

SOLUTIONS FOR THE STEEL INDUSTRY

**ELIMINATE PIVOT WEAR AND FUTURE LINE BORING
WITH EXPANDER SYSTEM**





PIVOT WEAR IN STEEL MILLS

Several machinery & processes in the steel industry depend on pivots — mobile equipment repair, coking operations, hot strip mill, slag operations or disposal of slag, down coiler coils, roller mill, and forging & steel presses to mention a few.

Equipment owners are plagued with the problem of pivot wear, accelerated by the high temperature working environment. Equipment breakdowns result in downtime and production shortfalls. These breakdowns often require line boring and welding.

The right system for the job

Line boring is a temporary solution to lug wear where Expander System involves fewer and quicker steps to install and remove. This results in a less expensive option as the system is also reusable, with no special machining for re-installation as lug wear will be eliminated. Expander has been proven in field tests during more than 50,000 hours without a failure.

To optimize pivot axles, the entire application must be taken into consideration — the bushing, working conditions and the environment to eliminate lug wear and secure fast installation and dismounting. Since 1985, Expander System has been designing solutions for a wide range of applications.

Common applications

- Tensioning arm pivot pins
- Oscillator machine pivot pins
- Segment machines
— locator pins
- Side roller guides lock-in pins
- Side tensioner frame pins
- Down coiler tensioner pivot pins
- Fixed axles for duplex tongs
- BOF furnace pins
- Mobile machinery pivot pins
- Tension reel pivot pins

EXPANDING SLEEVES FOR A PERFECT FIT

The Expander System by Nord-Lock Group offers an advanced, cost effective solution to pivot wear problems by reducing labor and downtime, resulting in savings over the lifetime of the product.

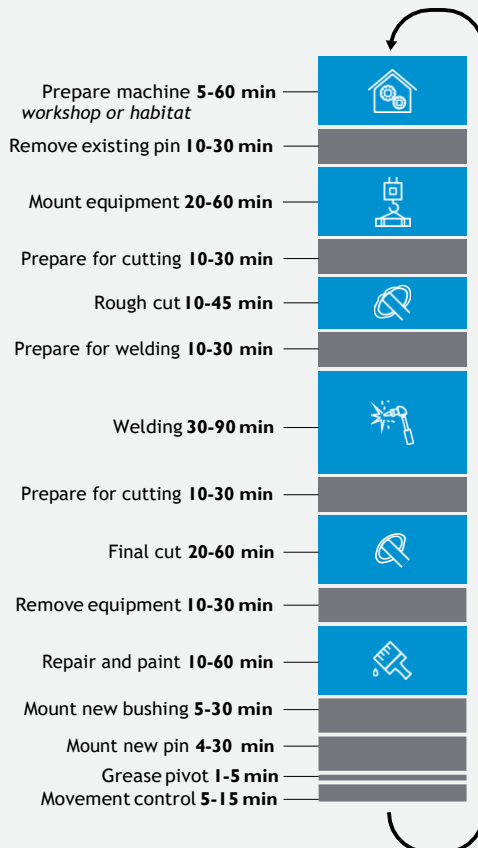
Sleeves are pushed onto the tapered pin ends by fasteners, the sleeves expand and make a firm fit between axle and lug. The system can be installed directly into the worn lugs, making it possible to avoid time consuming line boring repairs.



All Expander products come with a 10 year/10,000 hour lug wear warranty.

