

# BOLTED

**SIEMENS****SAFETY  
WASHERS  
GIVE GREEN POWER****4 NORD-LOCK  
SECURITY  
SOLUTIONS****NORD-LOCK  
WHEEL NUT  
CERTIFIED BY TÜV****ODU****KEEPING  
MERCEDES HYBRIDS  
ON THE ROAD**

# THE PRECIOUS WASHER

**KEEPING  
COSTS DOWN**



# ALWAYS AT YOUR SERVICE

When you choose Nord-Lock you do not only choose a manufacturer and a supplier. You also choose an expert in bolted joints as a partner. Our Technical Verification Center meet our clients locally, working together to solve bolt securing problems in the most demanding applications.



**NORD-LOCK®**  
*Bolt securing system*

[www.nord-lock.com](http://www.nord-lock.com)  
MADE IN SWEDEN



Boltered 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 further information on Nord-Lock, visit [www.nord-lock.com](http://www.nord-lock.com)

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**NORD-LOCK®**

## “Before we met you we didn't have any problems with bolts”

ONE OF MY COLLEAGUES, Denis Mullenbach, told me recently that a customer of his had said: “Denis – before we met you we didn't have any problems with bolts.” I was astonished, but he then clarified by saying, “They used to refer to a lot of problems as just problems – it could be failures or machine stops which created a lot of work, investigations, new maintenance routines and so on. Since they got to know Nord-Lock they have changed their way of thinking and easily identify ‘bolt problems’ – and solve loosening bolts with our help.” After hearing this anecdote I've come to realise that this is one way of explaining one of Nord-Lock's main strengths – helping companies realize what problems are bolt related and solving them so that our customers can get even better and more effective at what they do best.

IN THIS ISSUE of Boltered we focus on LCC (Life Cycle Cost) which is an important perspective in any product design. The article aims to connect this view to bolting. We are also very glad to promote the Nord-Lock Life Cycle Profitability concept in this issue. LCP is a new service we offer

our customers to compare bolt securing solutions and the related costs throughout the application's life cycle. Read more about this on page 8–12.

LAST YEAR we entered into a sponsorship with Ginaf Rally Power. Ginaf competes in the world's most legendary and demanding rally – Dakar. Our relationship with Ginaf has developed into not only a sponsorship but also teamwork to improve the bolted connections on their vehicles which elsewhere consists of reinforced or specially built parts. See the result on page 4. In this issue we are also very proud to bring you an update of Siemens latest product developments. See page 12–14. Enjoy!



**CARIN ESBERG**  
MARKETING MANAGER



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Choosing the right bolting solution could cost more in the short term, but will be cheaper in the long term. *Boltered* takes a look at Life Cycle Costs (LCC).

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At the Siemens turbine factory in Sweden, turbines are assembled for the energy sector. With Nord-Lock, Siemens is saving both time and money.

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“A downtime of only one minute can mean that up to 30 fewer logs are processed,” says Stefan Ladenburger, Managing Partner of Holzwerke Ladenburger.

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With Germany's first hybrid car, Mercedes-Benz had to get everything right the first time. Luckily, Nord-Lock was on hand to provide a reliable connection system.

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WORDS: NIC TOWNSEND

## STAYING IN PLACE

Nord-Lock wheel nuts are used not only because they ensure wheels stay fixed, but also allow for easy disassembly.



PHOTO: DAKAR PRESS TEAM

## OFF ROAD BUT ON TRACK

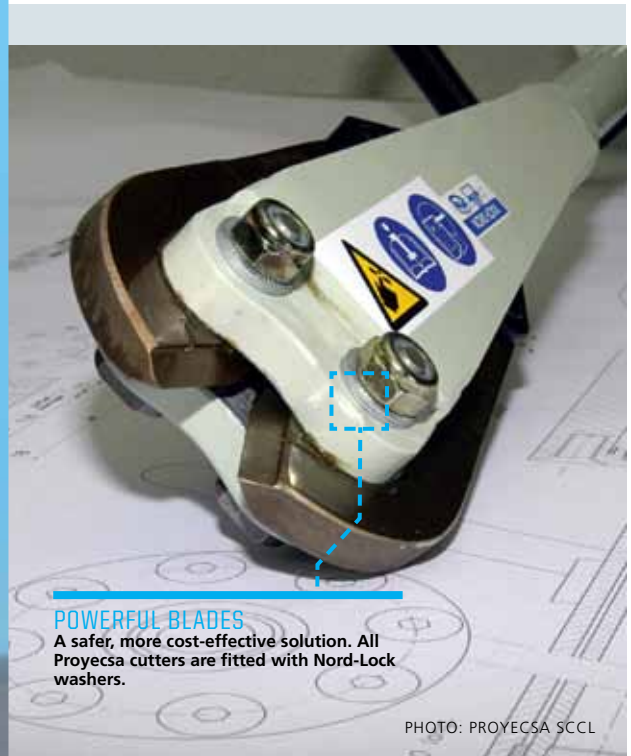
<b>CUSTOMER:</b> GINAF	<b>MODEL:</b> GINAF X 2222 SP	<b>ENGINE TYPE:</b> CATERPILLAR C18 (18 L)	<b>POWER:</b> 950 HP	<b>MAX TORQUE:</b> 3,260 NM
<b>TOP SPEED:</b> 160 KM/H	<b>TOTAL LENGTH:</b> 6.40 M	<b>TOTAL WIDTH:</b> 2.55 M	<b>TOTAL WEIGHT:</b> C 9,500 KG (FUEL INCL.)	

**IN 1977 FRENCH MOTORBIKE RACER** Thierry Sabine became lost in the Libyan desert. However, even in his despair he knew that the inhospitable environment was ideal for a rally. Thus, the famous Dakar Rally was born and for virtually every year since, rally drivers have gathered for the greatest and most arduous off-road race in the world.

Dutch truck manufacturer GINAF has been building custom designed trucks to compete in the rally since 1987. The race has since moved to South America, yet it is no less demanding. Over 16 days GINAF's trucks travel 9,000 km over dirt tracks and sand dunes. The trucks need to be tough, not just for the safety of the crew, but also because in a race as intense as the Dakar Rally, every delay can be costly.

GINAF started using Nord-Lock wheel nuts because they not only ensured wheels stayed fixed, but also allowed for easy dismounting, further reducing delays. The team at GINAF was so impressed by Nord-Lock's locking capabilities and ease of disassembly that they now apply Nord-Lock components to the chassis, the mounting of the steering house, the prop shafts, and the axle brackets.

With Nord-Lock products, the GINAF team has the competitive advantage of not having to check and/or retighten critical bolted connections at night. This shortens the everyday maintenance routines and allows for more sleep for the team. □



### POWERFUL BLADES

A safer, more cost-effective solution. All Proyecsa cutters are fitted with Nord-Lock washers.

PHOTO: PROYECSA SCCL

## A CUT ABOVE THE REST

<b>CUSTOMER:</b> PROYECSA SCCL	<b>MODEL:</b> RAPID CUT 16	<b>WEIGHT:</b> 18 KG
<b>MAXIMUM CUT:</b> 16 Ø (STEEL UP TO 70 KG/MM <sup>2</sup> )	<b>SPEED:</b> 10 CUTS PER MINUTE	
<b>MAXIMUM PRESSURE:</b> 8.5 BAR	<b>CONSUMPTION:</b> 48 LT./CUT AT 7 BAR	

**TRYING TO CUT THROUGH** steel requires powerful blades, yet the Rapid Cut 16 can slice through a 16mm thick steel bar like a pair of scissors cuts through paper.

Proyecsa SCCL has been manufacturing high-quality wire cutters in its factory just outside of Barcelona since 1974. Over the years, it has continued to develop and expand its range and currently manufactures twelve different models of its Rapid Cut series, which are able to cut through everything from high tensile wire to reinforcing steel bars.

