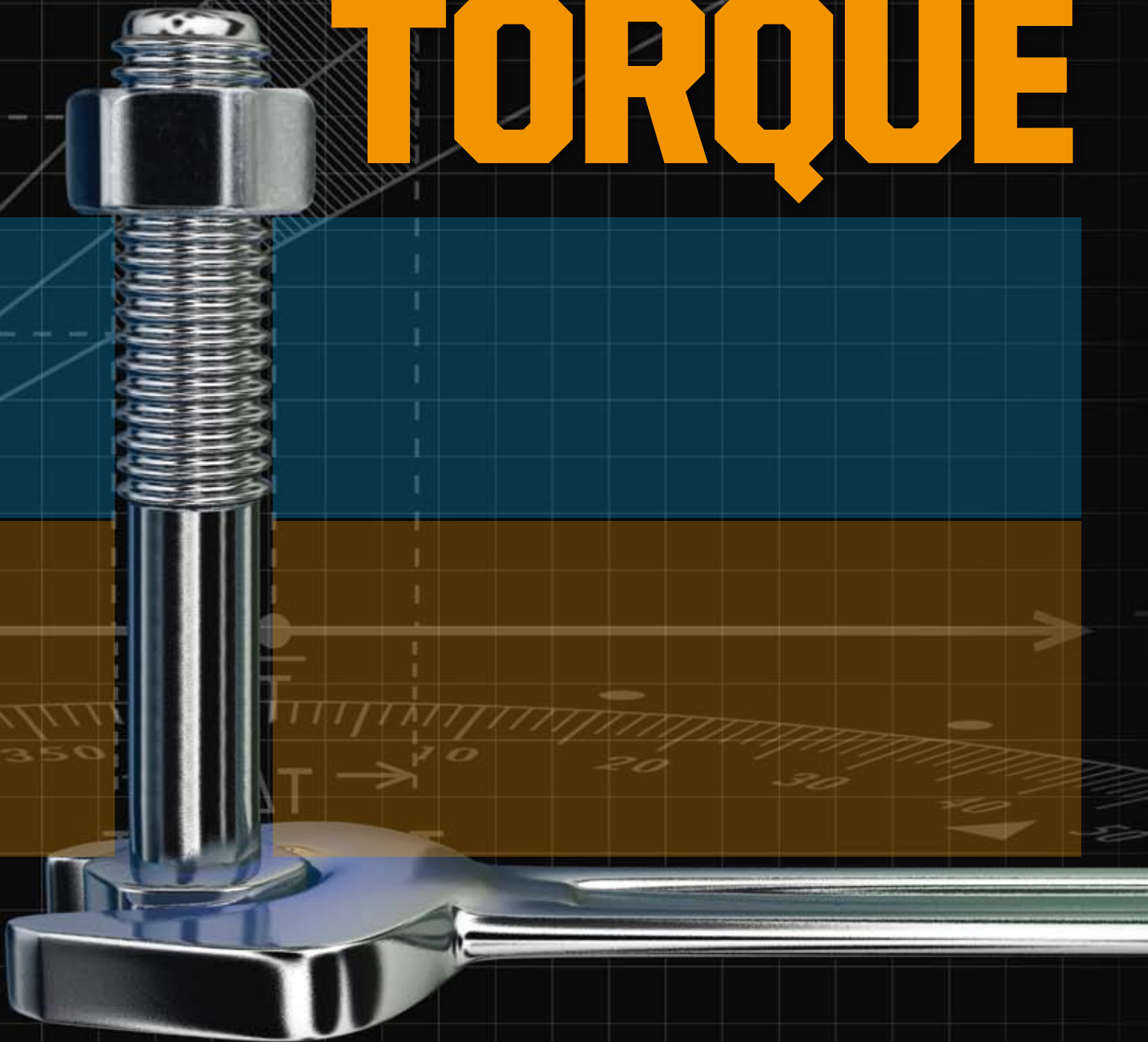
Nord-Lock's general tightening guidelines are taking the increased friction into account and permit to achieve a very accurate tightening.

Some users choose to keep their torque values when implementing Nord-Lock washers. It will result in a somewhat lower (-10% to -20%) but still acceptable preload.

It is also important to remember that friction varies significantly depending on bolt grade, bolt size, lubricant and joint material so real torque values may actually differ from torque guidelines. **DT**



TALKING THE TORQUE



TIGHTENING METHODS

Tightening is crucial for achieving control and reliability in joints. Experienced assembly technology engineer Bernard Tollet discusses optimising torque and clamp load, and the various ingredients concerning tightening technologies.