- EXTREME TEMPERATURES
- CORROSIVE ENVIRONMENTS
- MOUNTING RESTRICTIONS
- ALIGNMENT & OFFSET ISSUES
- EXTREME ABRASIVE ENVIRONMENTS
- LUBRICATION FREE REQUIREMENTS
- RADIAL OR AXIAL LOCKING OF BEARING

TRADITIONAL REPAIR

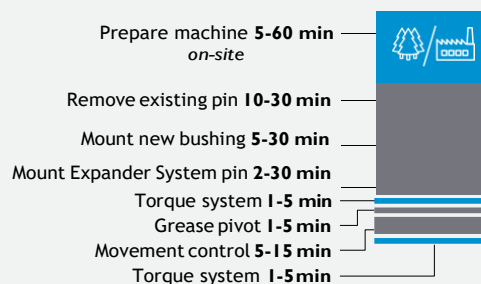


IF YOU DO LINE BORING – YOU’RE WORKING TOO HARD

Adding up the processes involved in line boring means at least a couple of hours, but can often take several days. Total time depends on application and moving needs of the equipment to be able to perform the repair.

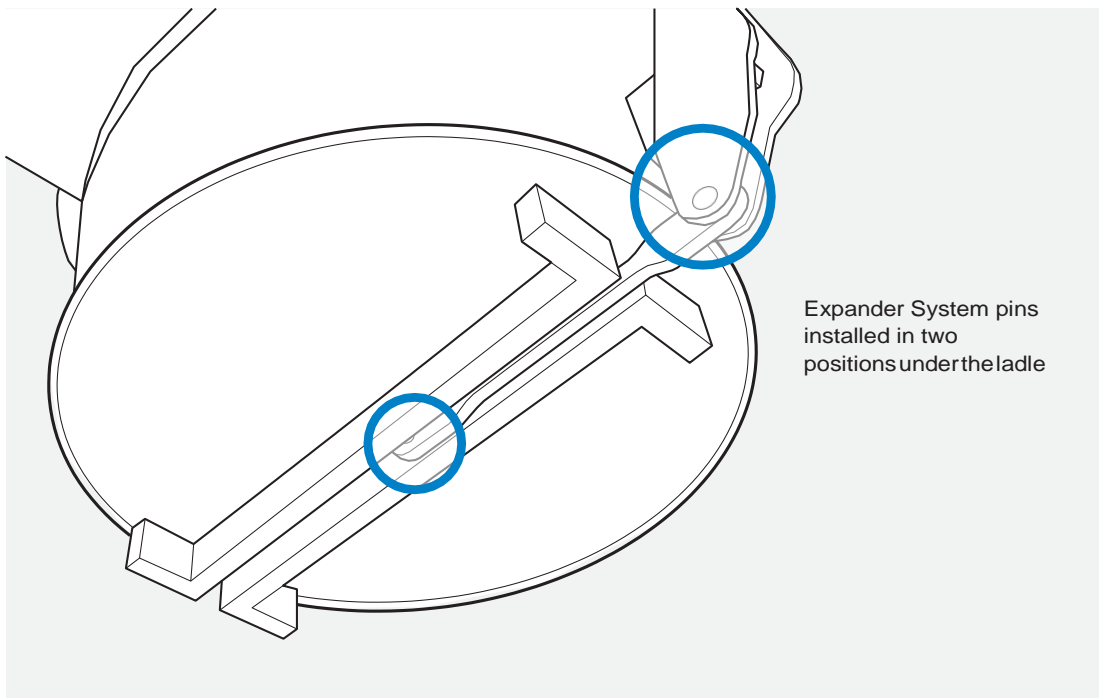
The Expander process involves fewer steps, can be done directly on the machine on site, as no hot works are involved. Repairs are done within half an hour up to a few hours.

EXPANDER SYSTEM



LADLE FUNCTIONALITY IMPROVEMENT

STEEL PRODUCER, INTERNATIONAL



The challenge

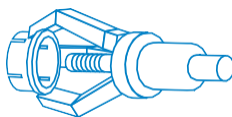
Traditional straight pins were used on the ladle in several positions. Pin removal was time consuming due to bending caused by hot temperatures while transporting molten steel. The bending deformation of the axle often resulted in the need for cutting, causing labor intensive maintenance.

