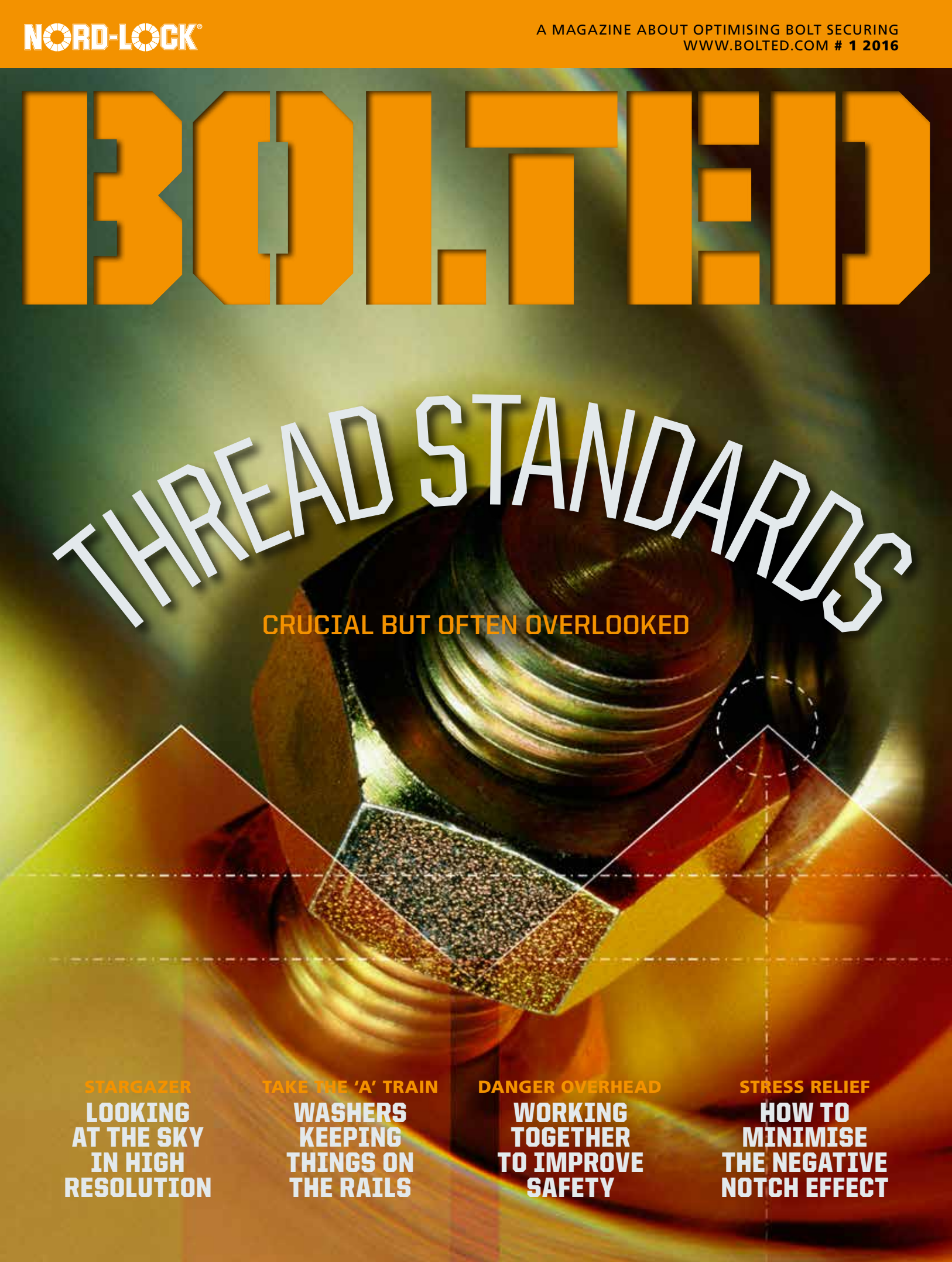
NORD-LOCK®
A MAGAZINE ABOUT OPTIMISING BOLT SECURING
WWW.BOLTED.COM # 1 2016

BOLTED

THREAD STANDARDS

CRUCIAL BUT OFTEN OVERLOOKED



STARGAZER
LOOKING AT THE SKY IN HIGH RESOLUTION

TAKE THE 'A' TRAIN
WASHERS KEEPING THINGS ON THE RAILS

DANGER OVERHEAD
WORKING TOGETHER TO IMPROVE SAFETY

STRESS RELIEF
HOW TO MINIMISE THE NEGATIVE NOTCH EFFECT

No loosening in **steel structures**

HV sets are a type of bolted connection that is frequently used in steel construction applications. The radius under the bolt head is a particular characteristic of these sets. Now you can safely secure such connections with the new **Nord-Lock steel construction washer** specially designed to fit HV bolts and nuts (in accordance with the European standard EN 14399-4 / EN 14399-8).

In order to ensure an optimal contact surface between the bolt and the washer, each SC-washer pair has chamfers on the inner diameter. The proven wedge-locking technology prevents the bolt from rotating loose.

Nord-Lock SC-washers are CE-marked for use with HV bolts. Safe usage with high-strength bolts has been confirmed by the General Building Supervisory Approval No. Z-14.4-629 and by the European Technical Approval 13/0246 issued by DIBT.

Go to **www.nord-lock.com** or contact your local Nord-Lock office.

CE

NORD-LOCK®
Bolt securing systems

BOLTED #1 2016

About optimising bolt securing – a customer magazine from Nord-Lock

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, Superbolt tensioners and Boltight hydraulic tensioning. These unique solutions withstand vibration and dynamic loads. For further information visit **www.nord-lock.com**

Bolted is published twice a year in English, German, Japanese, French, Chinese, Swedish and Finnish. It is free to customers of the Nord-Lock Group worldwide.

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NORD-LOCK®

Strengthening our tensioning offer

In this issue of *Bolted* we are really proud to present the newest Nord-Lock Division, Boltight. With the acquisition of Boltight we are now able to offer industry renowned knowledge and unsurpassed experience and a strong product range within hydraulic bolt tensioning.

With its expertise, engineering capabilities and international set-up, Boltight matches the Nord-Lock Group's existing portfolio very well. The combination of Boltight's hydraulic bolt tensioning and Superbolt multi-jackbolt tensioning creates a very strong foundation for the Group to build on. This tensioning knowledge and offer is unique in the business and we look forward to explaining and covering the topic further here in *Bolted*.

In this issue you get two chances to get acquainted with Boltight. We talk to founder Fred Heaton on page 7. There is a Boltight customer case in the 'Secured by' section on page 6 that will give you an insight into the company's abilities.

