SIEMENS
Ingenuity for life

Industrial machinery and heavy equipment

Nord-Lock Group

Bolting solution specialist uses Simcenter to develop cutting edge technologies

Product

Simcenter

Business challenges

Develop safe and reliable joint solutions

Develop innovative technologies for securing joints

Keys to success

Technical expertise

Comprehensive research and testing

Use of advanced digital simulation solutions

Results

Gained insight into bolted joint phenomena

Determined likely causes of joint failures

Reduced reliance on physical testing

Simcenter simulation solutions help Nord-Lock Group solve complex joint-related problems

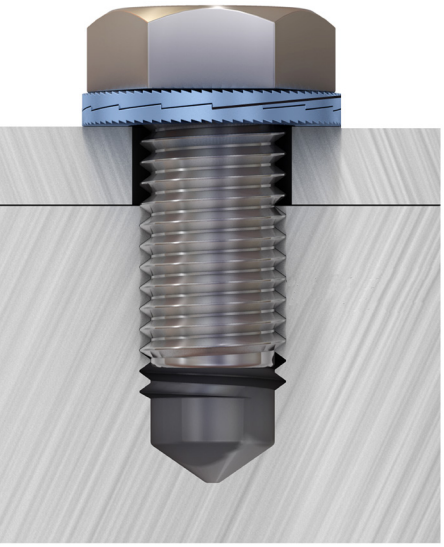
When security comes first

Humans have been using screwed joints for thousands of years. These devices have been a part of our daily lives for so long that we tend to forget how important they are. In fact, they surround us: in household appliances, transportation vehicles, machine tools, handling machines, bridges, and so on.

In many sectors, the security of joints represents an all-important factor throughout the product's lifecycle: for vehicles, which are exposed to dynamic structural loads and constant vibrations, security depends largely on the assembly's high resistance; the loosening of a joint in railway infrastructures or rolling stock can prove costly and have fatal consequences; skyscrapers, bridges and tunnels all contain a very large number of joints, some of which are difficult to access, but must be reliably secured in order to ensure the overall structure's security and functionality.

For more than 30 years, Sweden-based Nord-Lock Group has manufactured safe and reliable joint solutions. The company's motto is "providing maximum security for bolted joints." To meet security requirements and resolve the most complex joint-related problems, Nord-Lock Group proposes a unique combination of expertise in bolts and innovative technologies to

Simcenter is mainly used for advanced non-linear calculations to analyze stress states, deformations and movements in joints. The solution was naturally selected for the precision, performance and reliability of its NX Nastran solver, its integrated management of CAD data, and its openness.



secure and facilitate joints. Among the Group's flagship products are its wedge-locking washers, Superbolt™ mechanical tightening systems and, more recently, innovative Boltight™ systems for tightening bolts using hydraulic tensioners.

Cutting-edge technologies

Screwed joints have evolved considerably since the days when bolts and screws were manufactured manually, and when customers could only choose very basic products. Recently, companies like Nord-Lock Group have considerably improved the bolted joint technology by inventing, for example, locking systems. In addition, the focus has increasingly shifted to the actual analysis of joints. "In the past, people used to decide upon a certain size of fastener based on their experience alone, and, fingers crossed, it would work," explains Bill Eccles, the mechanical engineer behind Bolt Science having more than 20 years of specialized experience in bolted joint technology. "Nowadays, people focus more on analysis and making sure things work before products are built and sent out into the market."

The tightening systems have also evolved a great deal. The multi-jackbolt tensioners (MJT) of the Superbolt tightening system encapsulate innovative technology for tightening bolts and stud bolts. New-generation hydraulic tensioners facilitate and improve tightening since they do not generate any torsional stress, which means no reaction arm and no adverse lateral effect. Multiple screws are tightened simultaneously and the assembly remains flat.