WORDS:
JOHN COKLEY AND DAVID WILES

PHOTOS:
ORLA & STRESS INDICATORS

IN MORE THAN 20 YEARS of working with joining technologies, Bernard Tollet has never been bored. “There are so many levels to be involved in: design, purchasing, production and quality assurance,” says the 57-year-old, who had a long career at Volvo Trucks and who is now employed at the Technical Centre for Mechanical Industries (CETIM) in Saint-Etienne, France, as an assembly technology engineer. “I have worked in all four departments; never saw the same thing twice because everything is always evolving.”

TOLLET’S LONG EXPERIENCE has taught him that most fatigue failures of bolts are caused by incorrect mounting or tightening. Manufacturers therefore have to focus on controlling their bolt tightening processes as the main way of reducing fatigue failure in their bolted joints. While other causes of fatigue failure include machining

of parts, heat treatments, surface treatments, design, choice of materials and conditions of use, tightening accounts for more than half of all cases.

So how do you achieve this controlled tightening?

Tollet speaks about three important steps in achieving a good assembly.

The first step to a controlled tightening is of course controlling the design and dimensions of the joint to ensure that the aimed value of preload is correct, the second is controlling the fasteners, and the third controlling the tools and the tightening method.

“THE ISSUE FOR A DESIGN ENGINEER IS: ‘What amount of preload do I need to make the joint withstand static and dynamic loads?’” says Tollet. “Whereas all that matters for a producer is: ‘How do I control the amount of preload installed in the joint using available tools?’”

Control of the fasteners is normally linked to control of the torque-tension relationship (see

figure 1, overleaf) of the assembly, namely the friction involved in the assembly. Lubrication is the most common way to get low and even friction conditions in the joint. Low friction means less tightening torque is needed to

achieve the right clamp load, and also gives much more predictable behaviour of the joint. Another way to decrease friction is by using coatings on the fasteners. “Only 20% of nuts and bolts sold in Europe feature a friction coefficient requirement (a surface treatment for friction control)” says Tollet. “These are mainly used by railway, automotive, aeronautics and steel construction industries. And when all is said and done, applying a surface treatment for friction control represents an increase of only 3–5% in the →



Bernard Tollet

Preload domain

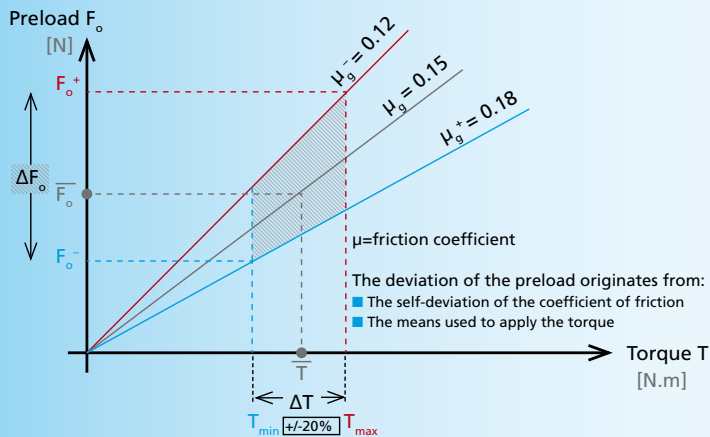


Figure 1. There is a linear relationship between the torque applied and the preload achieved. This relationship is dependent on the friction. Since friction is varying from joint to joint as well as the given torque is varying depending on the accuracy of the tightening method, ΔT , the achieved clamp load is varied.

Preload domain

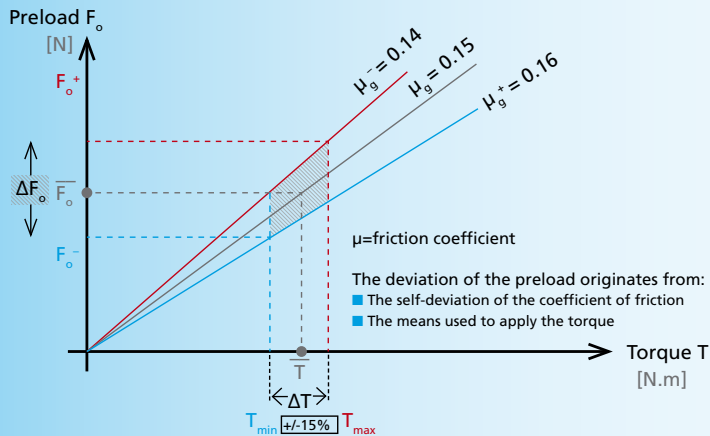


Figure 2. By choosing an accurate tightening method and by using a good lubricant it is possible to tighten up the variation of the achieved clamp load.

→ base cost of a fastener. Choice of fasteners and verification of their specifications are the responsibility of both the design and the purchasing department.”