The theme article in this issue (page 8) focuses on thread standards within mechanical engineering. Standardization is always contentious within any field and with the long history of threaded fasteners, various thread standards co-exist in the industry today. The article walks you through this sometimes bewildering area, and you will learn more about what you should think about when you choose your standard.

We visit the world's largest binocular telescope (page 13), go railway riding in Indonesia and South Africa (pages 4 and 17 respectively) and learn more about how the negative effect of notches can be minimized (page 12).

And if you like reading *Bolted* magazine, don't forget to follow our blog, www.bolted.com and our YouTube channel. We would also really like to interact with you on our social media channels – search for 'Nord-Lock' on Facebook, LinkedIn, twitter, Instagram, Google+ and YouTube, and connect with us!

Thank you for reading!

CARIN LAGERSTEDT
MARKETING
MANAGER

CONTENTS

SECURED BY THE NORD-LOCK GROUP

WORDS: NIC TOWNSEND **PHOTO:** RENDRA SWARIYAN HABIB

MOVING SAFELY

With Nord-Lock washers there will be no loss of preload during operation, and the connections between the bogies and under frame only need to be checked during scheduled maintenance.

STAYING ON TRACK

CUSTOMER:	PRODUCT:	END USER:
PT. INKA	CONTAINER FLAT WAGON	PT. INDUSTRI KERETA API (PERSERO)

TARE WEIGHT:	CAPACITY:	AXLE LOAD:	TRACK GAUGE:
15,000 KG	57,000 KG	16,000 KG	1,067 MM

LENGTH:	WIDTH:
12.5 METRES	2.4 METRES

FOUNDED IN INDONESIA IN 1981, PT. INKA were the first fully integrated rolling stock and automotive manufacturer in Southeast Asia. Over the years, the company has rapidly grown and developed to become a world-class supplier of rail and urban transport solutions. Today, PT. INKA's product range includes freight wagons, passenger coaches and electric railcars. As well as being a leading company in Indonesia, PT. INKA also export to Bangladesh, the Philippines, Malaysia, Thailand, Singapore and Australia.

Due to the nature of the rail industry, PT. INKA's products are subjected to heavy vibration. It's absolutely vital that all fasteners remain secure. One of the most critical joints is between the bogie and the under frame, which is subjected to the full traction and breaking force when the train accelerates or brakes. It is crucial that this connection is tightened to the correct clamp load at all times. Any loosening will result in damaged bolts, and in the worst case scenario, even derailment.

Using Nord-Lock washers, PT. INKA can now be sure of no loss of preload during operation, and the connections between the bogies and under frame only need to be checked during scheduled maintenance. ■

TOOLS THAT DELIVER
HSOS has good experience with using Boltight bolt tensioners for oil platform applications, complying with the high safety standards.

ON SITE, OFFSHORE, UNDER PRESSURE

CUSTOMER:	END CUSTOMER:
HEAT SOLUTIONS ON SITE BV (HSOS)	OFFSHORE OIL PLATFORM
LOCATION:	**PRODUCT USED:**
207 KM EAST OF ABERDEEN	BOLTIGHT BOLT TENSIONER
ASSIGNMENT:	
BOLT TENSIONING/PIPING PRESSURE TESTING	

DUTCH COMPANY Heat Solutions on Site BV (HSOS) is a leading service provider in the metal sector. Their services include heat treatment, machining on site, flange management and leak sealing.

Among its many assignments, HSOS is often brought in to undertake bolt tensioning and pressure testing of piping on offshore platforms, where leaks could potentially lead to disasters.

Customers have been very satisfied with the results, with no leaks being recorded. One example is Talisman Energy UK, which subcontracted HSOS when constructing a new 9,500-tonne oil platform off Aberdeen, Scotland. While not performing the pressure testing itself this time, HSOS provided all calculations and Boltight 1,500-bar series bolt tensioners for the project.

"The Boltight equipment is high-quality and easy to use with easy retraction," says Marcus Sutton, Flange Management, HSOS. "The Boltight staff are fast and efficient, and they offer lots of engineering support. They don't just sell you a product; they sell you a solution. And if they haven't got it, they will engineer it for you." ■

PHOTO: EPFL/ALAIN HERZOG

FUSION POWER

CUSTOMER:	PRODUCTION:
EPFL (ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE)	SWISS PLASMA CENTER
ITEM:	**CAPACITY:**
FLYWHEEL PULSE SYNCHRONOUS GENERATOR	254.40 MW

FUSION SAFETY
12 Superbolt Expansion bolts (EBB ø65x150) are used to connect the tokamak fusing reactor with the generator.

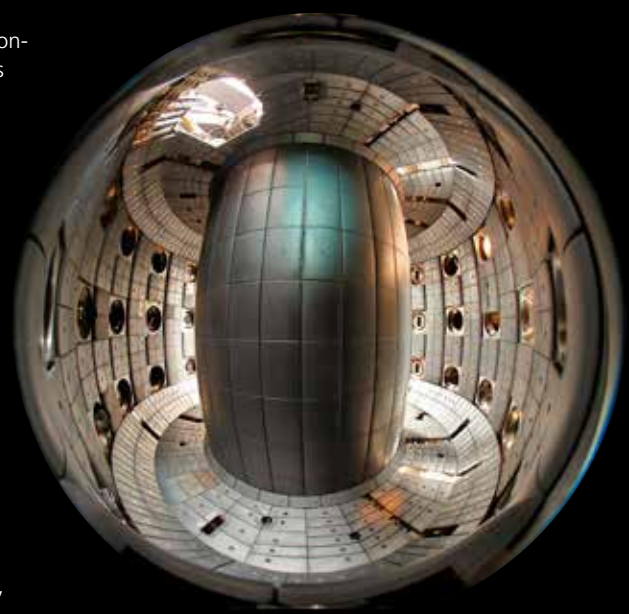
WITH FOSSIL FUELS RUNNING OUT and the need to reduce greenhouse gases continuously growing, fusion power could potentially be the answer to the world's long-term energy concerns. The Swiss Plasma Center – part of the world renowned university École Polytechnique Fédérale de Lausanne (EPFL) – is one of the institutions at the forefront of the worldwide development of this new energy source.

One of the key components of its research is the TCV tokamak, an experimental magnetic-confinement fusion reactor. To deliver the requested energy, a synchronous generator and its flywheel are accelerated up to 3,600 RPM. During the experiment the energy is extracted leading to a fast deceleration of the rotating group. This process, which is undertaken around 3,000 times a year, puts tremendous pressure on the generator's coupling and bolts.

