

BOLTED

**FOREIGN AID
ENGINEERS
HELP REBUILD
SRI LANKAN
COMMUNITY**

**VOYAGE INTO SPACE
THE NASA
SPACECRAFT
SECURED BY
NORD-LOCK**

**DEEP SEA DRILLING
IMPROVING
SAFETY POST-
DEEPWATER
HORIZON**

ALUMINIUM:

**THE
MIRACLE
METAL**



Save time with Expansion Bolts



Heavy machinery requires bolting elements that can be easily installed and removed. This is especially true on large and high-performance flange couplings where the bolting elements produce an interference fit for proper torque transfer.

Superbolt Expansion Bolts replace large fitted or interference fit bolts. Its outer diameter can be expanded to fit the actual bore size.

Easy: Loose fit sleeves are easily inserted even in holes not fully aligned due to rotation. Only hand tools are required for installation and removal.

Fast: Tightening requires only minutes per assembly.

Safe: Eliminates the need for special high powered tools, bolt deep freezing and high pressure hydraulic systems.

Economical: Save money over hydraulic systems in time and tooling.

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life examples



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www.superbolt.com/expansionbolt





Bolted magazine is published by Nord-Lock and strives to increase knowledge about bolt assemblies. The Nord-Lock Group is a world leader in bolt securing systems and offers a wide product portfolio, including wedge-locking technology and Superbolt tensioners. These unique solutions withstand vibration and dynamic loads. For further information visit www.nord-lock.com

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NORD-LOCK®

Bolt failures offshore cause incidents every third week

DROPPED OBJECTS ARE a major concern in the oil & gas industry. I had the opportunity to review statistics of incidents that have taken place on the Norwegian continental shelf. Using the industry's own data from www.oljefakta.no we evaluated bolting-related dropped object incidents over a period of five years.

It was surprising to see that even in this industry, with its comprehensive safety routines, incidents related to bolt failure occur as often as every third week. My colleague Petter Viken, Business Developer for Oil & Gas in Norway, also summarised the situation by stating that it is particularly notable as the operators spend huge resources every year on inspection and re-tightening of bolted connections. You can read the entire article here: www.nord-lock.com/every-third-week.

Please also take a look at the news video which, among other things, includes insight from a Principal Engineer at DNV & Transocean's Technical Director on a possible solution which would minimise costs for retightening whilst increasing bolt safety in the Oil & Gas industry.

More offshore updates in this issue include

Superbolt users MPO in Singapore (page 12) and Sky Access (page 6). We also get closer to the sun (page 4), contribute to a suspension bridge for tsunami victims in Sri Lanka (page 15) and secure fencing equipment in the UK (page 16).

On top of all this our theme is aluminium. So don't miss it if you'd like a thorough overview of the why's and how's and what to consider when bolting this miracle material (page 8). In other words, a broad mixture of exciting stories and insights on topics related to the world of bolting – we hope you will enjoy it!



CARIN ESBERG
GLOBAL MARKETING
MANAGER

08



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WORDS: NIC TOWNSEND & LINDA KARLSSON ELDH

REACHING FOR THE SUN

CUSTOMER: OHB SWEDEN AB	LAUNCH DATE: JULY 2017	BUDGET: \$1.1 BN
CLOSEST POINT TO THE SUN: 42 MILLION KILOMETRES		
MISSION LIFETIME: 7 YEARS	MAX SPEED: 70 KM/S	
TEMPERATURES IN SPACE: -100 TO +520 DEGREES CELSIUS		

NOTHING IS MORE IMPORTANT to life on earth than the sun. Without it, our planet would merely be an icy, lifeless rock tumbling through space. Still, the sun has remained mainly unexplored – until now, that is. The European Space Agency (ESA) and NASA are set to launch the Solar Orbiter, a spacecraft whose mission is to collect detailed information about the sun’s effects on our solar system. It will make history as being the closest man-made object to the sun ever, even closer to the hot star than Mercury.

OHB Sweden AB provides the Solar Orbiter with systems that allow it to position itself in orbit around the sun and make a complex series of gravitational-assist fly-bys past both Earth and Venus. One of them is a chemical propulsion system with 18 rocket engines and two tanks fuelled with a total of 200 kg of propellant. During the launch from Cape Canaveral, the propulsion system and the bolts securing it must cope with dynamic loads of up to 30 times the force of gravity. Since bolt loosening can’t be fixed in space, OHB takes no chances. All bolts are fitted with a total of 240 NL4 washers. The space system provider has been a Nord-Lock customer for decades and knows that any space voyage starts with a secure bolting solution. ■



OUT OF THIS WORLD
240 Nord-Lock washers are fitted to the Solar Orbiter, which must withstand vibrations up to 30 times the force of gravity.



PHOTO: SLEIPNER



DUAL SOLUTION
Nord-Lock washers ensure that the frame can withstand heavy loads, while Superbolt tensioners enable faster and easier onsite assembly.

FASTER TRANSPORT FOR HEAVY MACHINERY

CUSTOMER: SLEIPNER FINLAND OY		
PRODUCT: E550	LOADING CAPACITY: 565 TONNES	
WHEEL DIAMETER: 2.7 METRES	WIDTH: 5.4 METRES	
WEIGHT: 80.5 TONNES	TYRES: 8	

EXCAVATORS ARE A VITAL PIECE of machinery for any mine, but for all their horsepower, they are incredibly slow and cumbersome to move. In fact, 15 percent of their time is spent travelling, and this enforced downtime means lost income.

However, with a relatively simple yet unique solution, Sleipner has revolutionised excavator logistics, reducing travel time by 70 percent.

The E550, Sleipner’s biggest carrier, can transport excavators weighing up to 565 tonnes. Traditionally, Sleipner has used welded frames. However, in order to increase loading capacity they needed to find a more secure connection. They elected to use Nord-Lock washers as these were able to withstand the heavy loads without loosening.