Controlling tools and tightening method means investigating each characteristic and parameter of the tightening process. The most common tightening method is torque tightening, which involves applying a known rotational force to the assembly to achieve what's known as preload, or clamp load. This is the tension in the assembly which has been specified by the design engineer for best performance of the machinery. According to Tollet, torque tightening using correctly calibrated tools is normally sufficient to achieve a good clamp load for most industrial bolted joints.

But sometimes the function of the bolted joints only allows small differences between maximum and minimum allowable clamp load (see figure 2, above). “Engineers need assurance that the preload achieved in production is within the required range. For these cases you might need to consider switching from the torque tightening process to another method which might be more accurate or more suitable for the particular production conditions. The big responsibility of control of the tools rests with the production department. It has the responsibility for ensuring the required tightening operation has been completed, in sequence when necessary, that no bolt has been tightened twice and that all the other assembly items (especially washers) are in place. □



Choosing

Producers have to weigh up a range of issues and parameters when deciding on the best tightening method and the best tools for the job. The big issue is the fundamental method adopted, but Bernard Tollet warns that there is no universal way to ensure “this method is better and cheaper than the other one”.

THERE ARE THREE generally-accepted methods for tightening bolts used within industry (while in the lab there are other methods that are based on torque tightening but are more accurate as they measure the elongation of the bolt):

1. First and most common is the torque tightening method, and the price of tools for this method varies widely according to the accuracy and capacity requirements of the job. Torque controlled tightening is completely based on friction which often varies and results in deviation of preload.

2. Second – and increasing in popularity – is a method of combining torque tightening with angle tightening, allowing greater improvements in accuracy. Angle-controlled tightening is a method where the fastener is first tightened at a predetermined torque to pull the clamped parts together. The fastener is then further tightened by a measured additional rotation. The rotation is measured by angle and is independent of friction which makes it very accurate.

3. Finally, the bolt elongation method is the most accurate by far, but suitable only for big bolts, prototypes or very limited production series.



the right tool for the job

“We may see in a few years the proportion of electrical tools overcoming the proportion of pneumatic tools. Also, while torque tightening still dominates industry, the proportion of torque tightening combined with angle tightening is growing fast.”

BERNARD TOLLET, ASSEMBLY TECHNOLOGY ENGINEER

Bolt elongation is a method where a hydraulic tool stretches the bolt and introduces the desired preload. The nut is then manually turned to mate the contact surface and the hydraulic pressure is released.

THE OTHER ISSUES involve assessing existing equipment in the production plant, and the space available for assembly of the joint. Ergonomics and accessibility are important, as are the design of the assembly line or workshop, and the work routines and practices of production staff and machine operators. Production staff have to consider what fastening technologies are available (sheet screws or self-forming screws, for instance) and what accuracy or tolerance is required and allowed. They also have to include the torque level required and the energy source for the tools.

“For example, it’s impossible to use a pneumatic gun to apply torques higher than 450Nm. Also, elongation cannot be used on a continuous towed line,” says Tollet. Business needs play a role in the tools decision as well, especially the cost of the tools, and the produc-

tion volume required of the plant.

Are you selecting for prototype or low-volume production, or mass production such as in the automotive industry? Do you choose one tool for

multiple torques? Or are you only interested in applying one torque value per bolt size? Do you choose maximum traceability (in and out) of the tools, or for mistake-proofing systems (so-called poka-yoke)? And what are your company’s quality assurance requirements?

LOOKING FORWARD, while pneumatic energy sources have dominated the tools market for the past few decades, the proportion of manufacturers using electrical tools is continuously increasing. “This tendency is so important that we may see in a few years the proportion of electrical tools overcoming the proportion of pneumatic tools,” says Tollet. “Also, while torque tightening still dominates industry, the proportion of torque tightening combined with angle tightening is growing fast.” □

The business case for tightening

- **FOLLOWING THE SO-CALLED 20/80** rule, up to approximately 80% of bolted joints are not critical to the final assembly.
- **THE INSTALLED PRELOAD** must satisfy the functional requirements specified by the designers.
- **EFFICIENT METHODS** of installing clamp loads in bolted joints are:
 - normal torque application
 - combined application of pre-torque and angle tightening, or
 - direct bolt elongation
- **SEVERAL METHODS** can help reduce the deviation of the achieved range of preload with

various results. As the torque tightening method depends so much on the friction conditions of fasteners and on operator skill, final deviation can be reduced by only 10–20%. But switching from torque tightening to a combined method (torque + angle) can lead to a reduction of about 50%.

- **LUBRICATION** is very important. By decreasing friction, a greater percentage of the torque applied goes towards achieving preload.
- **PRODUCERS SHOULD DISCUSS** the suitability of several tightening methods as regards their requirements instead of considering the tools alone.