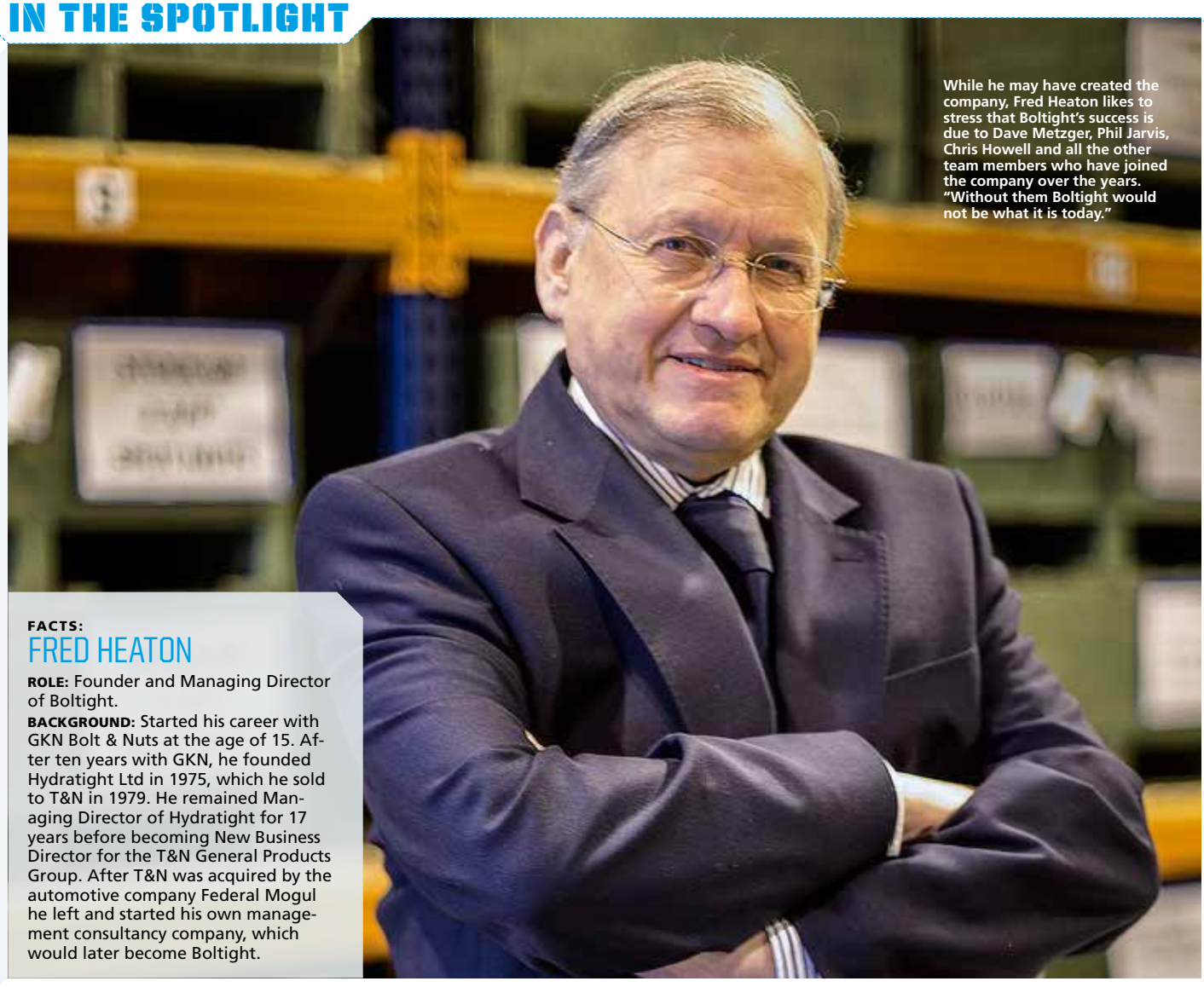
In the past, the Swiss Plasma Center had experienced problems with vertical, horizontal and axial vibrations. With RPM as high as 3,600, the vibrations can be very dangerous to the coupling and the whole generator.

However after consulting Nord-Lock engineers, who assisted with calculations and designs, Superbolt Expansion bolts have since been installed.

The main advantage of the Expansion bolts is that they allow for precise and reproducible alignment of the coupling flanges during assembly, and as a result, reduce the need for demanding balancing of the shaft line. ■



The heart of a tokamak is its doughnut-shaped vacuum chamber. The energy produced through the fusion of atoms is absorbed as heat in the walls of the vessel.



While he may have created the company, Fred Heaton likes to stress that Boltight's success is due to Dave Metzger, Phil Jarvis, Chris Howell and all the other team members who have joined the company over the years. "Without them Boltight would not be what it is today."

FACTS:
FRED HEATON

ROLE: Founder and Managing Director of Boltight.

BACKGROUND: Started his career with GKN Bolt & Nuts at the age of 15. After ten years with GKN, he founded Hydratight Ltd in 1975, which he sold to T&N in 1979. He remained Managing Director of Hydratight for 17 years before becoming New Business Director for the T&N General Products Group. After T&N was acquired by the automotive company Federal Mogul he left and started his own management consultancy company, which would later become Boltight.

"Offering a greater field of solutions"

WORDS: NIC TOWNSEND | **PHOTO:** SAM LEE

FOR FRED HEATON, what started out as a hobby in 1999 quickly grew into a thriving business specialising in hydraulic bolt tensioners. Now Boltight has been acquired by the Nord-Lock Group, in a move that is set to strengthen both companies.

What does Boltight do?

"As the name suggests, we provide tools for tightening bolts. Bolted joints do not always receive sufficient attention at the design phase, which can lead to tightening problems later, and we are here to provide a solution.

"Most of our customers are in the oil and gas, offshore, power generation and heavy engineering industries. Around 50 per cent of the time, we can provide a solution using standard tools, while the other 50 per cent will require tools designed and manufactured by us to meet the customer's needs. We use a 3D CAD system to model the customer's problem and our solution."

What are Boltight's strengths?

"We are fast to respond, quick to deliver and have many years of experience solving customers' bolting problems. We keep every tool we've ever designed stored in our 3D modelling system, which we can use as references whenever we're faced with a new problem."

What will Boltight bring to the Nord-Lock Group?