The result

Both positions on the ladle were resolved using Expander System with flange sleeve solution supplied as multibolt without additional coating due to temperature. Maintenance was significantly reduced to simply removing pins since bending was eliminated. With flange sleeves, the removal can be even more convenient with the use of a puller.



The solution: Expander System multibolt for large diameter applications



Expander System can include a flange or threaded holes in the sleeve to make it easy to remove with a puller

NO NEED TO RETIGHTEN SHREDDER CAP

SEINAN, JAPAN

The challenge

Seinan experienced high stress concentration on a shredder cap, which is held in place and secured by four swing bolts (four pivots secured by bolted joints).

During routine maintenance lug wear was discovered and this required retightening of the bolts regularly i.e. several times per week.

The result

Expander System was installed on the cap frame, replacing the four traditional straight pins. The risk of bolt loosening on the cap was eliminated. Seinan is now working with the OEM to evaluate whether regular retightening can be eliminated.



Overview of the shredder.



Expander System bolt fastener with washer



In addition to Expander (lower circle), Seinan also utilizes Boltight (top circle) from Nord Lock Group.

SPECIALIZED STEEL MANUFACTURING PLANT

SSAB, SWEDEN

The challenge

Sweden's leading producer of steel utilizes Expander System in heavy load trailers, locomotives and pressure rollers at the rolling mill.

These axles are exposed to strain and wear, including **dynamic loads and vibration.**

The result

- Utilizing Expander increases the stability
- **Reduced maintenance cost**
- Reduction in downtime



FINISHING MILL PINCH ROLL FRAME PINS

STEEL MILL, USA

The challenge

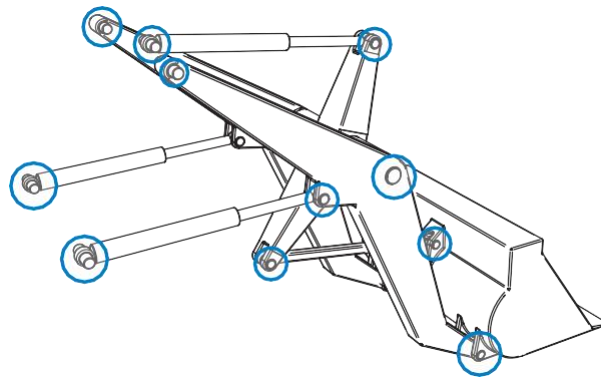
Pins causing lug bore wear costing thousands in downtime and lost productivity. Image shows the tensioning arm for a recoiler strip steel machine.

The result

Downtime reduction. Expander pins were easier and faster to install compared to the previous pin method.



THE STRENGTH OF YOUR MACHINE IS DEFINED BY ITS PIVOTS



Expander System is a proven solution for repair and OEM First Fit on industrial vehicles.

Pivots are at the center of the movement on your machines. Those exposed to extreme high temperature and work load risk cause unwanted downtime with costly repairs.

For vehicles used in the steel industry, we can ensure your pivots are strong, durable and up to task — be it loading raw material, beating the heat of hot slag or handling scrap in the recycling phase. Maximize productivity and minimize service and repair with Expander System.

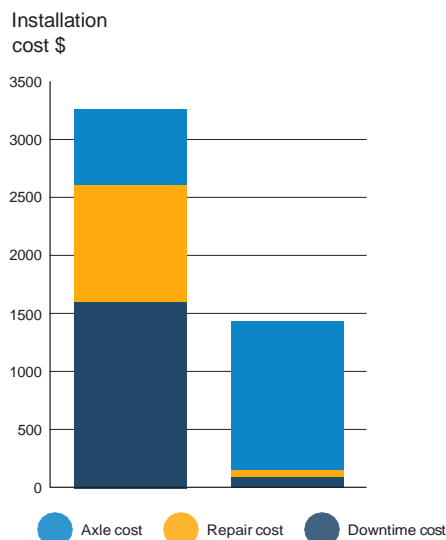
Expander System is a global expert in optimizing exposed positions and minimizing the installation/removal time as well as ensuring that the problem does not reoccur. Expander has been field tested for more than 50,000 hours without a failure and offers a 10 year warranty on lug wear. In addition, choosing Expander System can have a significant impact on precision, worker safety and overall productivity.