With customers all over the world, carriers are often sent to isolated places with limited resources, such as the Australian outback or the far north of Finland. For this reason, Sleipner uses Superbolt tensioners to connect the wheels to the frame as using a fastener that can be tightened with standard hand tools is a huge advantage when working in remote areas with no power supply. ■

PHOTO: EUROPEAN SPACE AGENCY

SECURED BY THE NORD-LOCK GROUP

BLOWN AWAY

CUSTOMER: SKY-ACCESS	OBJECT: TRANSFORMER STATION
LOCATION: THE NORTH SEA	WIND TURBINES: 80
ELECTRICITY GENERATED: 1.4 BILLION (KW/YEAR)	
HEIGHT (ABOVE SEA LEVEL): 30 METRES	
HEIGHT (ABOVE SEABED): 90 METRES	
SIZE: 41 KM ²	STATION WEIGHT: 9,000 TONNES

GLOBAL TECH 1 IS ONE of the first offshore wind farms being built in the German section of the North Sea. When completed, it will be able to generate more than 1.4 billion kilowatt hours per year of environmentally friendly electricity – enough to power around 450,000 homes.

Like many offshore installations, building a wind farm of this size is a demanding project. In addition to 80 wind turbines, a 9,000 tonne transformer station needs to be built offshore and above sea level.

When it comes to servicing and maintenance at heights, Sky-Access are specialists. Sky-Access' industrial rope technique is safe and cost-efficient, and often offers greater speed and efficiency than alternative methods. However, it also has its limitations when it comes to using heavy machinery. So, when Sky-Access was asked to connect the transformer station to its four pillars, it chose to use Superbolt. Unlike alternative fasteners, Superbolt tensioners can be torqued by hand – a huge advantage when tightening bolts 30 metres in the air – and in the middle of the ocean. ■

STURDY SEA LEGS

A total of 24 Superbolt tensioners, each weighing 80 kilograms, are used to secure the transformer station to its pillars.



PHOTO: SKY-ACCESS

KEEP A LID ON IT

The Superbolt tensioners used to secure the valve are subjected to a pressure of 130 bar and operating temperatures of up to 300 degrees Celsius.

PHOTO: REPCO

ETHYLONE AND PROPYLENE might not be well known substances to the general public, but they're actually among the most important products in the global petrochemical industry. For example, both are used in the production of Polyethylene – the world's most common form of plastic.

As a result, demand is always high. The SCG Chemical plant in Rayong, Thailand, produces hundreds of thousands of tonnes of Ethylone and Propylene every year, and it is up to Rayong Engineering & Plant Service Co. (REPCO) to ensure production stays on track.

Both substances are produced through steam cracking, a process whereby hydrocarbons are broken down into smaller molecules. This results in extreme temperatures and high pressure. Currently, REPCO uses Superbolt tensioners to connect the steam valves to the bonnet assembly – a connection that must remain secure despite the demanding conditions. Any pressure leak will negatively affect production and bolt loosening will create a hazard.

However, Superbolt tensioners not only offer a safe and reliable bolting solution, the aim is that they will also reduce bolt seizure and maintenance costs. ■

EXTREME TEMPERATURE AND HIGH PRESSURE

CUSTOMER: RAYONG ENGINEERING & PLANT SERVICE CO. (REPCO)	PRODUCT: DRESSER MASONELAN VALVE
APPLICATION: PRODUCTION OF ETHYLONE AND PROPYLENE	
OPERATING TEMPERATURE: 300 DEGREES CELSIUS	PRESSURE: 130 BARS



LENA KALMYKOVA
FIELD APPLICATION
ENGINEER



MARTIN SCHNEIDER
INTERNATIONAL SALES
MANAGER

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.

The importance of temperature in bolting

BOLT MATERIAL	PLATING MATERIAL	TEMPERATURE INTERVAL		TEMPERATURE INTERVAL	
		Min T (°Celsius)	Max T (°Celsius)	Min T (°Fahrenheit)	Max T (°Fahrenheit)
Carbon steel/alloyed steel	Oiled	-50	120	-58	248
Carbon steel/alloyed steel	Zinc plating	-50	230	-58	446
Carbon steel/alloyed steel	Cadmium	-50	110	-58	230
Carbon steel/alloyed steel	Phosphate	-50	200	-58	392
Carbon steel/alloyed steel	Heavy zinc	-50	200	-58	392
Carbon steel/alloyed steel	Heavy phosphate	-50	200	-58	392
Carbon steel/alloyed steel	Nickel	-50	590	-58	1,094
Carbon steel/alloyed steel	Chromium	-50	650	-58	1,202
Stainless steel	-	-120	320	-248	608
Inconel	-	-250	650	-418	1,202
Waspalloy	-	-250	870	-418	1,598

Exceeding operational temperature range of the fasteners may have several consequences:

1. Carbon steel and alloy steel become brittle at temperatures below -50°C.
2. Exceeding the plating's operating temperature can cause premature fastener failure due to hydrogen embrittlement as well as loss of corrosion protection.
3. The fastener's strength properties decline with an elevation in temperature.
4. Change in the clamping force due to different thermal expansion coefficients between the fastener and the joint.
5. Creep and stress relaxation.

Q: What is the most common temperature range for bolts, and what are the consequences of exceeding it?

A: Bolts can be made of many different materials, the most common being carbon steel, alloy steel, and stainless steel. For high temperature

applications, different iron, nickel and chromium based alloys are used, such as Inconel and Waspalloy. The bolts made from carbon and alloy steel can be used from -50°C while the upper level depends on the plating temperature limit. Some common examples are listed in the table. In

order to achieve higher operational temperature, nickel or chromium platings can be used as their temperature limit extends up to 590°C for nickel and 420-650°C for chromium. However, both methods are expensive and not widely used for fasteners.

Stainless steel bolts, available in a variety of alloys, normally require no protective coating and have a wider service temperature range than plain carbon or alloy steels. Depending on the alloy type, the temperature limit for stainless steel falls into the -120 to 320°C range. **LK**

Service life of studs and bolts exposed to dynamic loads

Q: How do you extend the life of studs?