BUILT FOR

HIGH SPEED TRAINS The world's fastest conventional trains run in France, and not just to break the April 2007 record of 574.8 km/h (under test conditions with a shortened train). The TGV regularly runs at 320 km/h and at those kinds of speeds it is absolutely vital that nothing falls off the rolling-stock to derail the train. This is where Nord-Lock comes into the picture.

WORDS:
CHRISTINA MACKENZIE

PHOTOS:
NIKOLAI JAKOBSEN

THE SNCF is the French national railway company which transports more than a billion passengers a year throughout Europe. Its five branches: SNCF Infra (management of the infrastructure), SNCF Proximités (urban, suburban and regional transport), SNCF Voyages (long-distance travel), SNCF Geodis (freight) and Gares & Connexion (station management) have a global spread: Infra has contracts in Saudi Arabia, South Korea and Poland; Keolis, a subsidiary of Proximités, runs trains, tramways, coaches, buses and metros in Australia, the USA, Canada, Scandinavia, the UK and Germany. Geodis, the group's major earner,

is the world's sixth logistics operator and freight transporter with a strong presence on all five continents while Gares & Connexion's subsidiary AREP is designing stations in China and India.

Because SNCF designs the specifications for its rolling stock and does all its own maintenance it has a Railway Test Agency, known by its French acronym, AEF, which does R&D; debugging; certification, qualification and acceptance testing; operating, maintenance and failure analysis; environment, industrial health & safety.

FRANCIS COCHETEUX is in charge of the Maintenance expert team at the AEF in Vitry-sur-Seine just south of Paris. It is here that all the technical resources and expert skills needed to carry out tests and analyses throughout the life cycle of rolling stock and its components can be found. →



SPEED





“Bolts are a strategic element in keeping trains on track: if you lose a piece it could be catastrophic.”

FRANCIS COCHETEU, MAINTENANCE EXPERT

“Our keyword is RAMS: reliability, availability, maintenance and security. Nord-Lock helps us meet this,” says Francis Cochetex, in charge of the Maintenance expert team at AEF, SNCF’s Railway Test Agency.

FACTS:
SOCIETE NATIONALE DES CHEMINS DE FER FRANCAIS - SNCF

WHAT IT DOES:
 RUNS THE VAST MAJORITY OF TRAINS – PASSENGER AND FREIGHT – IN FRANCE

NUMBER OF PASSENGER JOURNEYS:
 71.73 BILLION IN 2009

TGV:
 FIRST RAN BETWEEN PARIS AND LYON ON 22/9 1981

EUROSTAR:
 TGV BETWEEN PARIS OR BRUSSELS AND LONDON HELD 55% BY SNCF

THALYS:
 TGV BETWEEN PARIS-BRUSSELS-AMSTERDAM AND PARIS-COLOGNE (GERMANY)

LYRIA:
 TGV BETWEEN PARIS AND SWITZERLAND (GENEVA, LAUSANNE, BERNE, ZURICH) HELD 74% BY SNCF

FOUNDED:
 1 JANUARY 1938



Business arguments

THIS IS HOW the SNCF benefits from Nord-Lock washers:

- **GUARANTEED QUALITY** – there are many counterfeit, low-quality bolts and washers on the market.
- **RELIABLE** – prevents bolt loosening.
- **TIME-SAVING** – need to check less frequently.
- **MONEY-SAVING** – fewer technical incidents means less maintenance and ensures that trains run on time.
- **ADAPTABLE** – the Nord-Lock system fits existing nuts and bolts.
- **CRUCIAL** – for critical applications.

→ When he took up his assignment nearly a decade ago he discovered that although the SNCF uses 8,000 different types of fasteners on its rolling stock, “bolting was not taken seriously enough and people were not trained to do it. It seemed to be an assumption that anyone who’s played with Meccano knows how to screw a nut onto a bolt, but I discovered that this was far from true. Bolts are a strategic element in keeping trains on track: if you lose a piece it could be catastrophic.”

HE THEREFORE DECIDED to go back to basics and in early 2005 set up a commission to look into the engineering specifics, maintenance, purchasing and tests and trials of nuts, bolts and washers (the commission is managed today by Benoit Dodin). Meanwhile, he had also met Laurent Vincent, the Nord-Lock representative in France at that time who introduced him to Nord-Lock washers as a solution to the problems of parts shaking loose with the vibration of the train.

They started to make a record of instructions for those working with bolts on the TGV “because it’s no good just supplying technicians with a good product if they don’t know how to use it”. Mr Cochetex discovered for example, that some technicians, surprised to find the two Nord-Lock washers glued together made efforts to unglue them before using them and then had a tendency to set them upside down. “So we had

to explain why they were smoothly glued together and that if they were used upside down then the whole technological idea behind them was lost,” he says.