Minimize failures in electronic systems

Line boring and welding pose a risk in damaging electrical components due to the extreme temperatures required in the process. Choosing Expander as a repair method eliminates that risk.

CASE STUDY – VOLVO L220E WHEEL LOADER



Lifetime cost comparison

Cost over time	Line boring	Expander	Savings
Total cost now	\$1,655	\$1,339	\$316
Total cost now including downtime	\$3,255	\$1,439	\$1,816
Total cost lifetime	\$6,620	\$1,339	\$5,281
Total cost lifetime including downtime	\$13,020	\$1,439	\$11,581

* Cost comparison based on Swedish cost of labor per hour and a Volvo L22E wheel loader lower bucket pin application.

IMPROVED SAFETY AT CONVEYER BELT

YAMAMOTO ROCK MACHINE, JAPAN

The challenge

Yamamoto is a world famous rock excavator OEM since 1912. Their customers had a safety request:

“We have a lot of conveyors in the factory for the slag, iron ores and coal. Mine dust is falling through the clearance under the conveyers which is a fire hazard. We have to remove the slag but this means losing money as we have to turn the conveyors off for one day for staff safety. Do you have a solution?”

Yamamoto designed the remote controlled “Spider Bull” machine which is the lowest bulldozer in the world to work at steel plants, reduce downtime and costs since it is able to clear below the conveyor without risk to the workforce and without production stops. **The machine is to require a minimum of maintenance.**

The result

The Spider Bull machine uses Expander System as OEM design solution (i.e. first fit) on virtually all pivots in order to eliminate risk of lug wear and reduce downtime and cost for Yamamoto’s customers.

With Expander System the Spider Bull has maximum uptime and has eliminated the need to exchange the pivots and perform lug repair.

The Expander System design gives increased protection from dust and particles entering the lugs, which otherwise could damage surfaces.

The most important feature is that Expander System supports the original task: to remove the risk of fire and perform the clearance unmanned.



The Yamamoto “Spider Bull” is the lowest bulldozer in the world.



Expander is used at pivot positions to ensure minimized maintenance.



The system is lubricated through the axle and is designed with a nut that protects the grease nipple.

PERMANENT SOLUTION FOR GRAB MACHINES

VIGGO BENDZ/STENA RECYCLING, DENMARK

The challenge

The continuous motion of grab machines at this steel recycling plant puts strain on pivots over time, causing standard fittings and joints to become worn, ultimately leading to costly repairs and downtime.

The result

“By introducing the Expander System, Stena Recycling is saving money. /.../ longer machine life obviously means both greater sustainability and profitability.”

Poul Erik Jakobsen,
Owner and CEO, Viggo Bendz



Expander System through bolt design

ADAPTED TO THE ENVIRONMENT

LOADER CRAWLER, INTERNATIONAL

The challenge

Hot environment of 300° C (572° F) on CAT 973D excavator handling slag. Bucket pin had been damaged by the traditional straight pins.

The result

Expander designed a cost efficient solution, adapted material to sustain the environment and custom design optimized for wear conditions.