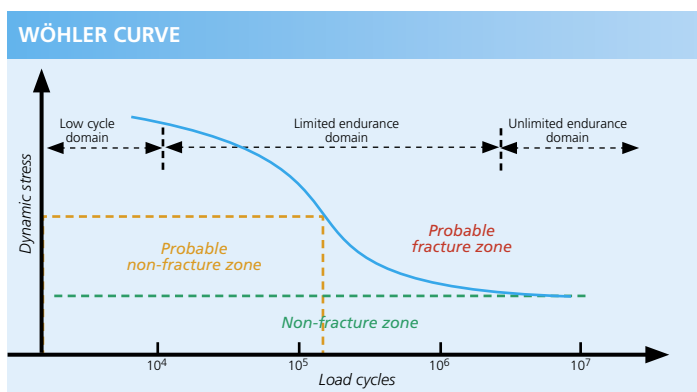
A: One of the most common failure mechanisms for bolted connections is fatigue – a phenomenon that typically occurs in bolts/studs exposed to dynamic loads that are often inferior to the Ultimate tensile strength (RM) or the Yield strength limit (Re). Reasons for fatigue include:

- Applied preload is lower than the dynamic loads the joint is exposed to.
- Loss of preload due to settlements and/or spontaneous bolt loosening.
- Poor elasticity in the joint.

To avoid fatigue failure a preload high enough to cope with the external dynamic loads is recommended.

However, a preload that is too high may also shorten the life of a bolted connection if the yield point or ultimate tensile strength is exceeded. It is therefore of utmost importance to have good control of the tightening process. Increased elasticity will also increase the service life of the stud and it is commonly known that a long and thin bolt is better than a short and thick one.

As a guideline, the free clamp length divided by the thread diameter should be at least 3 but preferably above 5. For small and medium sized bolts Nord-Lock wedge locking washers are a cost-effective solution in order to increase the life and security level of a bolted con-



Applications exposed to a low number of load cycles can stand higher dynamic stress while high load cycle applications need to be in the "Non fracture zone".

nection. As it is possible to lubricate the threads without jeopardising the locking function, you will achieve the desired preload and still be able to maintain it, even when exposed to severe vibration and dynamic loads.

For larger thread sizes, Superbolt multi-jackbolt tensioners (MJTs) are the optimum solution, since they combine high tightening precision with increased elasticity, equal to 2-3 times the thread diameter. **MS**

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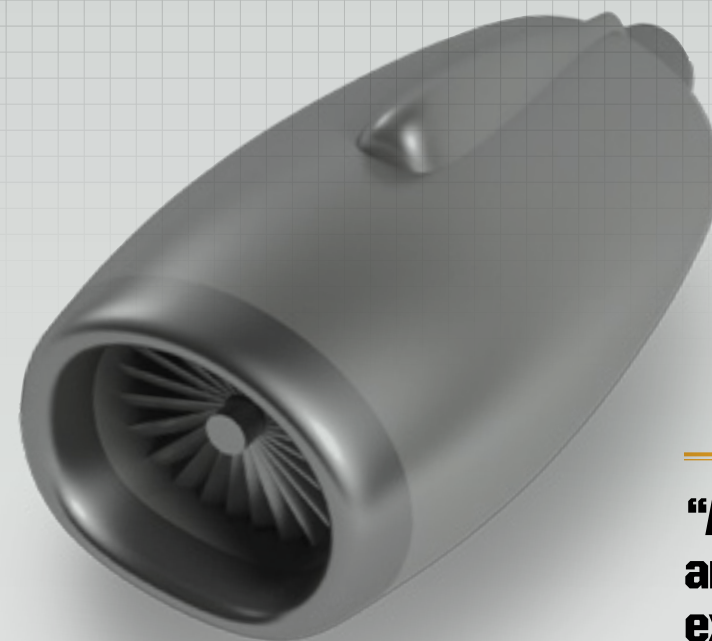
ALUMINIUM

ALUMINIUM: THE ENDLESS BENEFITS

It's lightweight, strong, recyclable, and the most abundant metal in the earth's crust. However, there is much to consider when using aluminium.

WORDS:
DAVID NIKEL

ILLUSTRATIONS:
DAN HAMBE, JUSTUS HULTGREN



DID YOU KNOW?

Two variants of the metal's name exist. Aluminium is the preferred spelling in Europe, Australia and by the International Union of Pure and Applied Chemistry (IUPAC). Aluminum is in common use in the United States and Canada, and considered an acceptable variant by the IUPAC.

“Aluminium is light, strong and easily fabricated into extrusions and other casts.”

DAVID HARRIS, ALUMINIUM FEDERATION (ALFED)

A LUMINIUM HAS DOMINATED the aerospace industry for over half a century. Now other industries are turning to the miracle metal.

Ford recently launched a revamp of its iconic F-150 pickup truck with an all aluminium body. In 2008, Apple launched an anodised aluminium casing for its new MacBook laptops, widely regarded as a design classic, while one year later, in the USA, the packaging industry began using more aluminium than the transport industry.

WHY IS ALUMINIUM the miracle metal?

David Harris from ALFED, the aluminium federation representing the industry in the UK, explains some of the metal's benefits:

“Aluminium is light, strong and easily fabricated into extrusions and other casts. It has good corrosion resistance and can be joined by welding, adhesive bonding and mechanical methods. It can be anodised and painted to give a wide range of attractive finishes that improve appearance and further enhance corrosion resistance. Aluminium is a good conductor of electricity, better than copper by volume and a quarter of the price, and a good conductor of heat. Crucially, at the end of its very long life it is recyclable again and again with no loss of quality.”

Despite that long list of benefits, the money men of the automotive industry favour aluminium for one reason: it is lightweight. Considerable weight savings (Ford claims the new F-150 will be 700 lb, which is about 318 kilos, lighter) lead to improved energy efficiency and a more appealing product.

Pure aluminium is rarely used for industrial purposes. Instead it's mixed with copper, magnesium, manganese, silicon and zinc to create aluminium alloys.

The extrusion process consists of pushing a pre-heated cylindrical aluminium ingot through a steel die, producing complex sections that slide together simply.

“Within the limit of the size of the extrusion press, the restriction in section design for extrusions is limited only by the imagination of the designer”, adds Harris.