BY 2008 he ensured that for each of the 38 railway maintenance centres in France there was a Mr or Mrs Bolt who had been trained and was responsible for all bolt assemblies. “When the one-year guarantee on a material is up, then we at the SNCF do the repairs and maintenance in-house and when you consider that a train generally lasts more than 30 years and that it needs a mid-life upgrade, then there is work aplenty.” Sometimes, these upgrades are the occasion to replace older systems with Nord-Lock although Mr Cochetex says that “despite the fact it is a good product it won’t be put everywhere. We target specific and crucial parts such as the guard iron.” This is a heavy concave metal part on the front wheels of the TGV locomotive which sweeps the railway line free of stones and other objects which otherwise could derail the train. It is attached with four nuts and bolts.

“There will be a call for tender for the next generation of TGVs but which must meet our specifications. Although we are not allowed to name brands we can specify that they must be GALE (globally at least equivalent) to what we already have... and for us, Nord-Lock is considered as a good product!” says Mr Cochetex. □



John Heronneau testing one of the TGV guard iron.

Providing an antidote to disaster

WORDS: CHRISTINA MACKENZIE | **PHOTO:** NIKOLAI JAKOBSEN

NUCLEAR POWER **WHEN** Philippe Nouaille came to his present job after 15 years on-site at nuclear power plants he took a fresh look at the ITS shut-off valves he is now responsible for to see how they could be better secured against earthquakes – the natural disaster which gives nuclear engineers their biggest headaches – and how maintenance on them could be improved. He’s been recommending Nord-Lock washers for two years now, and they are mandatory in contaminated areas because of the speed with which they can be put on and taken off.

What is the CIPN?

“The CIPN, Centre d’Ingénierie du Parc Nucléaire, is based here in Marseilles and is responsible for the maintenance of existing nuclear plants. We are part



FACTS:
PHILIPPE NOUAILLE

AGE: 49.
ROLE: Project manager responsible for qualifying the ITS (Important To Safety) shut-off valves in nuclear power stations within the material maintenance department of the CIPN, the engineering centre for nuclear power stations, part of the French-based global electric power company, EDF.

“Nord-Lock is one of our solutions to avoid loose bolts,” says Philippe Nouaille.

of EDF which has 38.1 million customers worldwide and 160,913 employees. Around 1,000 work for the CIPN. We have 58 nuclear reactors in France and are currently overseeing construction of the first EPR (European Pressurised Reactor) unit in Flamanville with a second scheduled to be built at Penly. Four EPRs will be built in the UK, two in China through a joint venture with China Guangdong Nuclear Power Group, four in the USA through a 50/50 joint venture between EDF and Constellation Energy called Unistar Nuclear Energy and we are gearing up to take part in Italy’s nuclear revival in partnership with Enel.”

And your particular section, the QR?

“In the QR, for ‘qualification et robinetterie’ (qualification and valves and fittings), we are responsible for ensuring equipment is kept up-to-date with the constantly evolving rules concerning the security of pressurised equipment and we approve the spare parts sup-

plied to us. All this for the ITS shut-off valves and anti-fire valves.”

What size are these shut-off valves?

“Well, they don’t look anything like your bathroom or kitchen taps! These shut-off valves are of various sizes but can be up to 3m high. We don’t make them ourselves of course, but we establish the specifications.”

What made you turn to Nord-Lock?

“Nord-Lock is one of our solutions to avoid loose bolts and we turned to it after doing a technical and business report. We’d had an incident when a bolt had been poorly tightened and it took engineers 10 weeks to verify all the other bolts. You can imagine the waste of time and money!”

“We don’t insist that Nord-Lock be used where the expense is not jus-

“Don’t forget we are working in a nuclear power plant not a supermarket and so cannot afford to make the slightest mistake!”

PHILIPPE NOUAILLE, PROJECT MANAGER, CIPN, EDF

tified but we do insist that this product be used in radiation contaminated areas because they allow a bolt to be tightened very quickly. The technicians go in, tighten the bolt and leave and for us their safety is paramount. With Nord-Lock we can be certain that once tightened the bolt will hold. Don’t forget we are working in a nuclear power plant not a supermarket and cannot afford to make the slightest mistake!”

“We also like the fact that it can be loosened when necessary and that it can be re-used.”

Any improvements you’d like to see in the product?

“I would like to see a system, perhaps of micro-capsules of colour that would break when the washers are locked together, which would indicate that they were correctly positioned because for the moment you can never be sure that this is so.” □

Note: Nord-Lock washers are pre-assembled with a soft hot melt adhesive in order to assure that they are always correctly positioned.