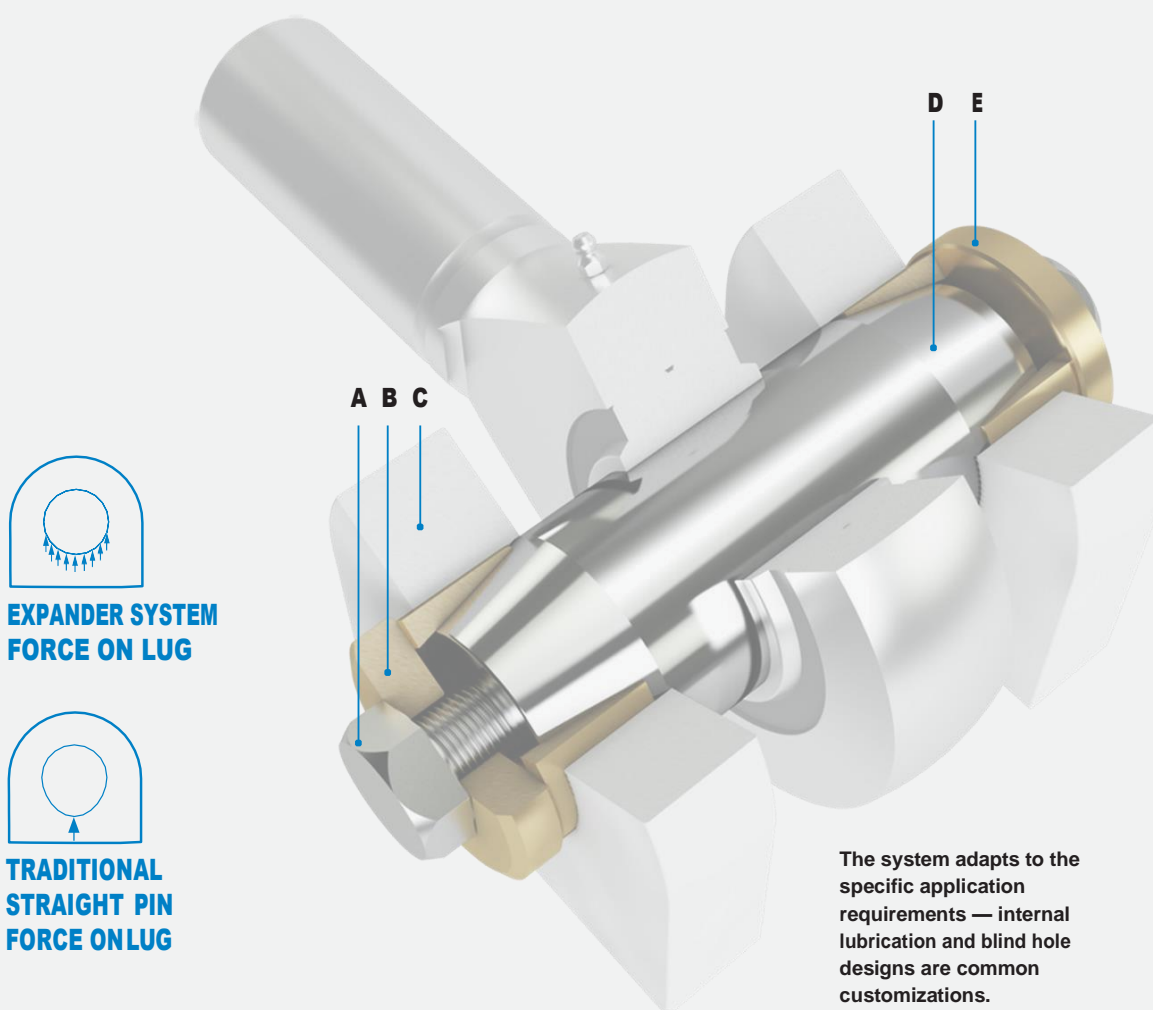


EXPANDER SYSTEM TECHNOLOGY

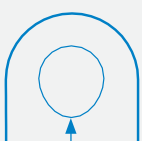
The Expander System offers an advanced, cost effective solution to pivot wear. Under torque, the fastener(s) push the expansion sleeves up the tapered section of the axle, locking the system into the lug ears and eliminating movement that causes pivot wear. The double-sided locking mechanism provides increased stability and security. Field installation, for reduced downtime and cost, is easy. For high-vibration applications, Nord-Lock's special vibration-resistant washers are integrated.