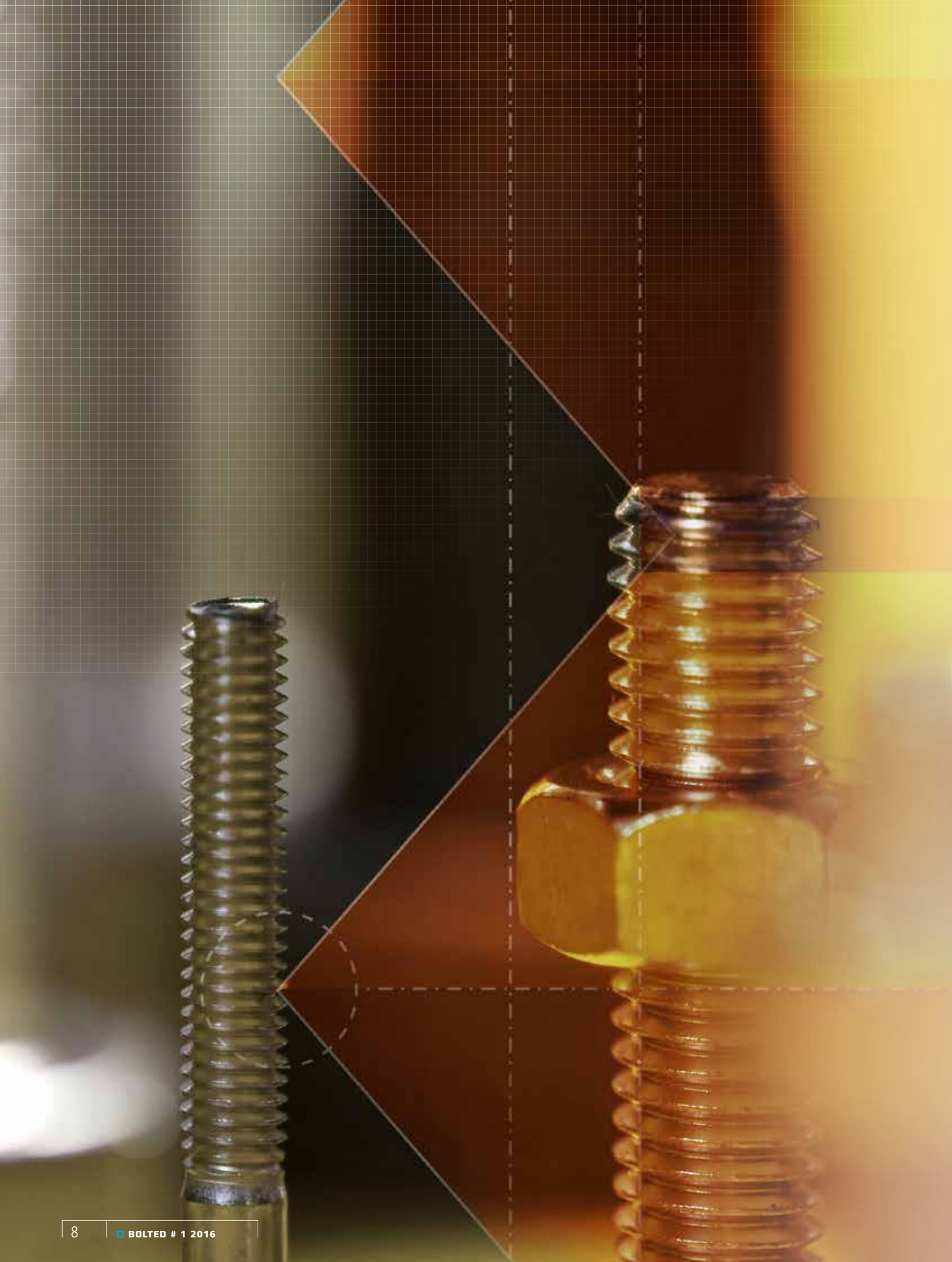
"Being able to draw on our product range will mean the Nord-Lock Group can offer a greater field of solutions. No one tightening solution fits all applications, so it's important to have a number of different products, other than just mechanical. Some customers will want a hydraulic solution, and Boltight has a whole range."

What will the Nord-Lock Group bring to Boltight?

"We have good products and good engineers, but we are a small company and not particularly strong when it comes to sales and marketing. We have built up a distribution network and 95 per cent of our products are exported from the UK but we've only really scratched the surface of the available market. With Nord-Lock sales & marketing resources, we can reach out to new markets and applications, and we expect to see good growth. For example, we tend to sell to large one-off projects, but with the Nord-Lock network, we can now start to supply to original equipment manufacturers as well."

Is the Nord-Lock Group a good fit for Boltight?

"Yes, Nord-Lock has a clear strategy and sees this as a long term investment. They are not just buying and selling companies – they expect long-term value and want to see Boltight grow." ■



STANDARDS: THE SEARCH FOR A RED THREAD

Thread standards are among the oldest standards in the world – all categories included. Today DIN, ISO and UTS have emerged as the dominant standards among countless others – creating a potential minefield where a wrong choice can lead to expensive joint failures. *Bolted* explores the history, the evolution and the future of these crucial but often overlooked standards.

WORDS: MARTIN NEANDER
PHOTO: ANDERS HÄRNQVIST, GETTY
ILLUSTRATIONS: JUSTUS HULTGREN

It may seem counter-intuitive that something with basically just a few functions has generated so many standards. In general, a screw thread has two main functions: to convert rotary motion into linear motion as in the case of power threads, and to hold parts together preventing opening or sliding of the clamped parts as in the case of threaded fasteners.

Standardization of screw threads has evolved since the early 19th century to facilitate compatibility between different manufacturers and users. During the late 19th and early 20th centuries, engineers found that ensuring the reliable interchangeability of screw threads was a multi-faceted and challenging task requiring more than standardization of the major diameter and pitch for a certain thread. It was during this era that more complicated analyses made clear just how important variables such as pitch diameter and surface finish are.

Metric threads were mostly unified in 1898 by the International Congress for the Standardization of Screw Threads, but separate metric thread standards were used in France, Germany and Japan, and the Swiss had a set of threads for watches.

THE STANDARDIZATION PROCESS is still going on, and competing metric and imperial thread standards are still widely used. Standard threads are commonly identified by short letter codes, which also include the prefix of the standardized designations of individual threads.

Additional product standards identify preferred geometries for screws and nuts, based on the thread standards, to meet

"Choosing the wrong standard can lead to manufacturing problems with increasing production costs due to standstills."

HENDRIK HUBBERTZ, AFS

special requirements of applications in particular, and to facilitate compatibility with tightening tools and wrenches.

According to Hendrik Hubbertz, of AFS (Advanced Fastening Solutions GmbH), a spin-off company from the University of Siegen, Germany, different standards have evolved over time. This is due to the need to meet requirements such as easy handling, loading capacity, and the tightening speed or time for tightening, which is more rapid for a higher pitch.

"There is an extremely large variety of thread standards when it comes to power threads and threaded fastening, although only a limited number of standards are typically used for threaded fastening," he says.

The most important are ISO and UTS standard threads, which are mainly used in mechanical engineering.

"There are also standards for self-tapping and thread-forming screw threads, which are increasingly used in mechanical engineering with metals and plastics," Hubbertz says.

There are also standards for threads in piping and special profiles. For power threads, there are standards such as ball screw (rolling spindles), and trapezoid thread.

"The bad thing about the many standards is that they cause great complexity," says Hubbertz. "But the upside is that standards facilitate easy replacement, and low costs for large series production, which is really the origin of standardization."