AS A BASE METAL, pure aluminium has excellent corrosion resistance but when connected to one of the noble metals, such as gold, silver or copper, aluminium can corrode. Very acidic or very alkaline solutions (outside of the pH range 3.5 - 8.5) should be avoided or corrosion protection measures will be necessary.

“It is hard to give clear advice as it depends on the aluminium used”, suggests Frida Cullin, Project Manager at the Nord-Lock Group, with

a background in material science, when asked what bolt grades are recommended for corrosive environments.

“Both steel bolts and stainless steel bolts can be used together with aluminium but we recommend that you check with your supplier what type of aluminium you are using and seek guidance regarding how to avoid galvanic corrosion,” she adds.

TO JOIN ALUMINIUM PARTS together there are various suitable solutions including welding, soldering, gluing and nailing, along with bolted connections.

During welding, all alloys suffer a loss of strength, particularly around the weld itself. Heat treatment can restore properties but this process risks causing internal element separation, which means the metal corrodes from the inside out. Alloy 5083 is especially suitable for welding since it offers the highest strength after welding of any other standard alloy.

For bolted connections, it is common to use standardised steel fasteners (for example, steel bolts class 8.8) since they have higher strength and are less expensive.

“Using aluminium bolts can be a good choice when the joint is exposed to temperature variations. Using bolts made of the same material as the clamped parts decreases →



“The industry should also explore options to better reuse discarded products, to avoid recycling completely.”

JONATHAN CULLEN, UNIVERSITY OF CAMBRIDGE

→ es the risk of having increased stresses in components and decreases the risk of dropped clamp load due to different thermal expansions”, says Cullen.

As aluminium deforms easily and does not support high pressures, consider reducing the load when clamping aluminium parts together with steel fasteners. Alternatively, placing a washer underneath the bolt head can help distribute the load over a larger area, thereby permitting a higher clamp load. Nord-Lock wedge-locking SP washers, with enlarged outer diameter, provide one possible solution.

“It is recommended to use the SP washers in conjunction with flanged fasteners, which are common in lower property classes”, adds Cullen.

If using a threaded hole in aluminium it is important to remember that the minimal threaded engagement length is longer for aluminium than for steel. A threaded insert might be required to increase the thread strength of the hole, particularly when the joint is re-tightened often. Self-pierce riveting is a method for joining two or more aluminium

sheets together, or joining aluminium with other materials such as plastic, which can’t be done by welding. The potential for automation makes it an attractive option for industrial use. Advanced research into self-piercing rivets began at SIMLab, the Centre for Research-based Innovation at the Norwegian University of Science and Technology, back in 2000.

“We realised early in the study that the process influences the behaviour of the connection. The rivet causes the material to deform, which impacts the mechanical response afterwards”, explains Professor Magnus Langseth, Director of SIMLab.

“WE HAVE ESTABLISHED and validated numerical models for riveting process simulation. Our latest model was implemented in the LS-DYNA simulation software and optimised against the experimental database on aluminium-to-aluminium riveted connections. Furthermore, steel rivets may create a challenge during recycling and a research project at SIM-Lab has been carried out to replace a steel rivet

with an aluminium rivet. The results so far look promising.”

Primary aluminium production across the globe currently stands at around 45 million tonnes per year, more than all the other non-ferrous metals put together. Industry analysts forecast the global automotive aluminium wheels industry to grow at a CAGR of 8.48% over the period 2012–2016, with much of this growth outsourced to China. This growth reflects an interesting global shift in primary production, as David Harris from ALFED explains:

“Primary production in China over the past ten years has expanded at a phenomenal rate and is now about half of the global total. Primary production is scaling down in Europe, driven by the need for affordable long-term energy supplies, the effect of EU legislation on emissions and taxation, and low primary metal prices.”

ALUMINIUM IS KNOWN for being almost infinitely recyclable, but the processes are energy intensive with potential for emissions. So as the

focus on environmental issues grows, is aluminium recycling as good as it could be?

Jonathan Cullen from the University of Cambridge co-authored a study titled “Mapping the Global Flow of Aluminum: From Liquid Aluminum to End-Use Goods”.

He believes there are two major issues:

“First, around half of all liquid aluminum produced each year never reaches a final product”, says Cullen. This is due mainly to dross, aluminium oxide and process scrap.

“Second, aluminum recycling, which avoids the high energy costs and emissions of electrolysis, requires significant “dilution” and “cascade” flows of higher aluminum grades to make up for the shortfall in scrap supply and to obtain the desired alloy mix, increasing the energy required for recycling.”

Cullen believes limiting the number of different alloys in today’s products would aid the future separation and recovery of specific alloys.

“The industry should also explore options to better reuse discarded products, to avoid recycling completely.” ■