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R&D Center Manager
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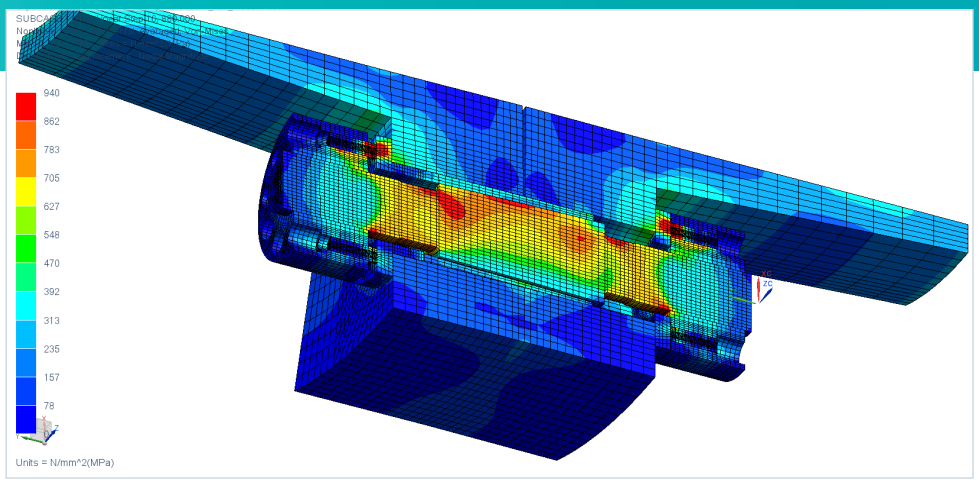

"During the design phase, we use the solution to gain insight into certain phenomena and to validate internal business rules. Parametric studies serve to analyze various scenarios and thus deduce simplified models which we make available to other technical centers throughout the world."

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New global R&D center

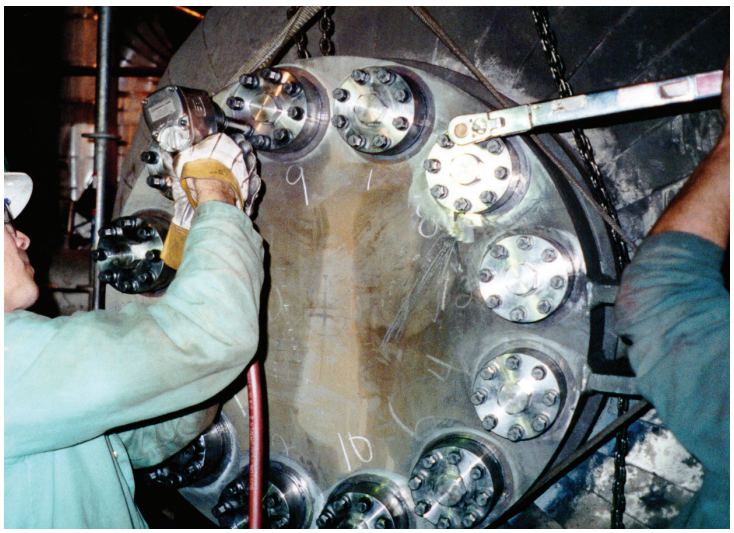
To consolidate its expertise, Nord-Lock Group opened a research and development (R&D) technical center in 2011. Based near Lyon, France, this global center sets out to support application engineers working in the field throughout the world to help customers conduct thousands of tests and checks. The center performs advanced calculations, characterizations and trials with partner laboratories such as the CETIM (Technical Center for Mechanical Industries). The lab is equipped with measuring instruments, in particular the Junker test, considered the most rigorous vibration test for threaded joints.

"In our laboratory, we carry out vibration, torque and preload tests, explains Zouhair Chaib, Nord-Lock Group's R&D center manager and a technical expert in secure joints. "We can also test the behavior of systems, for example to ensure that the proposed solution will work properly and be reliable. The Junker test allows us to measure the stress states and the deformation of joints subjected to alternating transverse movements under the screw head or under the nut."

The R&D Center uses Cetim Cobra software, a solution for designing and calculating pre-loaded screwed and bolted joints, which has been the calculation standard for many years in various mechanical sectors.

Selecting Simcenter for simulation

To remain at the forefront of expertise and build on its technical know-how, the R&D center recently adopted Simcenter™ software and NX™ Nastran® software from product lifecycle management (PLM) specialist Siemens PLM Software. Nord-Lock Group turned to SmartMeca Solutions, a Siemens PLM Software solution partner, to support it in its approach. "It was important for us to have a unique contact that was fully familiar with simulations and able to answer specialized technical questions," says Chaib. "We particularly appreciate the team's business expertise, their extensive knowledge of the software and their availability."