MOST TRIANGULAR THREAD FORMS are based on a flank triangle, and are called V-threads because of the shape of the letter V. For 60-degree V-threads, the isosceles triangle is, more specifically, equilateral. For buttress threads, the triangle is scalene.

The most frequently used thread form for fastening is the 60-degree thread form found in the metric ISO thread and in the UN series. Other thread standards are sometimes used for special applications, such as in medical technology, in aeronautical engineering or astronautics.

Screw threads are not made perfectly sharp due to cost reasons in large series production. Besides a sufficiently large root diameter, they have to use a well-defined thread-root radius for high loading capacity regarding vibrational loads to avoid fatigue failures. Threads always need a tight diameter tolerance, if not interference with the mating thread may occur. The thread diameter tolerance is also important to prevent thread stripping in applications.

The two most important things to consider when choosing threads for an application, Hubbertz says, are function – loading capacity over lifetime – and handling – logistics, assembly, and user knowledge.

"Choosing the wrong standard can lead to manufacturing problems with increasing production costs due to standstills," he says. "The wrong standard can also lead to loss of function resulting in a defective product, which is expensive to recall."

THREAD PROFILES other than the ISO metric screw threads remain commonly used in specific applications and in certain regions. Mostly this is for backwards compatibility reasons. Even today, over a half-century since the UTS superseded now defunct series, companies still sell hardware with the old designations such as "SAE" and "USS" to convey imperial sizes as opposed to UTS. Most of this hardware is in fact made to UTS standards, but the labelling and cataloguing terminology is not always precise, which adds to the confusion around thread standards.

"In the future, issues such as optimizing functions in terms of more loading capacity and better assembly behaviour will influence the development of standards," Hubbertz says. "There will probably be a conversion from work standards to general standards. The unification of standards worldwide will also take place."

3RD CENTURY BC

1800

1841

1864

1898

1947

1949

PITCHING FOR A COMMON STANDARD

AN INCOMPLETE HISTORY OF THREAD STANDARDS

Archimedes, living in 3rd century BC Greece, is sometimes credited as the inventor of the screw. But no one knows for sure.

Henry Maudslay develops the first industrially practical screw-cutting lathe, setting the stage for standardisation of screw thread sizes.

Joseph Whitworth devises the British Standard Whitworth system, the first nationally standardised system.

William Sellers presents the inch-based United States Standard thread (USS thread), one of his 90-plus patents, which simplifies thread cutting.

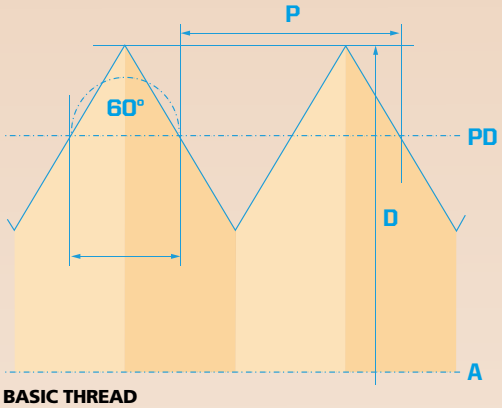
The International Congress for the standardization of screw threads at Zurich takes a bold step in unifying the disarray of metric thread standards.

The International System of Units (ISO) is founded, opening for the metric system's expansion.

The United Thread System (UTS) is adopted aiming to unify the inch-based thread standards.

Source: Wikipedia

Thread standard facts



BASIC THREAD

P = Pitch, D = Major (nominal) diameter, 60° = Thread angle, PD = Pitch diameter, A = Axis of screw thread

THE MOST COMMON THREADS in use today are the ISO metric screw threads (M) for most purposes and BSP threads (R, G) for pipes. These were among the first international standards agreed upon when the International Organization for Standardization was set up in 1947.

The design principles of ISO general-purpose metric screw threads ("M" series threads) are defined in international standard ISO 68-1. Each thread is characterized by its major diameter D and its pitch P.

The ISO Metric Coarse Thread DIN 13-1 is a globally standardized thread profile. The label consists of the letter M followed by a number indicating the nominal diameter. The flank angle is 60 degrees. For each coarse thread size with the nominal diameter, the pitch value is also defined.

ISO Metric Fine Thread DIN 13-2 to 13-11: Compared to standard threads, a fine thread has a smaller pitch, which allows higher preloads and provides a lower risk of self-loosening at load peaks. For example it is also used for adjusting screws in measuring instruments as it allows for finer settings. The term consists of the letter M, the nominal diameter and the pitch (e.g. M12 x 1,5); the flank angle is again 60 degrees.

THE UNIFIED THREAD STANDARD (UTS) defines a standard thread form and series – along with allowances, tolerances, and designations – for screw threads still often used in the United States and Canada. It is the main standard for bolts, nuts, and a wide variety of other threaded fasteners used in these countries.

UTS has the same 60-degree profile as the ISO metric screw thread, but the characteristic dimensions of each UTS thread (outer diameter and pitch) were chosen as an inch fraction rather than a millimetre value. The definition of allowed tolerances is covered with tolerance groups, which is different compared to ISO metric thread. The UTS is currently controlled by ASME/ANSI in the United States.

The standard designation for an UTS thread is a number indicating the nominal (major) diameter of the thread, followed by the number of threads per inch (e.g. 3/8 - 12). For diameters smaller than 1/4 inch the diameter is indicated by an integer number defined in the standard; for all other diameters, the inch figure is given.

UNC Thread ANSI B1.1: UNC – Unified Coarse Thread. NC and UNC threads are interchangeable, in an analogous manner like the metric and the ISO metric thread. The flank angle is 60 degrees. ■

THE EXPERTS

JOCHEN SÜSSENBACH
GLOBAL INDUSTRY MANAGER RAILWAY

MAX BASTIAANSEN
SALES ENGINEER

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

ASK THE EXPERTS

Do you have a question related to bolted joints? Put the Nord-Lock experts to the test.

The notch effect

Q: What is the notch effect and how does it affect bolts?
A: A notch is basically each change of the cross-section of a component. It may come from drill holes, grooves or cross-sectional variations. Notches result in uneven stress distribution, leading to stress peaks – known as the notch effect. The notch effect reduces the loading capacity, which makes it a crucial parameter when calculating the mechanical strength of components or constructions. It especially appears when the component is under tensile, compressive, bending, shearing or torsional stress. The notch effect – or the stress peaks – can lead to early failure, so it is normally considered a negative impact. A solution is to design the component sufficiently large.

But notches are not all bad. They can be designed to strengthen a component, for example strain hardening at the bottom of a thread, or to create a predetermined breaking point.