In assembling its cutters, Proyecsa uses Nord-Lock as it has found that these have consistently provided secure joints with accurate preload. Previously the company used castle nuts. However, the need to drill holes in bolts made the process expensive. The blades were also frequently coming loose, potentially causing serious injury.

When Proyecsa read about the Nord-Lock bolt securing system in a trade magazine, it knew it had found a safer, more cost-effective solution. Now all cutters are fitted with Nord-Lock. When supplying spare blades to customers, Proyecsa includes Nord-Lock washers, and always recommends and specifies the use of Nord-Lock in its machines. □



## SECURED BY NORD-LOCK

### DEEP-SEA SAFETY

The Nord-Lock bolt securing system has solved the problem of loosening fasteners.

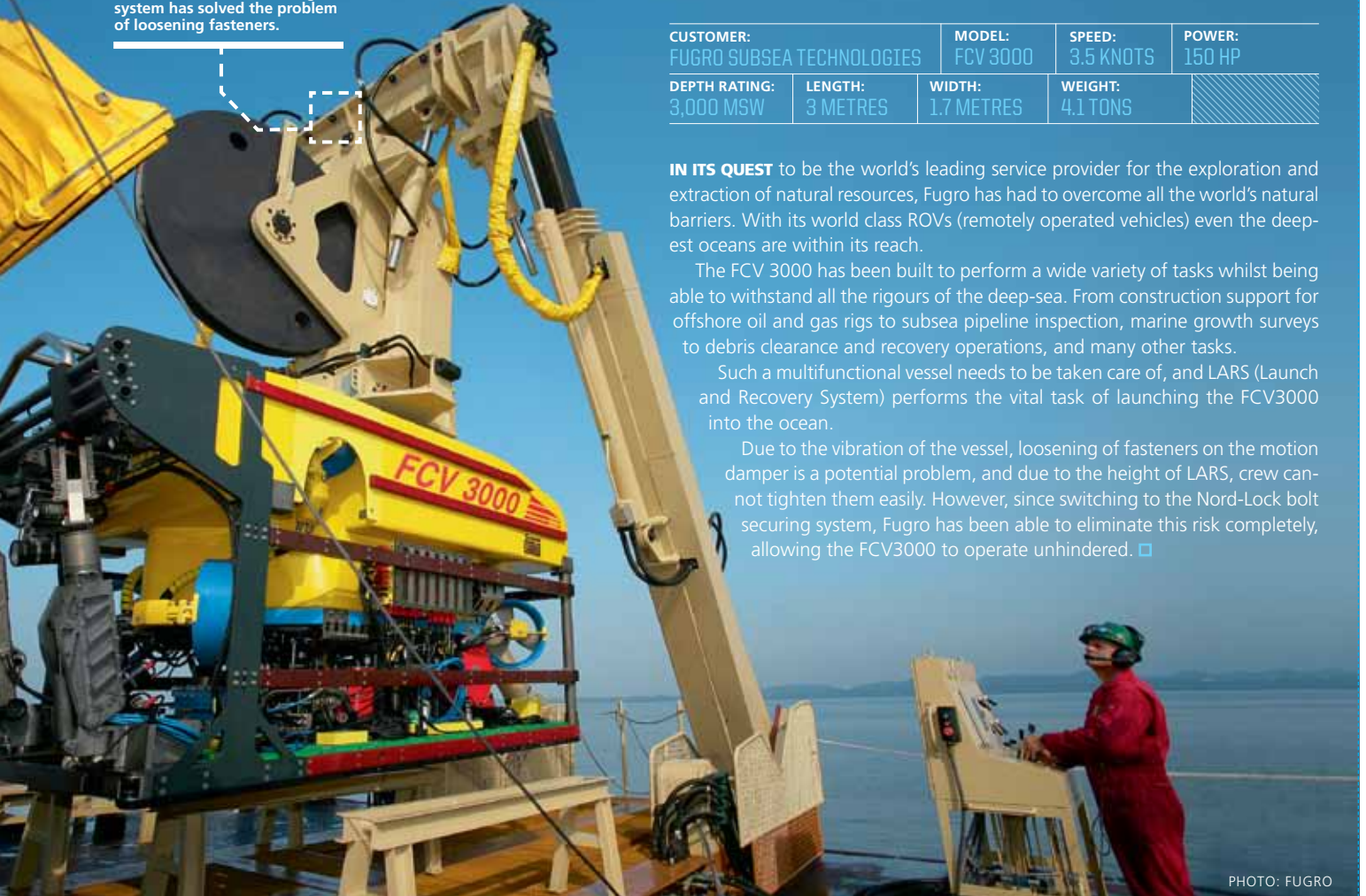


PHOTO: FUGRO

## PLUNGING TO NEW DEPTHS

<b>CUSTOMER:</b> FUGRO SUBSEA TECHNOLOGIES		<b>MODEL:</b> FCV 3000	<b>SPEED:</b> 3.5 KNOTS	<b>POWER:</b> 150 HP
<b>DEPTH RATING:</b> 3,000 MSW	<b>LENGTH:</b> 3 METRES	<b>WIDTH:</b> 1.7 METRES	<b>WEIGHT:</b> 4.1 TONS	

**IN ITS QUEST** to be the world's leading service provider for the exploration and extraction of natural resources, Fugro has had to overcome all the world's natural barriers. With its world class ROVs (remotely operated vehicles) even the deepest oceans are within its reach.

The FCV 3000 has been built to perform a wide variety of tasks whilst being able to withstand all the rigours of the deep-sea. From construction support for offshore oil and gas rigs to subsea pipeline inspection, marine growth surveys to debris clearance and recovery operations, and many other tasks.

Such a multifunctional vessel needs to be taken care of, and LARS (Launch and Recovery System) performs the vital task of launching the FCV3000 into the ocean.

Due to the vibration of the vessel, loosening of fasteners on the motion damper is a potential problem, and due to the height of LARS, crew cannot tighten them easily. However, since switching to the Nord-Lock bolt securing system, Fugro has been able to eliminate this risk completely, allowing the FCV3000 to operate unhindered. □



### CRITICAL AREAS

ITL use Nord-Lock washers in all critical areas, including the front axle, engine clutch and gearbox.

PHOTO: ITL TRACTORS

## PULLING THEIR WEIGHT

<b>CUSTOMER:</b> ITL TRACTORS	<b>MODEL:</b> WORLDTRAC 90	<b>POWER:</b> 90 HP	<b>RPM:</b> 2,200	<b>LIFTING CAPACITY:</b> 2,500 KG
<b>MAX TORQUE:</b> 339 NM	<b>FUEL TANK CAPACITY:</b> 77.5 LITRES			

**ITL (INTERNATIONAL TRACTORS LIMITED)** was established in 1995, and has since rapidly grown into one of the largest tractor manufacturers in India. Today, its tractors are exported all over the world to Africa, Australia and South Asia, among other places.

ITL's world class research and development facilities' commitment to maintaining environmental standards has led it to be the first ISO-14001 certified tractor manufacturer in India. Through tractors like the WorldTrac 90, it has built a solid reputation for its hard-working, high-performing tractors with minimal fuel consumption and low carbon emissions.