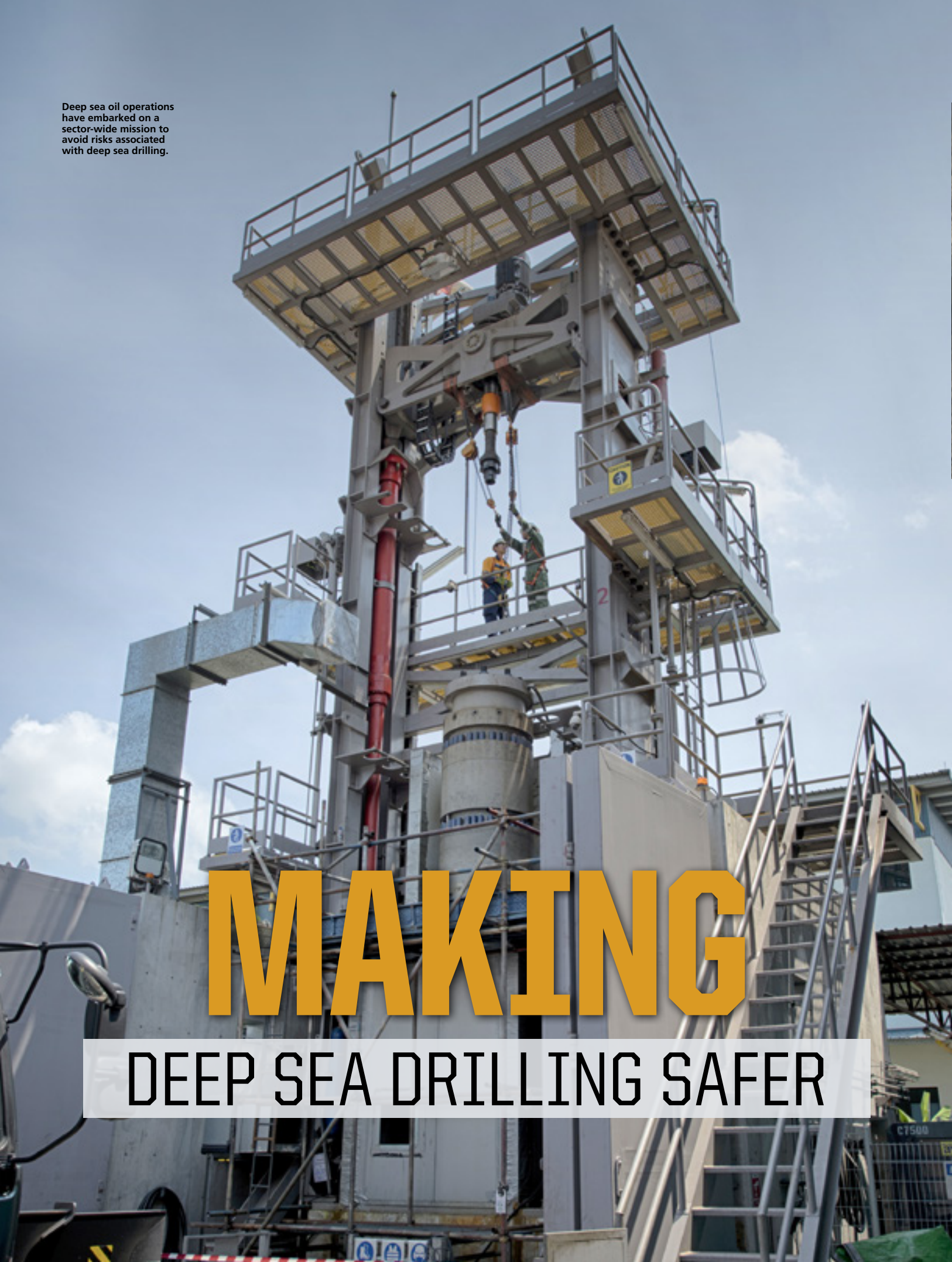
ALUMINIUM USE IN INDUSTRY

- **Transport** – The lightweight nature of aluminium reduces overall weight and therefore the fuel consumption of cars, trucks and trains. Especially important in aerospace.
- **Mechanical** – All sorts of applications due to its strength and ease of machining.
- **Construction** – Widely used for windows, facades and roofs, because its good resistance to corrosion results in low maintenance costs.
- **Electronics** – Similar conductivity to copper but with less weight.
- **Packaging** – Both flexible applications such as menu trays, food containers and plain foil, and rigid applications such as food and drink cans, and aerosol cans.
- **Sports equipment** – Lightweight, easy to shape into different parts.

Common Aluminium Alloys source: ALFED (alfed.org.uk)

Alloy Designation	Characteristics	Typical Applications
6060	Intricate sections Medium strength Good surface finish Good corrosion resistance	Construction Consumer products General engineering
6063	Intricate sections Medium strength Good surface finish Good corrosion resistance	Construction Consumer products General engineering
6082	Medium/high strength Good corrosion resistance	Transport Scaffolding Bridges General engineering
6005	Very good corrosion resistance Good weldability Medium strength Good extrudability	Transport Structural engineering Precision engineering
2618	High strength	Engine components Piston rings Compressor blades
5083	Excellent corrosion resistance Excellent weldability Medium strength	Specialised applications, e.g.: Highly stressed marine structures Pressure vessels Cryogenic applications
7020	High strength Good weldability Elevated temperature forming	Specialised applications, e.g.: High strength welded structures

Deep sea oil operations have embarked on a sector-wide mission to avoid risks associated with deep sea drilling.



MAKING

DEEP SEA DRILLING SAFER



Sayed Idris, Product Assembly Supervisor at MPO, Singapore, works on a gas riser handling system. The system features nuts and bolts in incredibly tight spaces and therefore relies on Superbolt tensioners from the Nord-Lock Group.



As the global industry looks for safer deep sea oil drilling solutions, MPO's gas riser handling systems are in high demand. In just a few years, they've grown from a small office into a global supplier with over 200 employees.

WORDS:
ROB O'BRIEN

PHOTO:
EDWIN KOO

EVER SINCE THE 2010 Deepwater Horizon explosion in the Gulf of Mexico, which killed 11 men and led to the largest oil spill in US history, deep sea oil operations have embarked on a sector-wide mission to stop another incident of that scale from happening again.

The equipment that is optimized for safety, and is geared toward eliminating the huge costs associated with failures, has been at the forefront of that push.

Leading the pack in the post-Deepwater Horizon goal to better deal with riser gas is a company called Managed Pressure Operations (MPO), which began engineering operations in Singapore three years ago with an office comprising just three desks.

Managing risk around riser gas in oil rigs is currently where the leading technological advancements are being made in equipment design. MPO has grown to a workforce of around 200 people and is busy building and shipping its equipment to all corners of the world.

"The technology to stop an event like the Deepwater Horizon incident is available to us today and we're at the forefront of this," says Alex MacGregor, Development Manager at MPO.

AWARDED THE WOELFEL Best Mechanical Engineering Achievement last year by the American Society of Mechanical Engineers (ASME), MPO's gas riser handling system is designed to manage the gas - and therefore associated gas risks - out of the traditional oil drilling process.

"You've got the rig on the surface and the riser going down to the seabed - and that might be anything up to 8 or 9,000-ft below, where you've got the subsea blowout preventer, which is an enormously capable and enormously expensive piece of equipment," MacGregor says.

"But because it is 8-9,000ft below the rig, it is actually very difficult to detect gas which has started to enter your drilling mud before it's already above that subsea blowout preventer. When that happens, the gas, as it rises from the seabed, expands massively and pushes all of the drilling mud ahead of it."