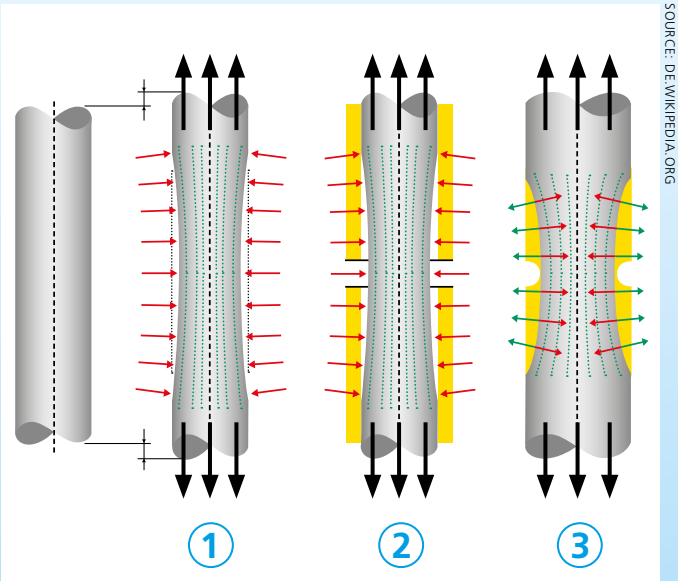
Bolts under tensile stress have local stress peaks due to their notch effects. The tensile breaking stress, especially of ductile material, can be up to 20 percent higher than that of un-notched round bars, due to the prevention of lateral contraction.

The notch effect in the free loaded thread of a bolt is not as big as in the thread run-out, or in the first loaded thread, due to the relieving notch effect of strung-together threads. Under tensile stress, a bolt will break in the free loaded thread, fulfilling the design principle that a bolt is supposed to break there. There is normally a ductile deforming of the threads quite early, so you can recognize the failure in time.

Besides tensile stress, bolts are normally also under repeated loads, which is important for their loading capacity. The notches generate high notch stress, which are again the reason why bolts can't transfer vibrational loading. It could even lead to fatigue fracture of the bolt.

JS

Illustration of the notch effect when having a static tensile load

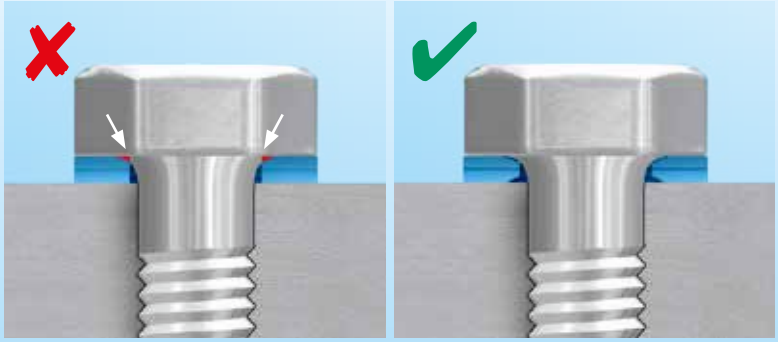


SOURCE: DE.WIKIPEDIA.ORG

1 A tensile force acts in longitudinal direction on a round bar. As soon as a certain force is reached, the round bar narrows (red arrows) and lengthens.

2 Welding two sleeves to the round bar, there would be no change in the mechanism as shown. It is different when the two sleeves and the round bar are firmly bonded. Then they form a notched round bar.

3 With a notched bar, there is additional stress in the bar. The core of the bar transfers the tensile force and narrows. The tensile force can't lengthen the yellow area, so this area doesn't narrow as the core. The area generates a force, which is directed outwards and prevents the lateral contraction.



Left: HV bolt with a Nord-Lock original washer. The inner diameter of a Nord-Lock original washer interferes with the larger radius of the HV bolt (marked red). Right: A chamfered Nord-Lock SC-washer is the optimal solution.

The benefit of SC-washers

Q: What is a SC-washer and when should I use it?
A: Nord-Lock has developed a range of washers specially designed for use in steel construction applications and to fit HV sets (bolts and nuts in accordance to the European standard EN 14399-4 / EN 14399-8), as the standard washers can't be used (see picture). These washers are named "SC" (Steel Construction washers). Their purpose is to replace plain chamfered washers according to EN 14399-6 in order to add safety to high-strength structural preloaded assemblies encountered in steel construction, when exposed to dynamic loads or vibration.

MB

LOOKING DEEP INTO THE STARS

The LINC-NIRVANA instrument has a function that fully lives up to its name. Once attached to the Large Binocular Telescope (LBT), the instrument will enable astronomers to look deep into the hearts of galaxies and see them with a unprecedented clarity. →

WORDS: CHAD HENDERSON

PHOTO: WIKIMEDIA COMMONS/NASA/LINC-NIRVANA

The Large Binocular Telescope (LBT) on Mount Graham in Arizona, USA, is already one of the world's most advanced optical telescopes. It consists of two 8.4-meter primary mirrors on a common mount structure. The LINC-NIRVANA near-infrared imaging instrument will combine the light from the two mirrors and provide a resolution comparable to a telescope that has a diameter of 23 meters.

Put another way, the LINC-NIRVANA instrument is like a camera app on your smartphone that would allow you to take pictures of the centre of a galaxy 53.5 million light-years away. But also an app that weighs 9.5 tons, has 139 motors, and took a team of international engineers ten years to build.

INVOLVED IN THE COMPLEX LINC-NIRVANA project since the start, Ralf-Rainer Rohloff is an engineer and the head of the Mechanical Design Office of the Max Planck Institute for Astronomy in Heidelberg, Germany. He says that there are currently about 40 engineers from many different fields working on the project, as well as several astronomers.

Ralf-Rainer Rohloff, engineer, Max Planck Institute

"When planning the instrument, the astronomers attended meetings between the scientists and engineers where we discussed what is possible," Rohloff says. "These astronomers needed to have a bit of a technical background, so they understood what we said, and on our side we needed a little bit of an astronomical background to understand what they wanted."

THE INSTRUMENT will serve a number of functions, including imaging planets outside our solar system and studying the most distant galaxies in the universe. Given the size and cost of the LINC-NIRVANA project, several institutes from around the world have been involved in its development. Rohloff's institute is →

LINC-NIRVANA

The LINC-NIRVANA near-infrared imaging instrument will use the full binocular capability of the LBT. The instrument allows the coherent superposition of light from the twin 8.4-metres LBT single-eye telescopes on a single science detector, providing a resolution comparable to a telescope that has a 23-metre diameter.

Measuring approximately 5 x 4 x 4.5 metres, the LINC-NIRVANA weighs 9.5 tonnes and has 139 motors. Given the extraordinary requirements of such as system, it is absolutely crucial that the instrument and its optical bench maintain their 3-dimensional spatial position, leaving no margin for error regarding the components used.