Through the daily grind of its gruelling work schedule, many areas of a tractor, such as the front axle, come under incredible strain and bolt loosening can be a constant problem. ITL use Nord-Lock washers in all such critical areas, including the front axle, engine clutch and gearbox. It has found Nord-Lock to be the best solution as it not only offers security and dependability, but also because the ease of application does not require ITL to make any changes to its existing designs. □



**LENA KALMYKOVA**  
APPLICATIONS  
ENGINEER



**CSABA MADRU**  
MANAGER,  
TVC



**FRIDA CULLIN**  
MATERIAL  
EXPERT

Email your questions about bolt securing to [experts@nord-lock.com](mailto:experts@nord-lock.com)



## ASK THE EXPERTS

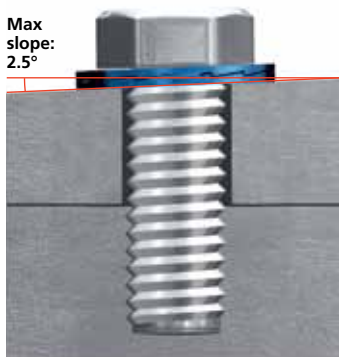
Do you have a question about bolt securing? Put the Nord-Lock experts to the test.

### Can Nord-Lock be used on inclined contact surfaces?

**Q:** Normally a mating surface is flat but sometimes it can be slightly inclined. What is the maximal angle of surface inclination where the Nord-Lock bolt securing system can still work successfully?

**A:** In order to ensure that the bolted assembly is safely secured by Nord-Lock washers, the incline of the mating surface should not exceed 2.5°. It's important to remember that tightening a bolt on an inclined surface introduces bending and increases the equivalent stress in the fastener. It may therefore yield at a lower preload than expected.

Due to the uneven load distribution when tightening against an inclined surface, the thread jams will increase friction and reduce clamp load as a result. This means that the full capacity of the bolt cannot be utilised no matter what locking system is being used. **LK**



The incline of the mating surface should not exceed 2.5°.

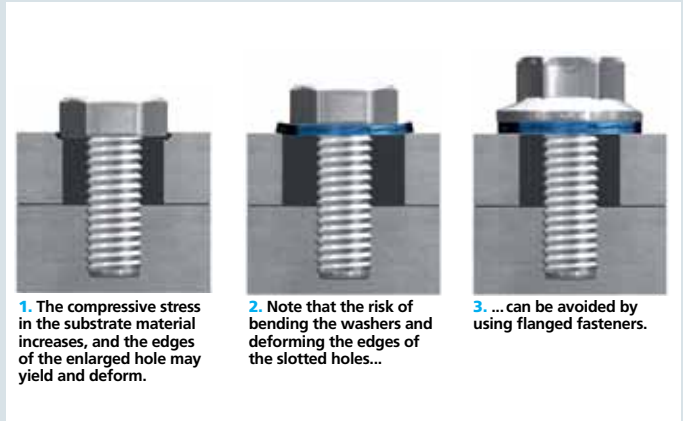
### Do Nord-Lock washers work with oversized holes?

**Q:** How can I apply Nord-Lock to slotted/oversized holes?

**A:** In some designs slotted or oversized holes are used in order to facilitate positioning of parts during assembly or adjustment/alignment of clamped parts.

However, a slotted hole results in a reduced contact surface between the fastener and substrate material. Therefore the compressive stress in the substrate material increases and the edges of an enlarged hole may deform (see picture 1).

By using washers with increased outer diameter the load can be distributed over a larger surface and the compressive stress in the substrate material can be reduced (see picture 2). In order to optimise the load distribution it is



1. The compressive stress in the substrate material increases, and the edges of the enlarged hole may yield and deform.

2. Note that the risk of bending the washers and deforming the edges of the slotted holes...

3. ... can be avoided by using flanged fasteners.

beneficial to use flanged fasteners. In this way, bending of the washers and deformation of the edges of the slotted holes and excessive settlements can be avoided even when the fasteners are tightened to a high preload (see picture 3).

Nord-Lock offers washers with an enlarged outer diameter, so called "sp", in sizes up to NL36sp in steel and NL30spss in stainless steel for use on enlarged or slotted holes. **CM**

### What effect will Nord-Lock washers have on my surfaces?

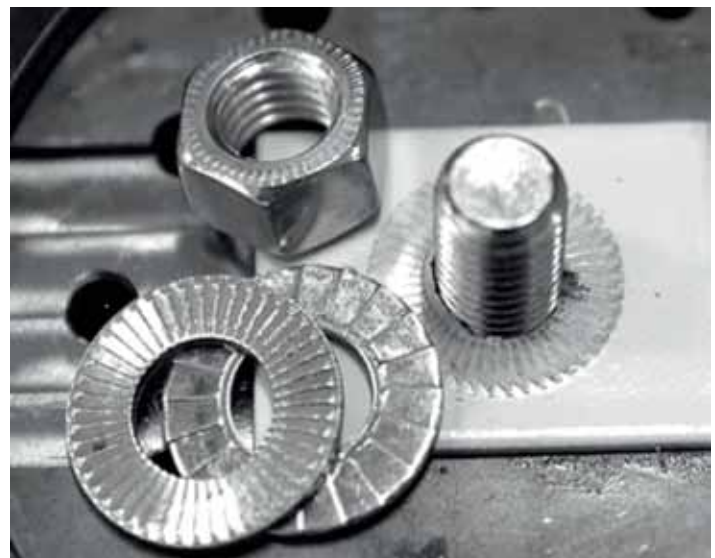
**Q:** Will Nord-Lock damage the surface in my application?

**A:** Nord-Lock washers are specially designed to create impression marks without scoring the mating surface. The impression marks are important since they prove that the serrations grip correctly into the mating surface. In bolted assemblies rotation always takes place where the friction is lowest. Provided that sufficient impression marks are created any tendency to rotate will occur between the cams of the washers. Consequently, any rotation is prevented by the wedge effect of the cams.

When a joint secured by Nord-Lock washers is tightened, rotation always takes place between the upper washer and the bolt head or the nut. The serrations are simply pressed down into the material, no scoring of the mating surface occurs. The bolt head/nut is hard enough to withstand the minor

scoring that it is exposed to. During untightening rotation takes place between the cams of the Nord-Lock washers. Therefore there is no risk of damaging the surface in the ap-

plication. The impression marks slightly increase the compressive stresses in the surface, but they will not score the material or damage it. **FC**



Impression marks are important since they prove that the serrations grip correctly into the mating surface.



# GET VALUE

Proper bolt securing may reduce costs





# FOR

## 1,000 times

# LIFE

### LIFE CYCLE COST

While there may be cheaper alternatives, choosing the right bolting solution will pay you back many times over in the long term. Here we take a look at the importance of life cycle costs (LCC) in bolting.

WORDS:  
DAVID WILES

PHOTOS:  
ALEXANDER FARNSWORTH & NORD-LOCK

**I**T IS A QUESTION that many an engineer or project manager has been faced with: whether to take the cheaper short-term option now and worry later about the consequences of machine failure; or to invest more from the outset in quality components, but wait years to see a return on investment in terms of lower cost of ownership. Increasingly, companies are seeing the benefits of the latter approach, a concept known as life cycle cost (LCC), which is defined as the total cost, from acquisition to disposal, of operating a machine or plant. But still many fail to recognise the economic advantages of taking the long-term view – not least when it comes to bolting.



Christer Idhammar.

“The concept of LCC is not well practiced in many organisations because they are driven by short-sightedness and a focus on short-term cost reduction instead of a focus on what drives cost,” says Christer Idhammar, founder and CEO of Raleigh, North Carolina-based maintenance management consultants Idcon Inc. “The right equipment might cost more, but the cost of ownership is lower. Long term you will have much lower costs and better maintainability, and therefore higher reliability.”

**STATISTICS SHOW** that more than 50% of accidents and failures in industries are related to bolt failures, and Idhammar has come across numerous such examples in his work advising companies around the world. In one extreme case, where a bolt came loose and fell into the machinery at a paper mill, a granite roll worth over \$1million was destroyed and the plant put temporarily out of action. Investing in a better bolt securing solution at an early stage could have saved such a massive expense years down the line.