Sea change

WORDS:
DAVID WILES

PHOTO:
ROTECH SUBSEA

THE CHALLENGE It is an all too familiar issue: bolts on heavy machinery vibrating loose during transport or operation. For Rotech Subsea, the world's leading provider of mass flow excavation services, the problem could strike when their excavators were en route from its Aberdeen, Scotland, plant, or in action on the seabed at depths of up to 1,500 m, excavating the seabed using water at high-volume and low-pressure.

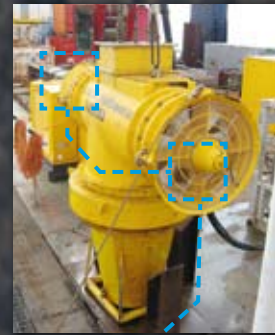
Their existing bolt securing solutions, such as lock tabs and spring washers, were coming loose due to vibrations or flexing, and although there was never an actual failure, Rotech's engineers were concerned.

THE SOLUTION Rotech Subsea turned to Nord-Lock, testing 200 pairs of washers on 1m-diameter bolted flange joints on an excavator bound for offshore work near Sakhalin, Russia.

"We put stainless steel washers on one side and zinc-coated washers on the other to see how they compared," says Steve Aitken, senior

IMPELLERS

Impellers – which increase the pressure and flow of the water – are mounted using Nord-Lock washers.



research engineer at Rotech. "We have a kind of inbuilt salt sea spray test – the excavators sit and basically corrode on the back of a boat because of the environment. It sat there for a couple of months, then operated subsea, then spent another couple of months on the back of the boat before it was offloaded in Singapore."

THE RESULT On inspection, Aitken found that not only were all the washers in perfect condition, but none had come loose. "Using Nord-Lock basically took all of our vibration worries away – they are like an insurance policy for us," he says. "Something else we really appreciate is that you can actually feel that they are working when you loosen them off. It's reassuring to tighten up a bolt to a certain torque and then loosen it off and make sure that the washer is working and everything is sitting well, and then tighten it back up again. I am now looking at using Nord-Lock washers on a wide range of R&D projects – not just subsea excavators." □

FLANGES

Each excavator has six flanges, and each flange has 16 bolts, all of which are fitted with Nord-Lock washers.



Tough trial puts wheel nuts to the test

In a sweltering limestone quarry flanked by sheer cliffs rising 60 metres, a truck stands idling at the top of a near-vertical muddy incline. This hill is so steep that a daring skier would think twice before tackling it, but the driver edges forward and expertly guides his 13-tonne vehicle in a controlled skid towards a gate below that is only just wider than the truck itself.

THE SPORT IS TRUCK TRIAL, and the driver is Marcel Schoch, reigning European champion and star driver of the HS Schoch team. The German team has helped Nord-Lock test its wheel nuts, which are fitted to all eight wheels of this monster vehicle. "When you're driving down hills like this, it's good to know that your wheels are safe," says Schoch, a 29-year-old who is in his fourth season in the competition. "We've been in some pretty tough situations but we haven't had any wheels come loose since we fitted Nord-Lock wheel nuts."

The extreme terrain of truck trial is an ideal proving ground for the wheel nuts. When not sliding down impossibly steep hills or powering back up them, the trucks buck, bolt and lurch around the course, with



PHOTO: EBERLEIN ROBERT

Nord-Lock wheel nuts are fitted to all eight wheels of Marcel Schoch's monster vehicle.

the chassis twisting and the axles taking a hammering.

Bolted caught up with the HS Schoch truck trial team at their home event near Crailsheim, northeast of Stuttgart. Marcel Schoch has high hopes of retaining his title after winning the first round in Lyon, France – although this round, the second of the season, was hampered by a broken spring in the first run.

Truck trial is the art of moving heavy vehicles with high precision over the most challenging of terrain. Speeds are minimal, as is the distance travelled; Marcel Schoch's truck is now in its sixth season but

still has only 3,000 km on the clock. The sport demands nerve, patience, driving skill and a keen understanding of the way the soft terrain behaves when in contact with the vehicle's weight. Anyone who has difficulty parking their car outside the supermarket need not apply.

PENALTY POINTS are accumulated for infringements such as knocking over a gate, missing a gate, or carrying out more than six forwards or backwards manoeuvres between gates. The winner at the end of the competition is the driver with the fewest penalties.

"We walk the course beforehand

and come up with a plan," says Schoch. "But it doesn't always go as you would like, so we have a Plan B, Plan C and Plan D too."