The basic Expander System is a patented pivot technology with a design including:

- Tapered axle/pin
- Expansion sleeves and tension washers
- Fasteners



**EXPANDER SYSTEM
FORCE ON LUG**



**TRADITIONAL
STRAIGHT PIN
FORCE ON LUG**

The system adapts to the specific application requirements — internal lubrication and blind hole designs are common customizations.

How it works

A

When the fasteners are tightened, the washers press the slotted expansion sleeves up the tapered ends of the pin.

B

The sleeves expand to conform with wear patterns in the lugs and lock the system in place.

C

Expander System fits into the existing lugs without expensive welding and line boring.

D

Once installed according to instructions, the system locks solidly to both lugs for significantly improved stability.

E

Removal and reinstallation are equally easy, and comes with a lug wear warranty of 10,000 hours.

The perfect pivot pin for any requirements

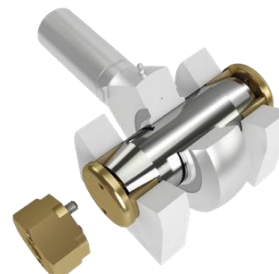
Expander Systems are used in new machines for best lifetime and high quality feel or as a repair solution during service. Regardless of the application, big, small, large volume or one piece production we have a solution. With experience in designing systems for more than 80,000 applications, our design teams know how to increase productivity of your pivots. All systems can be supplied with or without internal greasing and material certificates.



We design and manufacture any size, diameter and length of pin.

Our designs can be adapted to the needs of the application such as space constraints, single side mounting or flush mount.

Specials are standard to us — we do designs such as axial locking of bearing and have vast experience in adapting for extreme environments or enhanced safety requirements.



Designed to facilitate installation

Expander System can be designed with oversized sleeves which facilitates installation and alignment. It also minimizes the risk of unpredicted installation and removal issues.



VALIDATED IN THE FIELD

Since 1985 over 1 million Expander Systems have been installed around the world.

Expander Systems have been field tested for more than 50,000 hours without a failure. We've developed more than 80,000 pin locations for a large variety of machine makes and models. Ask your Expander System representative about custom designs for your specific needs.

MANUFACTURING SITES



Award-winning design

The Expander System is a recipient of the Swedish Innovation Development Award in memory of Alfred Nobel.

PIVOT PIN ENGINEERING EXPERTISE

Now it is your turn to make lug wear a thing of the past. Whatever challenges lug wear is causing your excavators, mobile cranes and dump trucks, we will work with you to maximize uptime and minimize maintenance costs.

Over 30-years of advancing and perfecting our pivot pin technology has given us unprecedented **expertise. No matter your engineering challenge –** Expander System has the perfect pivot pin solution for you.



To learn more about Expander or connect with our regional sales teams, visit www.expandersystem.com