Siemens Industrial Turbomachinery, based in Finspång, Sweden, employs the LCC approach in its manufacture of gas turbines for power generation. Several years ago the company conducted a study of its assembly process and concluded that securing the roughly →



Siemens saves about 50,000 to 100,000 Swedish kronor (5,500 to 11,000 euros) per gas turbine during assembly.

→ 2,000 bolts on each of its multi-million euro turbines was consuming too much time and causing too many injuries among its workforce. The method that was used to lock the bolts was a washer that was manually deformed with a hammer and tongs, a so called tab washer.

**BY TAKING A CRADLE-TO-GRAVE VIEW** on the bolt securing solutions it uses, Siemens has reduced costs throughout the lifespan of its turbines, and at the same time reduced workplace injuries and the costs associated with them. “Changing from the old method to Nord-Lock washers meant huge savings in time, injuries and money,” says Martin Lindbäck, Head of Project Office at Siemens’ R&D department. “We save about 50,000 to 100,000 Swedish kronor (5,500 to 11,000 euros) per gas turbine during assembly. And as we have to disassemble the turbine for servicing about four or five times during its life and unlock a lot of bolts and washers, there is a huge saving on maintenance costs during that

**“If you start operating the equipment and discover five years later that you have a problem, it typically costs you 1,000 times more.”**

**CHRISTER IDHAMMAR**, RELIABILITY AND MAINTENANCE GURU

life cycle. Downtime is very important for our customers, so every hour we can save when the machine is stopped is very important.”

Deciding on and investing in the right equipment from the outset can prove to be thousands of times cheaper over the life cycle of a product, but is often steered by internal politics or accounting procedures. Idhammar explains that as a rule of thumb, when a project has reached the halfway stage time-wise, only about 5 to 8% of the total cost has been spent. “But by that stage you have made decisions that will lock in about 85% of the future life-cycle cost,” he says.

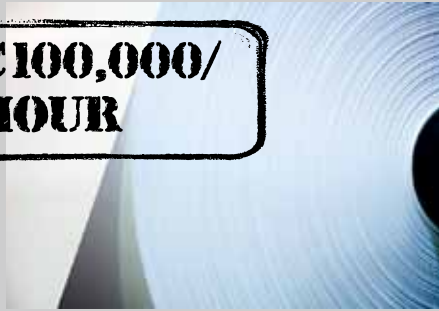
“You have decided at that point on having just one pump, instead of one pump plus a backup; on having stainless steel piping instead of galvanised; on having a bolt-securing solution that doesn’t guarantee that bolts won’t come loose. These are crucial decisions.”

**IF, AT THAT HALFWAY STAGE**, you want to make modifications, it will cost 100 times more than if you had thought of it from the beginning. “And if you start operating the equipment and discover five years later that you have a problem, it typically costs you 1,000 times more,” says Idhammar. □



## The cost of mechanical failure

**€100,000/  
HOUR**



**MACHINE PRODUCING HIGH-QUALITY PAPER:**  
5,000 to 100,000 euros per hour, depending on size.

**€420,000**



**GEARBOX IN PLASTICS FACTORY:**  
90,000 euros for new gearbox, 330,000 euros in estimated lost production time.

**€140,000/  
DAY**

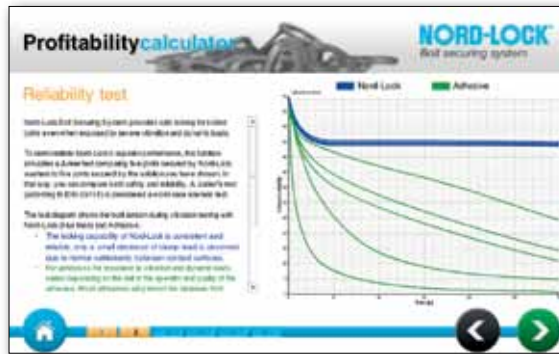


**OCEAN-GOING PIPELINE PLOUGH:**  
90,000 euros to 140,000 euros per day.

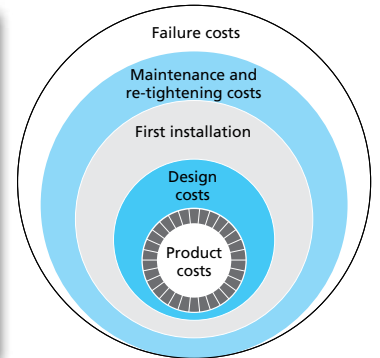
**€87,000/  
DAY**



**CONVEYORS FOR TRANSPORTING RAW MATERIALS IN MINING APPLICATIONS:**  
87,000 euros per day.



The Nord-Lock interactive profitability calculator enables customers to consider all factors for life cycle cost.



## New calculator reports on life cycle costs within minutes

How much money could you save over the life cycle of your equipment by using Nord-Lock's bolt securing system? The new LCP Calculator gives you the answer in just minutes.

**THE LIFE CYCLE PROFITABILITY (LCP) Calculator** spells out in black and white the long-term economic advantages of using Nord-Lock washers. Data on component costs, labour costs, assembly time and maintenance demands are entered into the web-based tool, and within minutes the user receives a report on total life cycle costs, both in figures and in text form.

"**THE UNIT PRICE** of our products may sometimes be a bit higher than for alternative design solutions," says Nord-Lock Applications Engineer Frida Cullin. "However, this tool shows that if you consider all the costs related to a bolted joint, not only the component cost,

you will most likely save a substantial amount of money over time by using Nord-Lock."

The LCP Calculator shows a step-by-step comparison of the total costs for Nord-Lock's washers against competing bolt securing solutions, although it does not take into consideration the costs related to a bolt failure. "This is not a tool to show that Nord-Lock is always the cheapest solution over time," says Global Account Manager Martin Schneider. "It can also show that Nord-Lock is more expensive, depending on the parameters and the application. But unlike other solutions, the chances of our solution failing are negligible, and the cost of bolt failure is the highest cost of all."

**ALL NORD-LOCK** sales staff have access to the calculator for demonstration to customers. Customers can also get a free temporary software licence to further explore the long-term cost savings of using Nord-Lock. The LCP Calculator is targeted at purchase managers and others at management level, but also at design engineers. "Twenty years ago design engineers were mainly focused on function, but now they have more responsibility for ensuring that their designs are also cost-effective," says Schneider. □

## Unique technical support service

**NORD-LOCK'S CUSTOMERS** not only get a superior bolt securing solution, they also get access to a unique technical support service.