Besides the Nord-Lock wheel nuts, Schoch's MAN truck also has Nord-Lock washers fitted at key points around the chassis. "The trucks must be very flexible to tackle this terrain, and in the past we have had a lot of problems with bolts coming loose," he says. "This doesn't happen anymore. It gives a good feeling and that's why I like Nord-Lock products – because of the security they create." □

DAVID WILES



Safe wheels save lives

NORD-LOCK'S NEW WHEEL NUT has been enthusiastically received among vehicle manufacturers, owners and operators during the initiated launch campaigns in the US and the UK. The product provides an effective solution to the widespread and dangerous problem of wheel detachment, offering a wedge locking function based on the same principle as Nord-Lock's prov-

en bolt securing system. The product will continue its rollout and will soon be available worldwide through Nord-Lock offices. "We believe that this product will make a huge difference in terms of road safety and productivity in on-road and off-road applications," says Carin Esberg, Nord-Lock's Marketing Manager.

The launch campaign for the

wheel nut is centered around safe wheels. During the launch campaign, wheel nut caps emblazoned with a safe wheels logo will be available free of charge with purchases of the Nord-Lock wheel nut. By using the caps, vehicle owners and operators will not only protect the studs and the nuts, they will also display their pro-active choice for increased vehicle safety. □



Certification opens doors in Poland

AFTER EXTENSIVE and rigorous testing, Nord-Lock washers have been approved by the Polish Instytut Techniki Budowlanej.

The Warsaw-based Building Research Institute subjected bolted joints secured with Nord-Lock washers to a range of mechanical and chemical tests before awarding a "Technical Recommendation". This recommendation allows for Nord-Lock's bolt securing solution to be used in steel constructions in the building industry in Poland.

"In some industries in Poland it is not possible to implement new technical solutions without acceptance of certificated state units, and Polish Building Research Institute is one of these," says Krzysztof Włodarz, managing director of Nord-Lock Poland. "To get acceptance it is necessary to carry out a long process of tests but the result is worth all the efforts. Now the doors to the building industry in Poland are open." □



Demonstrations at German exhibitions

NORD-LOCK'S EXPERTS will be demonstrating the unique Nord-Lock bolt securing system at two major German exhibitions this autumn. At Europe's leading railway exhibition, InnoTrans (hall 7.2 C stand 202) in Berlin, the company's experts will be on hand to discuss the wide range of applications for the wedge-locking system both on the trains themselves and around the tracks. At Husum Wind Energy (stand 4E16), one of the world's top trade fairs for the renewable energy sector, the Nord-Lock washer's suitability for this high-vibration and high dynamic load environment will be on display to visitors. □

In every edition of **Bolting**, we present one of the areas in which Nord-Lock is working actively on quality assurance and competitiveness. In this issue we focus on sales force training.

QUALITY IN EVERY STEP

Technical training creates knowledgeable sales force

In-depth technical training provided by Nord-Lock to its international sales force and authorized partners ensures that customers get the best possible service from their Nord-Lock contact.

THE TRAINING, which takes place at least twice a year at Nord-Lock's technical verification centre in Malmö, Sweden, gives the sales

force the opportunity to broaden their technical knowledge and keep up to date with the latest developments in bolt securing.

"We want to be recognised as a company that has profound knowledge in fastener technology and bolted assemblies," says Frida Cullin, applications engineer at Nord-Lock who runs the technical training course with two colleagues. "We hope that the customer feels that they are in good hands when our salespeople come to them."

Each of the two-day courses is

attended by about 15 to 20 Nord-Lock sales staff and authorized partners from all over the world. The training covers topics such as bolt tightening methods, lubricants, and the relative strengths and weaknesses of competing bolt securing solutions, while participants get the opportunity to share experiences with colleagues from other markets.

"They gain extensive knowledge and are able to answer almost any questions the customer could have," says Frida Cullin. □

"We gained experience from the professionals"

Darryl Campbell and Junade Rahiman, from Nord-Lock's distributor for sub-Saharan Africa, BMG, took part in the training earlier this year.

"I THINK IT'S VITAL for anyone selling Nord-Lock washers to attend this training – whether they think they know the product or not," says Darryl. "The Nord-Lock staff have broad knowledge of fasteners which they pass on to the participants."

Junade says the course was an eye-opener for the washers' potential. "Previously I couldn't understand why such a simple-looking product costs so much – now I know it is a simple but brilliant product. There are a variety of ap-



Darryl Campbell and Junade Rahiman think it's vital for Nord-Lock sales people to attend the in-depth technical training.

plications where it will be appreciated."