"With compact design you have impossible-to-get-to fasteners, which you couldn't put together without the Superbolt."

ALEX MACGREGOR, DEVELOPMENT MANAGER AT MPO





MPO staff work on the company's gas riser handling systems, which are designed to manage the gas – and therefore associated gas risks – out of the traditional oil drilling process.

→ The way a conventional rig has to deal with this is the diverter is closed and the drilling mud and gas get blasted overboard through huge diversion lines, which costs rigs in lost time.

“That kind of event costs a huge amount in loss of time, as much as \$30m,” says MacGregor. “With our equipment we add another blowout preventer just below the rig. We control pressure build-up, stopping the gas bubbles expanding as they rise, and then process the mud and gas returns in a large mud-gas separating vessel, which we also supply the rig with. We then flare off the gas and return the drilling mud to service.”

The simplest version of the MPO gas riser handling system is 25 tonnes and 50 feet long with the largest version being 70 tonnes and 70 feet long. Its design features nuts and bolts in

incredibly tight spaces, which means the most difficult-to-access parts of the equipment rely on Superbolt tensioners.

“I have dismantled and assembled this piece of equipment about a dozen times,” says Sayed Idris, Product Assembly Supervisor at MPO, Singapore. “Access to a conventional bolt would have been almost impossible, but it is easy with the Superbolts.”

MPO IS WORKING on its fifth gas riser handling system for clients including Transocean, Statoil and Repsol, one system will soon be dispatched to oil fields in Brazil, one to the Gulf of Mexico and one for Papua New Guinea.

“The key factor in building this piece of equipment was to ensure compactness: our number one problem was making this system

as small and compact as possible,” MacGregor says.

“Throughout the design you have these impossible-to-get-to fasteners, which you couldn’t put together without the Superbolt.”

THE ADVANCEMENTS MADE in technology to manage gas riser incidents on oil rigs resulted in huge cost savings for rig operators,” MacGregor adds.

“You’ve gone from what would have been an emergency situation – a reportable incident – to something that is basically routine, which can handle it without ‘down time’ and everyone wins. On the very high day rates at the rig – it may take anything up to a week to stabilise the well again after an incident like this – that’s already \$14 million.” ■

FACTS:

MANAGED PRESSURE OPERATIONS (MPO)

WHO:

MPO is designing, building and transporting gas riser handling systems for clients – such as Transocean, Statoil and Repsol – to Brazil, and the Gulf of Mexico.

GAS RISER HANDLING SYSTEM SIZE:

The largest is 70 tonnes and 70 feet long, the smallest is 25 tonnes and 50 feet long.

TOTAL NUMBER OF EMPLOYEES:

200.



Business argument

This is how MPO benefits from Superbolt tensioners:

- **ALLOWS THEM TO** develop and build a more compact design.
- **ENABLES SECURE** fastening for hidden fasteners.
- **ELIMINATES** the risk of bolt loosening



Robert Jürgens was one of 22 students at the Karlsruhe Institute of Technology who used their engineering expertise to build a footbridge for a Sri Lankan community.

FACTS:

ROBERT JÜRGENS

AGE: 25

BACKGROUND: With his business engineering degree studies at Karlsruhe Institute of Technology, Robert Jürgens was the right person to handle the logistics, fundraising and public relations aspects of the bridge building project in Pitigala.

Building communities through bolts

WORDS:
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PHOTO:
KARSTEN THORMAEHLEN

STUDENTS FROM THE GERMAN city of Karlsruhe founded "Engineers Without Borders – Karlsruhe Institute of Technology e. V." in 2004 to supply first aid to Sri Lanka in the wake of the tsunami. The club, which is not affiliated to the Engineers Without Borders global organisation, has over 100 students divided into independent project groups in seven countries. Robert Jürgens is one of the 22 members of the Sri Lanka project group, which built a suspension footbridge in the second half of 2013 over the Bentara river in the region of Karawwa in the south-western part of the island.

How did you know a footbridge was needed here?

"We'd already undertaken two projects in Sri Lanka so we have contacts in situ who give us leads. We visited the area and realised that the river separates the homes of around 2,000 people from their fields and school. So even if they could wade across when the waters are low it was very dangerous to cross during the monsoon

season. The project was feasible and really helpful so we went ahead."

How did you choose the exact site?

"There were technical reasons linked to the solidity of the river banks and to where the locals wanted the footbridge to be located, even if there was no road at all to reach the site. We had to build a temporary one using palm trees that we cut down so that our manual cement mixers and other equipment could reach the construction site!"

Why a suspension bridge?

"Well, it had to be cheap! We only have a small budget and it is my task to approach companies for supplies or funds. Nord-Lock gave us 1,300 pairs of NL12sp, 400 pairs of NL16sp and 50 pairs of NL20sp to ensure that the hundreds of bolt connections on the bridge remain tight. Due to the tools and manpower available, the bridge had to be easy to assemble. We wanted to avoid welding in these somewhat difficult conditions so bolting was the answer. And to

ensure the bolt didn't come loose it was recommended that we use Nord-Lock washers. We also didn't want the bridge to be an eye-sore in the landscape as it is quite big: a 30 metres span for an overall length of 56 metres and 1.30 metres wide."

How long did it take?

"Actual construction took place from July to October 2013 with a maximum of 22 people working at any one time. We had help from locals and several villagers came every single day. One of them was particularly motivated and reliable so today he is the bridge manager, checking the bolts and the state of the concrete. Overall the project took nearly two years."

Who maintains the bridge today?

"As with all our projects the maintenance is in the hands of the locals and our successors in the student club check up on them from time to time. Earlier this year nine students went to Sri Lanka looking for a new project and they checked over our earlier operations." ■



PUT TO THE SWORD

Leon Paul now uses Nord-Lock washers to secure the blade to the handle.



The blade sticks to the handle

WORDS:
NIC TOWNSEND

PHOTO:
LEON PAUL

THE CHALLENGE Fencing is a demanding sport, not only for the athletes but also on the equipment. In any competition a fencing sword is subjected to lots of movement and pressure, which can gradually loosen the connection between the blade and the handle.