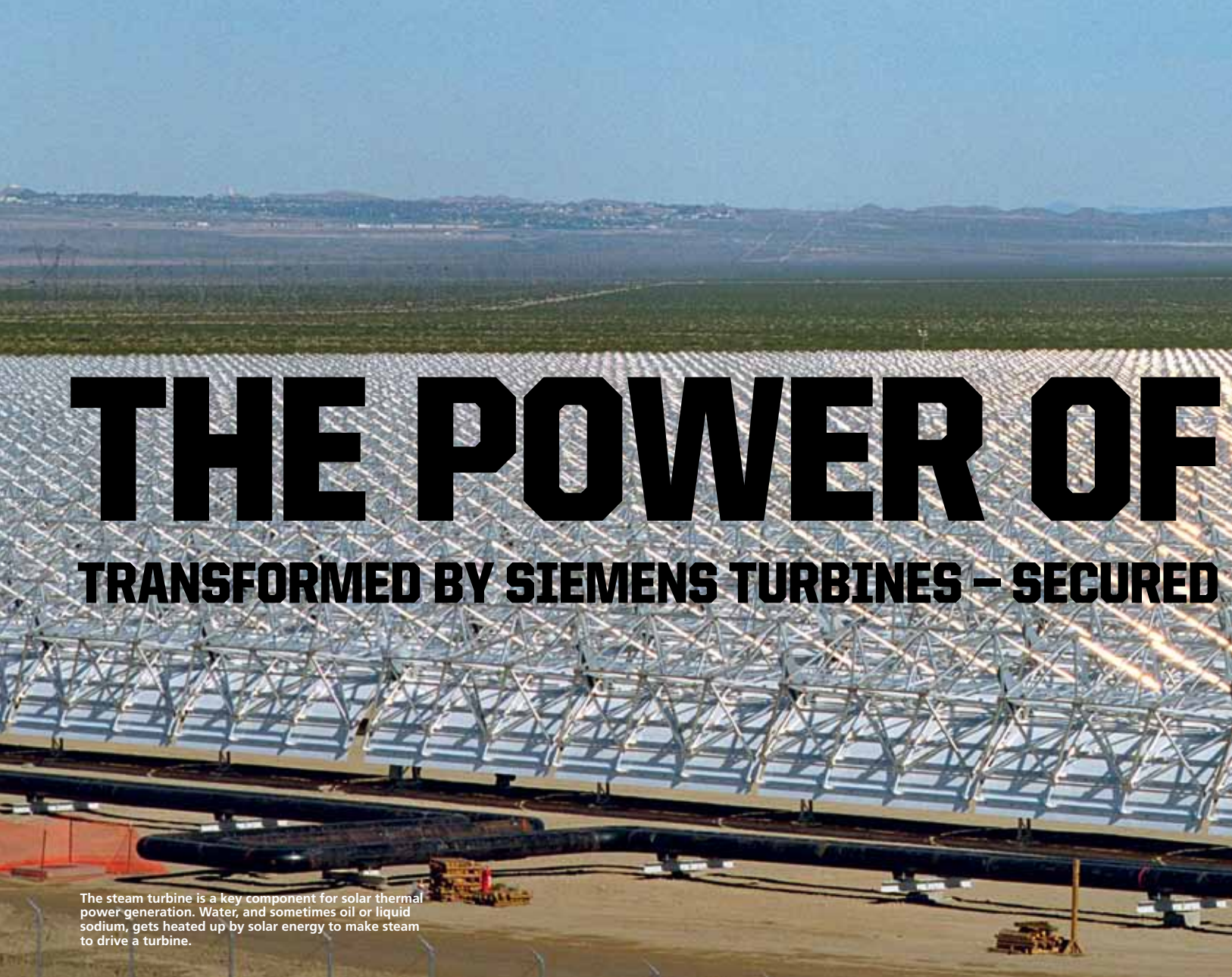
The company's experts receive enquiries from around the world on subjects ranging from torque to choice of materials. "Getting accurate information on these parameters is extremely important because of the critical applications in which our products are used," says Applications Engineer Lena Kalmykova, who is one of the team of experts providing support, assistance and advice, not only on Nord-Lock products but also on bolted joints in general. The support service is based at the company's



facilities in Sweden and the US, and from this year also in France and Japan.

These support services increase the value of each unit purchased from Nord-Lock. "When you buy from us you don't just buy the part – you are buying a whole package," says Kalmykova. "Not only do you save time looking for all the information you need, but you also save money on going to external institutes for testing, or hiring extra design engineers to provide the correct values."





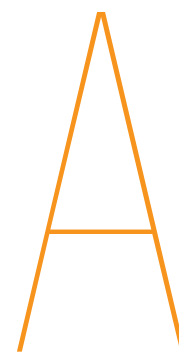
# THE POWER OF TRANSFORMED BY SIEMENS TURBINES – SECURED

The steam turbine is a key component for solar thermal power generation. Water, and sometimes oil or liquid sodium, gets heated up by solar energy to make steam to drive a turbine.

**ENERGY** Assembling an industrial-sized turbine requires acres of room. It also requires thousands of bolts and washers to be assembled and tightened to guarantee a service life of the product, which in the solar energy, biomass, oil and gas sectors, is typically upwards of 30 years.

WORDS:  
ALEXANDER FARNSWORTH

PHOTOS:  
ALEXANDER FARNSWORTH AND SIEMENS

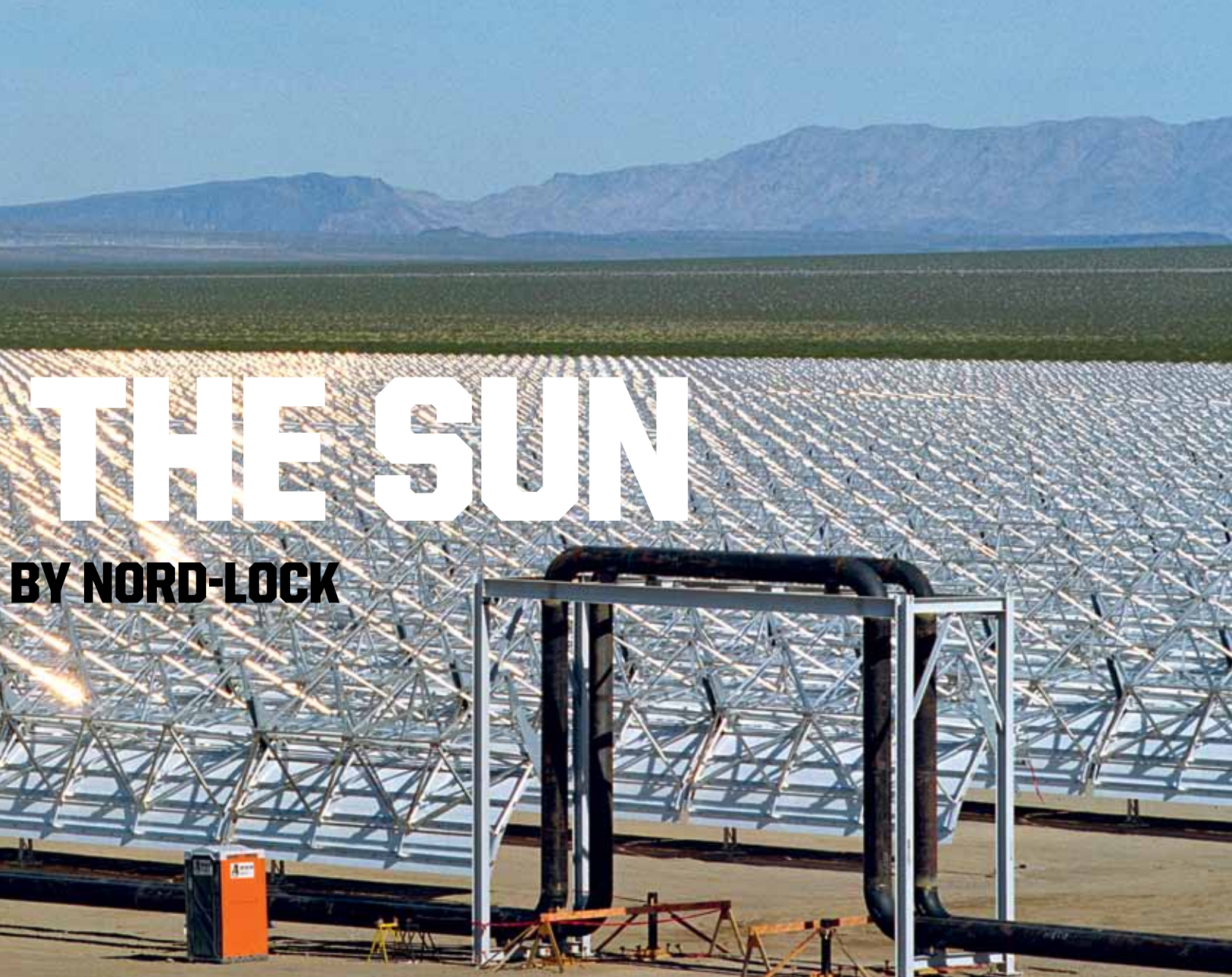


**SIEMENS TURBINE FACTORY** in Finspång, Sweden is one of the leading suppliers of steam turbines to the burgeoning solar energy industry. The factory, which also manufactures gas turbines, relies on Nord-Lock safety washers to make sure the bolts in the turbines stay put. This represents savings of almost 80% compared to traditional bolting methods.