FACTS:

IN A GALAXY FAR, FAR AWAY

The new astronomical instrument for the Large Binocular Telescope (LBT) will enable astronomers to see planets and galaxies extremely far away. One galaxy that astronomers may study is the giant elliptical galaxy Messier 87 (M87), also known as Virgo A or NGC 4486. It was discovered by the French astronomer Charles Messier in 1781 and has been popular with astronomers ever since.

M87 is part of the Virgo Cluster, located 53.5 million light-years away from Earth. The galaxy contains an exceptionally large population of so-called globular clusters, approximately 12,000 compared to 150 to 200 in the Milky Way.

In particular, the LBT telescope would investigate the nucleus of this galaxy, which has shooting out of it a jet of high-energetic plasma, which travels at relativistic speed, and is close to 5,000 light-years long. The plasma is being ejected from a supermassive black hole at the centre of the galaxy.

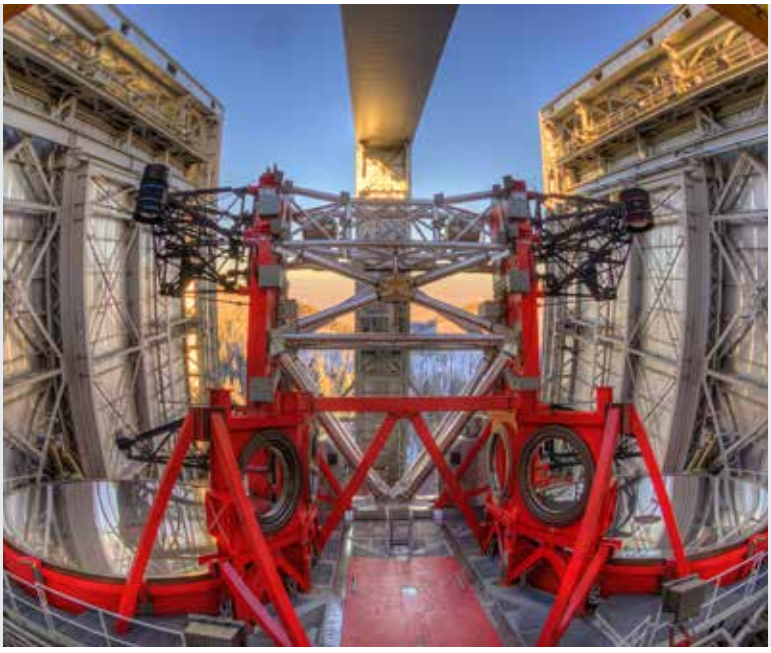
In the image above, cold matter from the Virgo Cluster falls towards the core of M87. Met by the relativistic jet it produces shock waves in the galaxy's interstellar medium.

Source: Wikipedia

FACTS:

THE PERFECT SPOT

To reach optimum results modern telescopes need a special environment. The requirements for ground-based observatories include many clear nights per year as well as minimal light pollution from urban areas and low water vapour content in the atmosphere. That is why these telescopes are located in dry regions at high altitudes, such as USA's southwest. LBT is located at an altitude of 3.221 metres on Mount Graham, Arizona.



The LINC-NIRVANA astronomical instrument was built and tested at the Max Planck institute of Astronomy in Heidelberg, Germany. The right picture shows the instrument mounted on the telescope platform at LBT in Arizona with white electronic cabinets and black carbon fibre structure.

→ responsible for coordinating the work of the German institutes working on the instrument, in cooperation with institutes in Italy and in the USA.

The instrument was completed in June 2015, then carefully packed during the summer and shipped from Germany to Arizona in September. Rohloff and the team visited Arizona in November to conduct a number of tests on the instrument on site.

"IT WAS VERY EXCITING because we had no real problems and everything fit," Rohloff says. "With such a long design and development process, we were all happy that it went very smoothly. The final installation will take place in 2016."

When mounting an instrument that weighs 9.5 tons to an extremely sensitive telescope, precision and stability are essential. Nord-Lock Superbolt tensioners and wedge-locking washers were selected to mount the frame of the instrument to the frame of the telescope and play a key role.

"We chose Nord-Lock Superbolts and wedge-locking washers because they are the most secure," Rohloff says. "When we were looking for washers, we learned that 70 percent of them are not really safe. In our case, the instrument must be completely secure – even slippage of a few hundred microns would be unacceptable."

Nord-Lock products were also chosen because of the very precise clamp load needs to be achieved in the bolts in a very limited space.

"There is no room around the instrument for large wrenches," he says. "With the Nord-Lock Superbolt solution, we can apply the exact torque needed using a small torque wrench, which is a big advantage."

NOW THAT this decade-long project is almost complete, Rohloff says he has plenty of other projects to keep him busy. His work often takes him to the remote, arid locations that make the best sites for telescopes, from the deserts of Spain to the mountaintops of Chile. He says that he has had a lifelong passion for astronomy.

"In my childhood I was already very interested in astronomy," he says. "I even built my own small telescope then. It's amazing to me now that I am helping build one of the largest telescopes in the world." ■

FACTS:

THE NORD-LOCK SOLUTION

CUSTOMER:
Max Planck Institute for Astronomy in Heidelberg, Germany.

END-CUSTOMER:
Large Binocular Telescope (LBT).

LOCATION:
Mount Graham, Arizona, USA.

APPLICATON:
Mounting an astronomical instrument to the telescope frame.

NORD-LOCK SOLUTION:
30 Superbolt CY-M20 tensioners and wedge-locking washers.

PRODUCT BENEFITS:
Absolute stability with zero slippage. Able to apply the exact torque needed in a small space.

Putting the X-series to the test

WORDS: ANDREAS KARLSSON
PHOTO: GETTY IMAGES, WAM METALS

THE CHALLENGE Wam Metals is a manufacturer and supplier of a wide range of specialized non-ferrous and ferrous components, servicing both the local South African and the international markets. The company has a long-standing and close relationship with logistics company Transnet's Freight Rail Division, which specializes in the transportation of freight, mainly through its electrified rail network.

The contact splice conductors in the installations Wam Metals did for Transnet used to be designed to use locking plates to lock the bolts after being tightened. However numerous incidents occurred because of bad maintenance. The procedure stated that splices had to be tightened and later re-tightened, and only then could the locking plate be bent to lock the bolts.

The incidents revealed that the plates were usually intact and therefore, because of vibration in the overhead line, the bolts loosened and the contact wire pulled out of the splice.

The use of Nord-Lock washers on the contact splices means there is no need to re-tighten at a later stage. The same goes for signal, rail and mast bonds, which translates into reduced maintenance costs and fewer hook-up incidents.

THE SOLUTION Wam Metals requested approval from Transnet's Engineering Department in April 2014 to change its specifications and to start using stainless steel Nord-Lock washers instead of the locking plates.

Thorough tests were carried out. The washers from Nord-Lock performed as they should, with no slip occurring, so Transnet approved the use of the new product instead of locking plates.