"Our engineers are all highly enthusiastic about mechanics and simulation, and we seek to contribute our expertise in finite element calculation tools and our technological proficiency to the industrial projects of our customers, whether they are small to medium enterprises or major corporations," says Sébastien Duchesne, manager of SmartMeca Solutions. "SmartMeca Solutions has supported Nord-Lock Group at every step of its project: evaluation of the software, selection of the overall software and hardware solution, installation, training and technical support."

Today, Simcenter is used primarily for advanced non-linear calculations to analyze stress states, deformations and movements in joints. The solution was naturally selected for the precision, performance and reliability of its NX Nastran solver, its integrated management of CAD data, and its openness.

Understanding, capitalizing, validating

"During the design phase, we use the solution to gain insight into certain phenomena and to validate internal business rules," says Chaib. "Parametric studies serve to analyze various scenarios and thus deduce simplified models which we make available to other technical centers throughout the world. This furthers our support mission since sales engineers have neither the time nor the resources to carry out complex calculations. It also helps to capitalize on the company's technical expertise."

Simcenter also helps investigate failure situations. "We are sometimes confronted with complex breakage cases, in particular for multi-fastener joints," Chaib explains.

"To propose effective repair solutions, the process that led to the failure must be understood. For this purpose, we need to imagine the most likely scenario possible. This means defining different possible cases, then simulating them virtually to determine the most viable scenario."

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Solutions/Services

NX Nastran
www.siemens.com/plm/nxnastran

Simcenter 3D
www.siemens.com/simcenter3D

Customer's primary business

For more than 30 years, Nord-Lock Group has provided safe and reliable bolting solutions. Nord-Lock Group offers real value from the design to the operation and maintenance phases of its customers' equipment.
www.nord-lock.com

Customer location

Lyon
France

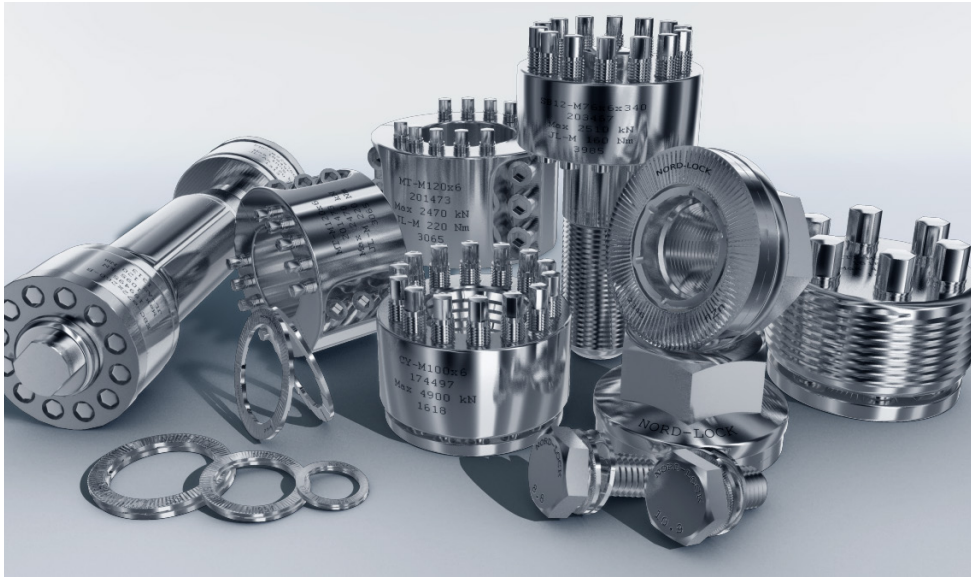
Partner

SmartMeca Solutions
www.smartmeca.com

"Weaknesses in screwed joints generally have two main sources: spontaneous loosening caused by vibrations and dynamic loading effects, and slackening caused by preload loss as a result of settling and relaxation. To propose effective repair solutions, the process that led to the failure must be understood. For this purpose, we need to imagine the most likely scenario possible. This means defining different possible cases, then simulating them virtually to determine the most viable scenario."

Nord-Lock Group uses Simcenter 3D as an alternative to physical testing. "For some applications, physically testing a joint is quite simply not feasible," Chaib says. This is the case both with giant structures and very small structures. Here, we turn to digital technology."

Nord-Lock Group's plans for the future include custom application development using the NX application programming interface. "In the future, we plan to use NX Open to develop business tools that integrate Nord-Lock Group's design rules, and then to make them available to sales engineers on tablets," says Chaib.



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