Steam and gas turbines are assembled from pre-machined steel parts. They operate in solar plants, biomass, and in oil and gas facilities, under enormous pressures and temperatures to generate electricity. Historically, tab washers were used to secure bolts. After installation, these washers were manually folded over the bolts to prevent them from moving.

“It is amazing how such a little thing as a





# THE SUN

## BY NORD-LOCK

Nord-Lock safety washer can be so beneficial. They save an enormous amount of time and they are cheaper,” says Martin Lindbäck, who works with R&D at Siemens Industrial Turbomachinery AB in Finspång.

Indeed, anywhere you look in the well-organised factory you see bolts, and more bolts.

“We save a lot of time by using Nord-Lock safety washers,” says Nicklas Lundbom, a 14-year veteran of the Finspång factory. “It is a very easy solution that works.”

**A STEAM TURBINE** is a device that extracts thermal energy from pressurised steam and converts it into rotary motion to drive a generator that in turn can make electricity. It is like a reverse fan. Hot and pressurised steam is used to spin the blades that impart rotary motion to generate electricity.

The steam turbine is a key component for solar thermal power generation. In these so-called Concentrated Solar Power (CSP) plants, water, and sometimes oil or liquid sodium, gets heated



Nicklas Lundbom (left) and Oskar Gunnarsson tightening turbine joints. Siemens turbine factory in Finspång, Sweden, relies on Nord-Lock safety washers to make sure the bolts in the turbines stay put.







**“It is amazing how such a little thing as a Nord-Lock safety washer can be so beneficial. They save an enormous amount of time and they are cheaper.”**

MARTIN LINDBÄCK, R&D AT SIEMENS INDUSTRIAL TURBOMACHINERY AB

Thousands of bolts and washers have to be assembled and tightened to guarantee a service life of over 30 years.

**FACTS:**

**SIEMENS INDUSTRIAL TURBOMACHINERY AB, FINSPÅNG, SWEDEN**

**WHAT IT DOES:**

**MANUFACTURES INDUSTRIAL STEAM AND GAS TURBINES FOR USE IN THE SOLAR, BIOMASS, OIL AND GAS SECTORS**

**PART OF:**

**THE SIEMENS ENERGY SECTOR WHICH HAD REVENUES IN 2010 OF 25.5 BILLION EUROS**

**STEAM/GAS TURBINE RANGE:**

**50-250 MW/15-50 MW**

**TURBINE WEIGHT:**

**UP TO 200 TONS**

**TURBINE LENGTH:**

**UP TO 24 METRES**

**STEAM/GAS TURBINES MANUFACTURED PER YEAR:**

**20/40-50**

**NUMBER OF EMPLOYEES:**

**2,700**

**ACQUIRED FROM:**

**ALSTOM POWER, 2003**



**Business arguments**

**THIS IS HOW** Siemens Finspång benefits from Nord-Lock safety washers:

- **TIME SAVING** – Compared to other bolt locking systems, Nord-Lock washers are faster to install by a factor of 20.
- **EASE OF USE** – Easier to install and perform service on turbines on customer sites.
- **LOWER COSTS** – 80% costs savings were achieved compared to tab washers that can only be used once.
- **SAFETY** – No risk of bolts loosening.
- **CORROSION-RESISTANT** – Nord-Lock washers are coated with zinc flake, Delta Protect®, as a standard.

→ up by solar panels, or mirrors, which concentrate the sunlight in three different ways – a parabolic trough collector, a linear Fresnel collector, or a solar tower. In each case, the solar energy is used to make steam to drive a turbine.

**INTERESTINGLY**, the heat can be stored for hours, for example in tanks filled with molten salt, which means that solar thermal power plants can also supply electricity when the sun is no longer shining. Power generated in this way does not produce any pollutants like carbon dioxide.

According to a one-year production estimate, two out of every four steam turbines made in Finspång will be used in the solar industry.

“The solar energy market is notoriously cyclical and highly dependent on government subsidies,” says Lars-Göran Sjöberg, General Manager for Industrial Steam Turbines at Siemens Industrial Turbomachinery. “But we have had a good run.”

“As living standards increase around the world, an incredible need for electricity arises. And everyone agrees that renewable energy in the form of biomass, wind and solar is the way to go,” says Sjöberg.

Some notable Siemens steam turbines that are being bolted together in the Finspång factory include the 123-MW steam turbine for Bright-Source Energy Inc’s Ivanpah Solar Complex in



“Everyone agrees that renewable energy is the way to go,” says Lars-Göran Sjöberg, General Manager Industrial Steam Turbines.

Southern California. The order is for an SST-900 steam turbine that is especially suited for the load swings and frequent starting and stopping that is characteristic of solar energy generation.

**IN THE GAS TURBINE FIELD**, the Siemens Energy sector launched a new industrial gas turbine on November 18, 2010, in Finspång, Sweden. With a capacity of 37 megawatts (MW), the SGT-750 will close a gap in the Siemens industrial gas turbine portfolio, which offers a power range between 5 and 50 MW. This versatile machine can be employed for both power generation and as a mechanical drive. The new development provides economic viability and eco-friendliness as well as a high level of availability and reliability. □



Steam and gas turbines are assembled from pre-machined steel parts. They operate in solar plants, biomass, and in oil and gas facilities, under enormous pressures and temperatures to generate electricity.



# Safe operations in extreme conditions

WORDS: LINDA KARLSSON ELDH | PHOTO: LADENBURGER

**TIMBER** A FEW YEARS AGO, Stefan Ladenburger took over as Managing Partner of Holzwerke Ladenburger (Ladenburger Timber Works), representing the third generation of this family business. It is a big responsibility: Ladenburger has a total capacity of over 500,000 m<sup>3</sup> and 500 to 600 employees at five sites in Germany, making it one of Europe's leading wood processing and refinement companies. For Mr Ladenburger, it was important to further develop the company through innovation. Therefore two years ago the company invested over 40 million euros in a state-of-the-art sawmill in Kerkingen, Baden-Württemberg, Germany.

**How do you approach your role as manager of the family business?**

"I view Holzwerke Ladenburger as an extremely innovative company. A great deal was achieved in the 1980s and I want to build on that. The new sawmill, which was commissioned in 2008, was an important step forward."

**Tell us some more about the new plant ...**

"The technology of the old sawmill was 20 years old and had reached its maximum capacity. Due to increased demand, the plants were being operated way above the originally configured capacity. Repairs were increasing and the plant was worn out. The new sawmill not only has a higher capacity of up to one million m<sup>3</sup>, but also offers much greater added value, which is extremely important given current market conditions, such as the scarcity of resources."

**Can you give us concrete examples of this added value?**

"Our product portfolio is extremely wide-ranging compared with many of our competitors. We supply all types of customers, from small carpenters to the produc-



Stefan Ladenburger in the new sawmill, where the machinery is secured by Nord-Lock.

**FACTS:**  
**STEFAN LADENBURGER**

**POSITION:** Managing Partner of Holzwerke Ladenburger, representing the third generation of this family business.

**BACKGROUND:** Degree in Business Administration and Research Assistant at Augsburg University. Took on a management role at Holzwerke Ladenburger following the death of his father.