As one of the UK's leading manufacturers of fencing equipment, and the only one run by Olympic fencers, Leon Paul is continuously looking for ways of improving and developing its products.

Currently it supplies equipment to Olympic athletes, Olympic and other international competitions, including the 2012 London Olympic games, and even Hollywood films.

Accordingly its products need to be of the highest quality, and loosening needs to be minimal.

THE SOLUTION After being introduced to Nord-Lock products, Leon Paul decided to trial its washers, which were used to secure the nut connecting the handle to the blade. The new swords were then distributed to members of the Brit-

ish Olympic fencing team to see how they would hold up in competition.

THE RESULT Each of the athletes returned to Leon Paul reporting a significant improvement, and that the blade no longer came loose. In light of such results, Leon Paul has since taken the decision to fit Nord-Lock washers in all its swords. ■

Fastenal staff benefit from Nord-Lock training session

AS PART OF ITS continuous efforts to offer training and support to its partners, the Nord-Lock Group recently provided a special training session for staff at Fastenal Malaysia.

The event, which took place last February at Fastenal's head office in Johor Bahru, Malaysia, included technical presentations and product demonstrations.

"The purpose was to create an awareness of bolted joint problems in different industries, particularly how to identify the root of a problem," says Harlen Seow, Technical Manager, Nord-Lock Group, who organised the training programme.

"In most cases a problem will not disappear by itself. We have

to address it and find the right solution to deal with it. Nord-Lock has different solutions for different bolted joint issues and this kind of training is a great opportunity for us to pass on to the participants the experience we have gained over the years in this business – what product to consider for a particular problem."

Fastenal Malaysia is an authorised distributor of Nord-Lock products and the training programme was designed to give greater insight into Nord-Lock's technical capabilities. This included demonstrations using the Junker machine and Superbolt demo unit.

It is hoped that this knowledge and experience will assist Fastenal employees as they attempt to

meet the needs of their customers.

"The training gave us an insight into how secure and safe Nord-Lock washers can be and provided a platform that we can now propose to heavy industrial applications such as cargo, ship manufacturing, mining, dumper truck and others," says Adrian Lee, one of the attendees from Fastenal.

"The Nord-Lock team even cleared up some myths such as double nut locking and multiple washer method, which are not as efficient as traditionally believed."

In addition, the training programme was also an ideal opportunity for Nord-Lock to network with a valued distributor and increase collaboration. ■



THE MYTH: Titanium is stronger than steel.

THE TRUTH: Named after the epic Titans with incredible strength in Greek mythology, titanium has earned a reputation of being the strongest metal on earth. This claim is further strengthened by titanium's use in military applications, references in Hollywood movies and the recent text from of David Guetta.

In reality steel is stronger than titanium as it has both higher yield strength and Young's modulus than titanium. However, titanium is the strongest metal when comparing strength to weight. Titanium is also extremely resistant to corrosion. ■

Reader survey!

WITH EVERY ISSUE of Bolted magazine, we aim to bring you interesting and relevant stories concerning bolt security. However, as the reader, only you can tell us if we are succeeding, and right now we are running a survey, so it is your chance to be heard!

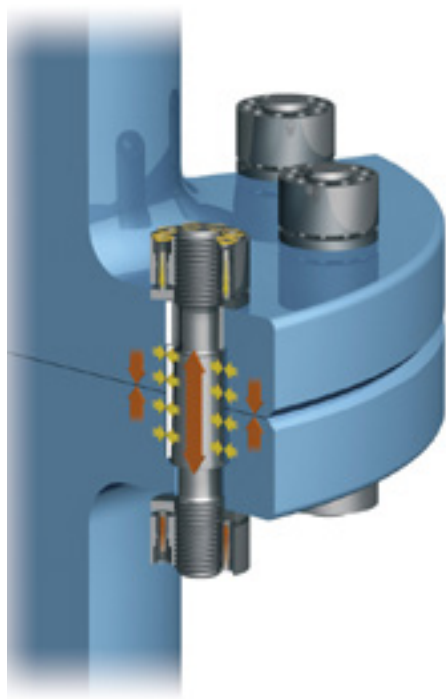
The survey can be done online and will only take a few minutes. It is anonymous and the results will be used to improve Bolted magazine so that we can bring you the stories you want to read.

To take part in the survey, visit www.bolted.com/survey. ■

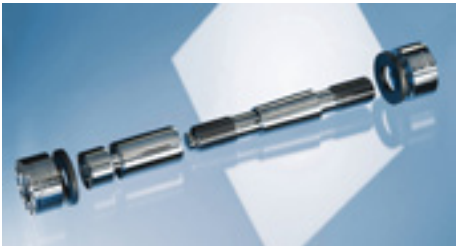


Would you like to read about your company in Bolted?

NORD-LOCK IS ALWAYS on the look out for good stories for its customer magazine, Bolted. If you currently use Nord-Lock products in a unique product or interesting application, we would love to hear from you. Contact us at: info@nord-lock.com. ■



Superbolt Expansion Bolts clamp the joint axially (red arrows) and radially (yellow arrows).



Build-up of Superbolt Expansion Bolts.

Expandable bolts save time and money

Superbolt Expansion Bolts offer a simple and quick bolting solution for large machinery couplings that will save time and costs.

Simply put, Superbolt Expansion Bolts are adjustable fitted bolts with an outer diameter that can be expanded to fit the actual bore size. They can replace fitted bolts where the parts to be connected must be precisely aligned and high shear forces act on the connection. Typical applications include coupling bolts on high power drive shafts, such as ship drives, as well as thermal, hydro and wind turbines.

In the majority of cases, when fitted bolts are used, either the fitted bolts are machined to fit the bores or the bores are reworked to match the fitted bolts. Both methods are costly and time consuming because the dimensions must be measured accurately on site and then adapted. In the meantime, work is at a standstill.