Darryl says that BMG's customers now benefit from his presence

on the course. "They get someone who is well-versed in the product and has experience gained from the professionals." □

Comparing solutions for bolt securing

How do Nord-Lock washers compare with nylon insert nuts? This guide lists key parameters to help you make the right choice.



| | NORD-LOCK | NYLON INSERT NUT |
|---|---|---|
| LOCKING CAPABILITY | Reliable. High and constant quality of the product. | Not reliable. Variable efficiency of the product depending on quality of the nylon insert, on the manufacturer, and on temperature. |
| RANGE | M3-M130. | M3-M48. |
| TEMPERATURE | Same operating range as regular bolts and nuts, locking function not affected by temperature changes. | Efficiency decreases as temperature increases. Usual operating range set by ISO 2320 is limited to [-50°C ; +120°C]. |
| ASSEMBLY/ DISASSEMBLY | Swift and easy to assemble/disassemble, even in confined spaces. | Time-consuming operations for installation and dismantling, thereby increases maintenance time. |
| CLAMP LOAD DEVIATION WHEN TIGHTENING | Possible to predict the clamp load. Can be lubricated, and thereby even further minimize clamp load deviation and torsion stress. | Larger deviation in clamp load due to friction-based locking. Lubrication not recommended. |
| REUSABILITY | Reusable. Does not affect reusability of bolts/nuts. | Not recommended for reuse. |
| RECYCLABILITY | Recyclable. Meets ELV and RoHS directives. | Consists of nylon and steel. |
| LIFE CYCLE COST | Low. Relatively high price per unit. However long life cycle, reusable, improves productivity and minimises maintenance cost. | Variable – from low to very high – depending on application. Involves high mounting costs due to time-consuming installation. |

Nord-Lock shares offshore safety expertise

NORD-LOCK HAS BEEN invited to contribute to an international forum of leading oil industry players dedicated to improving safety within the offshore industry.

The Dropped Object Prevention Scheme (Drops) brings together health, safety and environment experts from oil companies, contractors and suppliers to tackle the pressing problem of accidents on oil rigs and associated vessels. Unsecured bolts and nuts account for a significant proportion of these accidents, so Nord-Lock was invited to join the forum to share its technical expertise in bolt securing solutions.

Nord-Lock washers are already used and recommended by several international oil companies because of the safety improvements they bring.

"These accidents occur every day, and everyone's awareness of safety has increased," says Gösta Rydin, Nord-Lock's Global Industry Manager Offshore. "The safety benefits of our products have been recognised by the industry." □

CALENDAR

Exhibitions

EACH YEAR, Nord-Lock participates in over 60 large exhibitions and events for various industries. In the Nord-Lock stands you will find experts on bolt securing and you can also see Junker demonstrations, a comparative worst-case scenario vibration test for bolted joints. Here are some of this autumn's highlights:



Fastening & Assembly Solutions Exhibition (FAST Exhibition)

WHAT: FAST is the only dedicated fastening and assembly exhibition in the UK that shows the latest advances in industrial fasteners, adhesives and assembly technologies.

WHEN: 21 Oct, 2010.

WHERE: MotorCycle Museum -NEC-Birmingham, UK.



Japan International Machine Tools Fair (JIMTOF)

WHAT: JIMTOF is the largest machine-tool show in Asia and the third largest in the world. This exhibition, held once every two years, will introduce worldwide new machine tools, components and technical information.

WHEN: 28 Oct-2 Nov, 2010.

WHERE: Tokyo Big Sight (Tokyo International Exhibition Center), Tokyo, Japan.



CUTA 2010 Fall Conference & Trans-Expo

WHAT: The Canadian Urban Transit Association (CUTA) represents the public transit community in Canada and is a leading partner in national and international education and outreach initiatives.

WHEN: 13-17 Nov, 2010.

WHERE: Vancouver, Canada.

Visit www.nord-lock.com/events for a complete list of exhibitions.

Our roads are full of danger

Now there is a simple way to make them safer



A bomb exploding. That is what a survivor said it felt like when a wheel which dislodged from a heavy vehicle struck his windshield. Hopefully, you have never been involved in an accident caused by a wheel travelling across the highway. But it only needs to happen once to cause a devastating impact on the life of any person or company. Now there is a simple and cost effective way to eliminate unintentional loosening of wheel nuts, which is the main cause of this safety problem.

The new Nord-Lock wheel nut safely secures wheels by maintaining a high clamp force even under severe operating conditions. Once tightened, the Nord-Lock wheel nut cannot loosen by itself. It is based on our proven wedge-locking technology, which has been

used worldwide for over 25 years in millions of bolted applications exposed to strong vibrations and high dynamic loads. The product has been thoroughly tested and offers outstanding performance compared with conventional wheel nuts*. The Nord-Lock wheel nut suits standard flat-faced steel rims, M22x1.5 studs and is easy to install.

Safe wheels save lives

Find out more at www.safe-wheels.com

** Independent comparative testing of different wheel nuts was performed in 2009 by IMA, a leading material testing and research institute in Germany. More information available through www.safe-wheels.com.*

**Safe
Wheels**



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NORD-LOCK®
Bolt securing system