**LIVES:** In Bopfingen/Aufhausen, Baden-Württemberg, Germany, where the group has its headquarters.

tion industry and the timber trade. Everything has a value: the bark for bioenergy and gardening, sawn timber which is further refined to products for use in design, boards for the wooden pallet industry, wood chips for paper manufacturing and sawdust for the pellets industry. With the new plant, we get a lot more from the wood – with greater efficiency."

**What was particularly important when planning the plant?**

"In the wood processing industry as in any other industry, with major investments of this type, the machines used must be as reliable as possible. Even the slightest machine failure can have critical results. A downtime of only one minute can mean that

**"A downtime of only one minute can mean that up to 30 fewer logs are processed. It is therefore very important to avoid repairs and downtime."**

STEFAN LADENBURGER, MANAGING PARTNER OF HOLZWERKE LADENBURGER

up to 30 fewer logs are processed. It is therefore very important to avoid repairs and downtime."

**What is the role of Nord-Lock in the new plant?**

"Nord-Lock maximises the security of bolted connections that are subject to vibrations and dynamic loads. In a sawmill, the machines are subjected to extremely harsh operating conditions, with several tonnes of wood running through the plants every minute. For me,

the safety of employees, and of machines, is therefore of vital importance. Nord-Lock is integrated in the units for securing motors and in numerous other vital bolt connections. In the operative life cycle, this ensures quick mounting and removal, a high degree of operational reliability, low maintenance costs and a significant reduction in the risk of failures. Further advantages include the re-use of Nord-Lock washers and on-site technical support." □

# The Mercedes connection

WORDS:  
LINDA KARLSSON ELDH

PHOTO:  
MERCEDES-BENZ AND ODU

**THE CHALLENGE** Hybrid vehicles use combustion engines and electric motors in parallel. High-voltage supply systems in these new vehicles place considerable demands on the connectors which provide the interface between the battery and the electronics. ODU Automotive GmbH based in Mühlendorf, Germany specialises in the development and manufacture of connectors for use in the automotive industry.

When Mercedes-Benz wanted to introduce the first German hybrid car onto the market, it turned to ODU to equip the vehicle with a reliable connection system. The project received a great deal of attention.

The reliability of the locking was of particular importance. If the connection system was loosened by vibrations, this would inevitably lead to the failure of the supporting hybrid function of the vehicle.

**THE SOLUTION** The search for a suitable locking system led to Nord-Lock. Thanks to the locking function of Nord-Lock washers, the

risk of bolts coming loose could be eliminated. A permanent connection between the battery and electronics was ensured.

"In this important project, we only had one chance to do everything right", explains Richard Espertshuber, General Manager of the Automotive department at ODU. "We therefore chose the bolt locking system which we felt would offer the best possible chance of success."

**THE RESULT** The connection system was installed in the first prototype cars. It then immediately achieved qualification according to AK test guidelines. The AK test guidelines were developed jointly by automotive manufacturers Audi, BMW, Mercedes-Benz, Porsche and Volkswagen and define various tests for the properties of connections.

In June 2009, Mercedes-Benz successfully launched the S-Class with hybrid drive onto the market. □



## CONNECTORS

The connectors provide the interface between the battery and the electronics. To pre-empt loosening by vibration, Nord-Lock washers are used.







## Investing in knowledge

Nord-Lock has long been a world leader in bolt securing systems and in 2011 the company will be investing heavily in Research and Development to ensure it continues to provide premium products and services.

**NORD-LOCK'S WASHERS** are currently used all over the world in some of the most demanding applications and have earned a global reputation for reliability and security. However, this has only been made possible by the extensive testing and research carried out by Nord-Lock.

"We have been in the market for nearly 30 years and in that time we have built up a vast amount of knowledge on bolt securing," says Elisabet Österlund, Sales & Marketing Director at Nord-Lock.

Nord-Lock customers can currently take full advantage of the company's accumulated knowledge and expertise through the company's technical support and testing. The new Performance Services concept



**"The key to our success has been the high level of knowledge provided by our personnel."**

**ELISABET ÖSTERLUND, SALES & MARKETING DIRECTOR AT NORD-LOCK**

is a tool for analysing and optimising customers' bolted connections. The aim is to increase the customers' profitability as well as reduce the life cycle cost of their joints, by avoiding failures, warranty claims and excessive service/maintenance. Since 1982, the company has gone from

being a manufacturer and supplier of washers to producing custom-made products and providing tailor-made services to customers with specialised needs in bolt securing.

However, having consolidated itself as a world leader in bolt securing, Nord-Lock is now looking to move forward. The company is planning on making a fresh investment into research and development and the recent appointment of Maxime Thonnerieux as the company's new Global R&D Director is just the first step in this process. "We want to increase our range of products. This is why we're investing in R&D."

This investment will hopefully lead to new products, new services, and an even greater level of expertise offered to all Nord-Lock customers. "To date our product range has been narrow but extensive. We have developed different types of washers in a range of sizes from various materials, and can provide one of the best bolt securing solutions in the world," says Elisabet Österlund. "The key to our success has been the high level of knowledge provided by our personnel. So investing in R&D is a key part of developing our product range." □

**NIC TOWNSEND**

## Introducing Nord-Lock's new Global R&D Director



**Maxime Thonnerieux, recently appointed Nord-Lock's new Global R&D Director.**

**IN LINE WITH** Nord-Lock's aspirations to provide world class expertise in bolt securing, the company has adopted an overall strategy of creating market value through product development. To this end Maxime Thonnerieux has recently been appointed as Nord-Lock's new Global R&D Director. Thonnerieux took over this February and joins the company after extensive experience as manager of the Joining Technologies Division of CETIM in France.

**What led you to take up the position as R&D Director at Nord-Lock?**

"During my ten years working at CETIM in the field of bolted joints, I was constantly trying to find effective solutions for market needs. This is what Nord-Lock has been doing best for years."

**What can you bring to Nord-Lock from your previous experience at the Joining Technologies division of CETIM?**

"The knowledge and know-how of bolt securing systems that I acquired while at CETIM will be invaluable in forming a strategy to further develop Nord-Lock's product range."

**What will be your main goals and aspirations at Nord-Lock?**

"My main goal will be to add new product solutions to what Nord-Lock already delivers. I want to help the company take the next step forward." □



## Nord-Lock wheel nut certified by TÜV

**LAST SEPTEMBER** the Nord-Lock wheel nut was certified for safety and quality by the pre-eminent German inspection organisation TÜV. In what was a two-step process, both the wheel nut and its production were approved. The wheel nut showed no reduction in torque during extensive testing at TÜV's facilities, while the long-term product test certified that the wheel nut would last the entire lifetime of a truck. TÜV also monitored and approved Nord-Lock's production facilities, encompassing everything from raw materials used to the processes in the manufacturing line. In fact TÜV is so satisfied with the quality of the wheel nut that the rigorous testing procedures now form an approval programme, which all future products will be required to pass.

"No other wheel nut on the German market has both Nord-Lock's safety features and TÜV approval," says Andreas Maile, Authorized Manager, Nord-Lock Germany. "TÜV is well known all over the world. It is a great argument for using the wheel nut, and a great basis for selling the product to new clients." □

## Follow Nord-Lock on LinkedIn

**NORD-LOCK NOW HAS** a company profile page on the business-oriented social networking site LinkedIn. Through individual profile pages, LinkedIn allows members to create and engage in business networks where they can find potential clients, service providers, business partners, employees, employers, and new business opportunities.

The new Nord-Lock page offers forums, where users can get the latest updates, ask questions about products and discuss all bolt securing issues. Users can also share their own reviews of Nord-Lock's products and follow the activities of Nord-Lock's representatives. Find Nord-Lock now at [www.linkedin.com](http://www.linkedin.com) □

In every edition of *Bolted*, we present one of the areas in which Nord-Lock is working actively on quality assurance and competitiveness. In this issue we focus on laser marking of Nord-Lock washers.