THE RESULT To date, no incidents regarding hook-ups caused by contact splices – fitted with Nord-Lock washers – have been reported. Wam Metals currently uses NLX10 for the signal bonds, NL10ss for 107mm² contact splices and NL12ss for 161mm² contact splices and the rail and mast bonds.

For Wam Metals, the use of Nord-Lock washers on the contact splices means there is no need to re-tighten at a later stage. The same goes for signal, rail and mast bonds, which translates into reduced maintenance costs and fewer hook-up incidents.

For Nord-Lock, the experience from Wam Metals is highly interesting. It is really putting the company's X-series to the test, in a new field where the company has not previously been widely involved. ■

Health & Safety

Shared expertise increases safety

PHOTO: TERRY VINE/GETTY IMAGES

Nord-Lock is an active member of DROPS, which aims to counteract damage from objects dropped from height.

EACH YEAR OBJECTS DROPPED from height damage equipment, disrupt operations and cause a number of injuries – in the worst case fatal ones. To counteract this, the work group DROPS (Dropped Objects Prevention Scheme) was started in the late 1990s.

Oil and gas operators, major engineering and drilling contractors, inspection specialists, industry bodies and suppliers come together in DROPS to share and discuss best practice. The organisation produces publications and offers resources such as training to its members.

"While the collaboration of all the key players is not so unusual in the oil and gas industry, our single-issue focus is unique and means we can be very effective at what we do," says Greg Reid from Silverdot Ltd, who administers the activities of DROPS.

WITH OVER 200 member organisations, interest in DROPS continues to grow. "When DROPS started it was solely focused on the drilling sector within the oil and gas industry," Reid says. "Today, we are a truly global organisation that covers all aspects of the industry. In fact, we are attracting attention from mining and construction companies, as they see the benefits of industry-wide collaboration."

The Nord-Lock expertise in bolted connections is showcased in the third revision of Reliable Securing, which highlights the company's washers as a recommended solution for mechanical and structural connections where maintaining the clamping force is critical.

"Nord-Lock has been a very active member of DROPS for around ten years," explains Reid. "Our organisation can only be successful if all our members bring a collaborative attitude to the table. Nord-Lock are always free and open with their advice, offering unbiased expertise that doesn't have their own interests at heart."

DAVID NIKEL

For more information:
dropsonline.org

MYTH BUSTERS

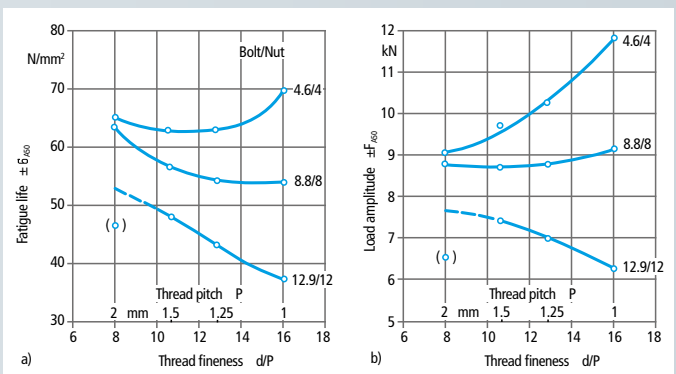
THE MYTH: A small thread pitch reduces fatigue life due to the notch effect.

THE TRUTH: A general statement is, as so often, not possible in this case since various parameters interact. In the literature there are partially contradictory statements. Heinrich Wiegand et al have conducted comprehensive studies on the influence of thread pitches. Diagram (a) shows the influence of thread pitches on bolt fatigue life.

Different property classes result in different characteristics. The fatigue life of high-strength 12.9-class bolts decreases with increased thread fineness, caused by the increasing notch effect. With decreasing strength and increasing ductility this effect is not visible anymore.

For bolts of property class 8.8, a decrease in fatigue life can also be seen. A larger cross-section of the fine thread will compensate for the decreasing fatigue life. The tolerable load amplitude (diagram b) is practically continuous.

There are more factors that influence the thread pitch than those mentioned. These include, for example, the displacement of the force application point, the root radius, the notch depth, the distribution of load force at the thread pitch and the notch sensitivity of the bolt material. ■



SeaTwirl's vertical axis turbine is fixed on an underwater gravity-based structure that reaches deep down under the surface. The full body then rotates as one piece.

Taking wind energy to new depths

ENERGY. Offshore wind turbines are an increasingly common sight as the world moves towards more sustainable forms of energy production. But these standard horizontal axis turbines have a number of drawbacks, such as being expensive to build and install because of the way they work, and because they are fixed to the seafloor.

But Swedish company SeaTwirl has taken a different approach to generating wind power at sea that promises easier construction, installation and maintenance, which in turn means lower lifecycle costs and lower energy costs.

"SEATWIRL has a simple robust design with few moving parts," says Gabriel Strängberg, managing director of SeaTwirl. "It can be placed in deeper water with good wind conditions. SeaTwirl is built for the ocean."

SeaTwirl's vertical axis turbine is fixed on an underwater gravity-based structure that reaches deep down under the surface. The full body then rotates as one piece. Strängberg explains: "The vertical axis makes the wind turbine rotate regardless of wind direction. A horizontal axis turbine must be aimed to catch the wind. That kind of yaw mechanism is not needed in the SeaTwirl turbine."

SeaTwirl AB was founded in 2012, but traces its history back to 2006 when inventor Daniel Ehrnberg wondered how water could be used as a bearing. After some small-scale testing, the first large prototype was launched in 2011. The second prototype, off Lysekil on Sweden's west coast, started producing energy in July 2015.

Nord-Lock has taken on a crucial role with the SeaTwirl prototypes, delivering both washers and Superbolts.

NORD-LOCK HAS TAKEN ON a crucial role with the SeaTwirl prototypes, delivering both Nord-Lock wedge-locking washers and Superbolt tensioners.

Strängberg says: "We chose Superbolts to easily achieve a high preload in the joints and to simplify the assembly process."

Other prototypes are currently being tested and SeaTwirl's turbines are expected to be commercially available around 2021.

FRIDA ERIKSSON

Welcome to our world!

BE PART OF our business network. On our LinkedIn page you get lots of news and stories from Nord-Lock as well as, for example, new job opportunities. Sounds good? Follow us today on https://www.linkedin.com/company/nord-lock.

Would you like to read about your company in Bolted?

NORD-LOCK IS ALWAYS on the lookout 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: bolted@nord-lock.com.

Securing bolted joints is about safety for installers and the public alike. Watch how the company ActSafe trusts the **proven quality of Nord-Lock** wedge-locking washers for their power ascenders. For when failure is not an option.

Nord-Lock is **number one** in bolt securing systems for many great reasons. Discover them all on our Bolted blog:

www.nord-lock.com/bolted

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