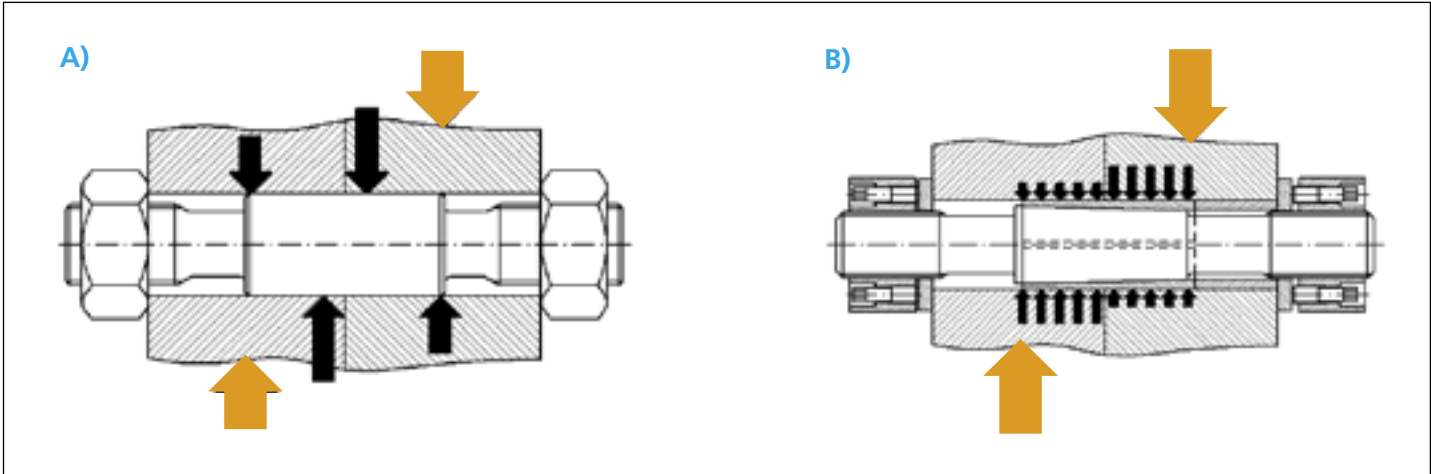
Furthermore fitted bolts never fit perfectly. There is always some minute sliding in the joint, which causes the fitted bolts to tilt inside the bores. Contact between the fitted bolt and the

bore is limited to four points at which the flange is plastically deformed by the extreme contact pressure. These deformations may not only cause the flange to eventually fail, but make removal of the fitted bolts during maintenance impossible.

An Expansion Bolt consists of five parts. The tapered sleeve is placed in the bore and centered by the spacer. The tapered stud is pulled into the sleeve by tightening the Superbolt tensioner on one side. The sleeve is split along the entire length so it can expand radially and adjust to the bore (yellow arrows, to the left), while a second Superbolt tensioner on the other side is then tightened to clamp the joint together axially (red arrows, to the left).




Superbolt Expansion Bolts not only produce an optimal fit despite manufacturing tolerances, they can additionally preload the bore in a radial direction. The radial preload helps maintain the contact with the bore and prevents detrimental tilting. Understandably, expansion bolts can carry much higher loads than fitted bolts.

As a result, Superbolt Expansion Bolts save both time and money. The savings are highest for new designs where the joint can be made smaller while requiring less bores with wider tolerances. Our engineers will gladly support you in optimising the joint. But retrofits also benefit from no on site machining, fast installation and full reusability. For positive connections, Superbolt Expansion Bolts are simply the best choice.



Load distribution in the bore for a fitted bolt (A) and a Superbolt Expansion Bolt (B).

THE COMPARISON

			
COMPARING SUPERBOLT EXPANSION BOLTS WITH OTHER POSITIVE LOCKING BOLTS FOR LARGE SIZES.	SUPERBOLT EXPANSION BOLT (EB)	HYDRAULIC EXPANSION BOLT	FITTED BOLT
BORE TOLERANCES	Wide. Due to the split sleeve, IT 11 (International Tolerances) are sufficient. No reaming on site necessary.	Narrow. Typically, IT 6 (International Tolerances) are required. Bores must be bored or reamed together.	Narrow. IT 6 or tighter (International Tolerances) are required. Frequently, fitted bolts are machined to fit on site.
ULTIMATE SHEAR OFF LOAD	High. A Superbolt EB fills the entire bore.	High. A Hydraulic EB fills the entire bore.	High.
RADIAL PRELOAD	High. The sleeve is split, so a defined radial preload is exerted onto the bore.	Low. The sleeve is not split. The resulting radial preload is approx. 30% lower than with the Superbolt EB.	None. The resulting radial preload is insufficient to carry the shear load.
FATIGUE LIFE OF FLANGE	High. A high radial preload prevents all movement in the joint, so the fatigue life of the flange is maximal.	Medium. Since the radial preload is lower, peak loads may cause movement in the joint and lead to stress concentrations.	Low. Since there is no radial preload, there is frequent movement in the joint, which disrupts the flange.
REWORKING OF THE FLANGE DURING MAINTENANCE	None required. The radial preload is limited to keep the flange in the elastic range.	Seldom. Peak loads may cause deformation of the flange.	Frequent. Typically, the bores must be reworked and a new, oversized fitted bolt installed.
REUSABILITY	Always. No bolt or flange deformations occur.	Mostly. Destructive removal is seldomly necessary.	Seldom. Destructive removal is frequently necessary.
TOOLING	Only handheld torque wrench.	Hydraulic pump and tensioning tool are required.	Must be deep cooled or installed with a hydraulic press.
SAFETY	No safety hazards.	High pressure hydraulics are dangerous. Additionally, spills represent a fire hazard.	Unsafe handling of tooling is hazardous, especially removal with a mallet.

New Nord-Lock office in the United Kingdom

NORD-LOCK GROUP Western Region has now relocated to a new and improved office in the UK, which will be home to Nord-Lock's UK and Benelux offices. The larger facility,

which is located in Andover, will enable the Western Region office to hold seminars, training programmes and global events for its customers and partners.



The background of the top half of the page is a solid blue color with a repeating pattern of white icons representing diverse people. These icons include men and women of various ages, some wearing glasses, hats, or uniforms, and others with different hairstyles or accessories. In the center of this background is a large, white, rounded speech bubble with a subtle drop shadow.

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Bolted readership survey!*

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