## QUALITY IN EVERY STEP

# Keeping track of genuine Nord-Lock washers

Nord-Lock's washers are already a high-end product. However, with the introduction of laser marking for every washer pair, the company has taken a significant step forward in terms of safety, quality and service.

**ONE WASHER** in every washer pair produced by Nord-Lock will now be individually inscribed with its type code, the Nord-Lock brand name and its own unique control number. This has been made possible by Nord-Lock's recent investment in laser marking equipment, and the benefits for customers are numerous.

"It means customers know they have the right washer type in their application," says Christer Svedberg, Nord-Lock Development Engineer and developer of the new laser marking system. "They can also see that it is a Nord-Lock product and know this means high quality." The marking not only reinforces Nord-Lock's technical superiority and reliability, but also helps differentiate it from generic copies. Customers can feel assured that they are using genuine Nord-Lock components, while the company can protect its reputation and image.

Nord-Lock has traditionally always marked every box with a control number. However, by also marking each individual pair, traceability has been significantly improved. "By using the control number, any washer pair can be

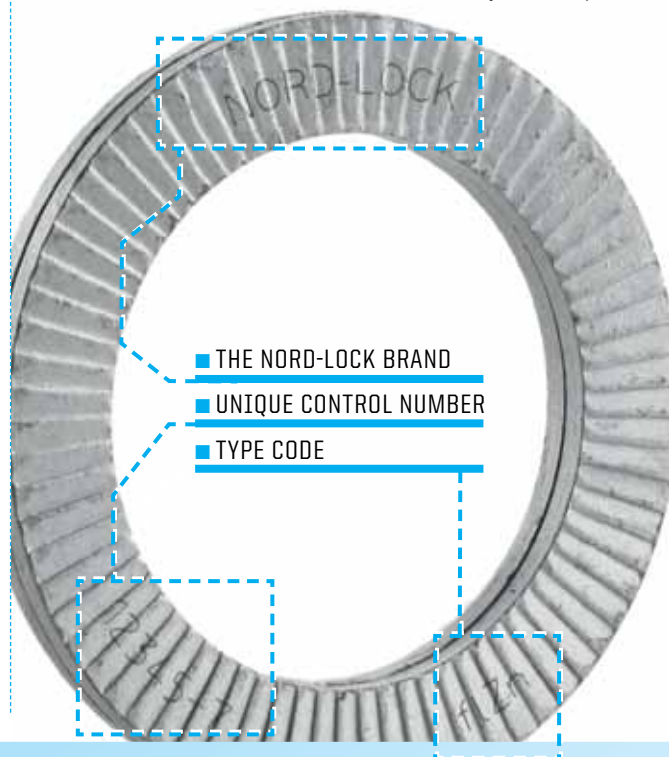


Christer Svedberg, Nord-Lock Development Engineer and developer of the new laser marking system.

traced back through the production stages, right down to the steel charge," says Svedberg. Better traceability also helps Nord-Lock maintain overall quality control, by making it easier to identify any problems that may come up during production. "If a problem or variation arises we can trace it back to the root cause and prevent it from reoccurring, as well as ensuring that our customers always get the product they expect." Washers are also marked with a type code, making it easier for users to differentiate between different types of materials and coatings.

Laser inscriptions will be strong enough to be readable until the washer has been assembled for the first time, while at the same time soft enough to ensure that the quality of the washer cannot possibly be affected. "We have ensured that the laser marking does not compromise the quality in terms of corrosion resistance or locking function," says Svedberg. "It is merely an improvement for users who demand full control in their applications."



Read more on [www.nord-lock.com/laser](http://www.nord-lock.com/laser) □





# Comparing solutions for bolt securing

Extension sockets or Nord-Lock washers? Let us take you through the key parameters so that you can make the right choice.

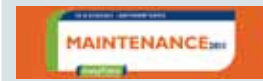
	NORD-LOCK	EXTENSION SOCKET
		
<b>LOCKING CAPABILITY</b>	Reliable. Constant quality of the product.	Not reliable. May eventually loosen.
<b>RANGE</b>	M3-M130.	Not advisable for large bolts, as parts and assembly will be expensive.
<b>CLAMP LENGTH</b>	Safely secures both long and short clamp lengths, by preventing rotation.	Good flexibility in joint, since clamp length is always long. This compensates for settlements, but cannot prevent rotation.
<b>CONTROL OVER CLAMP LOAD</b>	Locking function not affected by lubrication, which provides for good control over clamp load.	Due to risk of loosening, lubrication is not recommended, which results in larger clamp load deviation.
<b>REUSABILITY</b>	Reusable.	Reusable.
<b>USE IN CONFINED SPACES</b>	Suitable for and easy to assemble in confined spaces.	Limited use in confined spaces, due to extension body and long bolt. Bulky design solutions.
<b>LIFE CYCLE COST</b>	Low. Relatively high price per unit. However, improved productivity, minimized maintenance costs and reusability will lead to low life cycle costs.	High. Relatively high price per unit. Eventual loosening will lead to increased maintenance costs and down time.

## CALENDAR

### Exhibitions

**EACH YEAR**, Nord-Lock participates in over 60 major exhibitions and events for various industries. At the Nord-Lock stands there are experts on bolt securing and you will also be able to see Junker demonstrations, a comparative worst-case scenario vibration test for bolted joints. Here are some of the forthcoming highlights:

#### EUROPE:



#### □ Maintenance 2011

**WHAT:** Entire spectrum of maintenance services. Integrated overview of products, solutions and services for industrial operators who are looking to optimise their production process. Devoted to "sustainability in industrial maintenance".  
**WHEN:** 6-7 April, 2011.  
**WHERE:** Belgium, Antwerp.

#### USA:



#### □ Railway Interchange 2011

**WHAT:** The largest event of its kind ever in North America. It is sponsored by AREMA, REMSA, RSI and RSSI, and will replace the four separate trade shows and conferences traditionally sponsored by these organisations. Railroaders will see and hear all that is new and innovative in the rail supply industry.  
**WHEN:** 18-21 September, 2011.  
**WHERE:** USA, Minneapolis.

#### ASIA:



#### □ SWEET 2011

**WHAT:** Specialised exhibition on New & Renewable Energy. SWEET is the first UFI approved exhibition in the new & renewable energy field held in Korea in three years. It is also the only UFI approved exhibition in this field.  
**WHEN:** 16-18 March, 2011.  
**WHERE:** Gwangju, South Korea.

Visit [www.nord-lock.com/events](http://www.nord-lock.com/events) for a complete list of exhibitions

## MYTH BUSTERS



**THE MYTH:** If the clamp length is at least five times the bolt's diameter, then the joint will not loosen from vibration.

**THE TRUTH:** A long clamp length generally increases the elasticity in the bolt. This improves the resistance against fatigue and loosening because the bolt is subjected to less dynamic stress and can follow the movements of the joint. However; the resistance against vibration induced loosening also relies on friction conditions, which often vary significantly. The elasticity alone may not be sufficient to keep the fastener from rotating loose. A long clamp length may instead result in increased cost and weight but not provide sufficient safety for critical applications. □



# For demanding applications

Nord-Lock customers have the world's most demanding applications and require maximum control. At Nord-Lock we are well known for our high quality production. Our rigorous testing and traceability routines make us almost unique in the fastener industry.

We now introduce a laser marking on our products which includes the Nord-Lock brand, the control number and a type code so you can see which product you hold in your hand.

The laser marking ensures full traceability down to first assembly, even when using bin-systems for fasteners. As a user you can also be sure that you put genuine Nord-Lock products in your application.

Read more about this product development:  
[www.nord-lock.com/laser](http://www.nord-lock.com/laser)

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**NORD-LOCK®**  
*Bolt securing system*