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NORD-LOCK
GROUP

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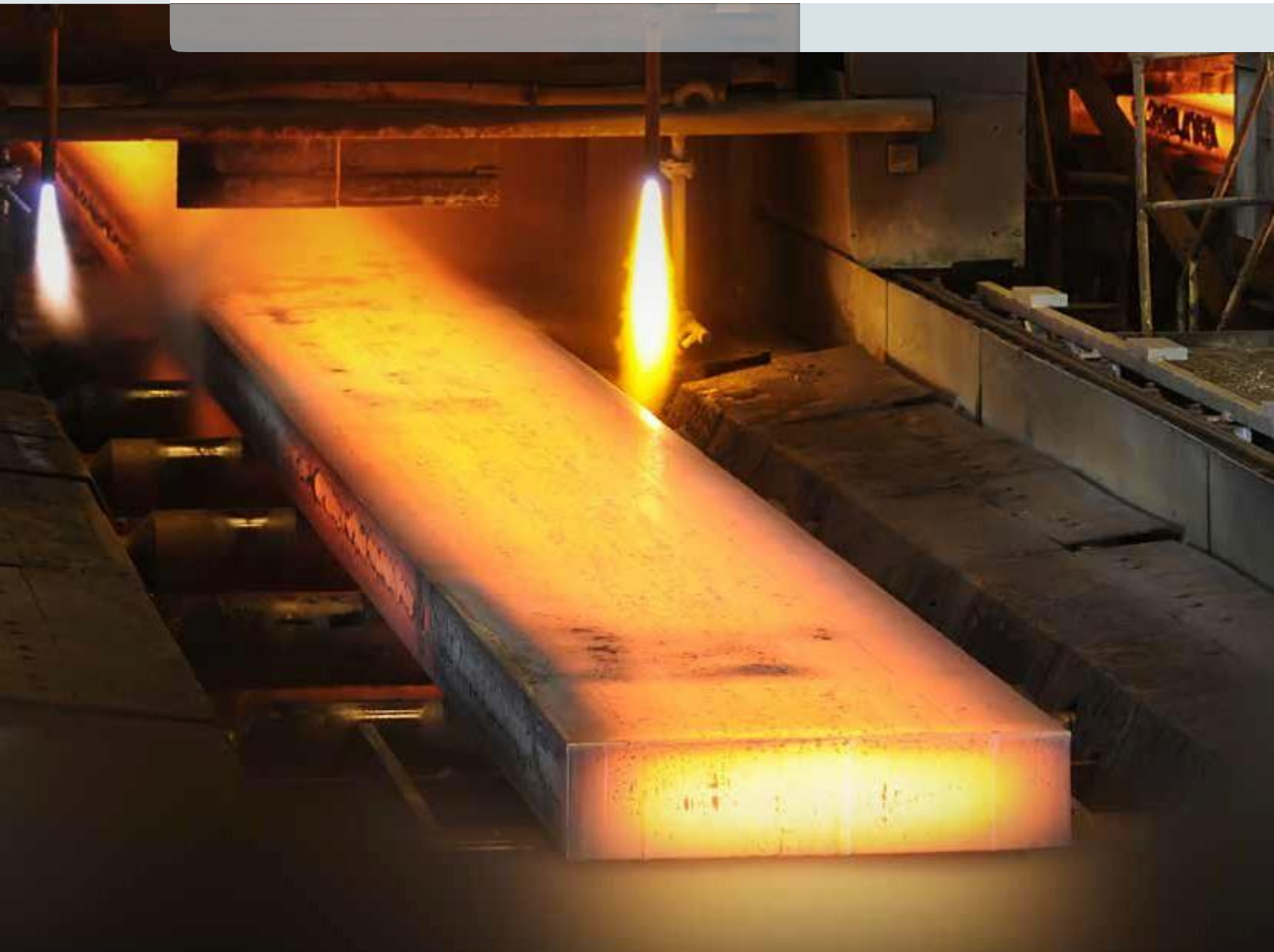
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Steel Mill Applications

Bolting solutions for your critical joints



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The ultimate solution for bolted



joints

The Nord-Lock Group has been manufacturing safe and secure bolting solutions since 1982. Our innovative solutions include wedge-locking technology and Superbolt tensioners.

Bolting applications in Steel Mills can be especially challenging. You need a bolting solution that can be installed and removed safely and quickly. One that will keep your bolted joints tight through demanding operations and improve your bottom line. That's where Superbolt tensioners come in.

On the following pages you will see several examples of bolting problems solved with Superbolt tensioners from the Nord-Lock Group. In addition to Superbolt products, we offer wedge-locking solutions, expansion bolts, studs, and more. We look forward to working with you on your critical bolting applications.



Challenge

Bolts with a diameter greater than 1" cannot be effectively torqued to capacity with hand tools. To achieve high preload levels, some form of high energy equipment is required. Slugging wrenches and crane wrenches are dangerous and thermal tightening can be time consuming. Hydraulic wrenching can be expensive, time consuming, inaccurate and it often leads to thread galling problems. Hydraulic tensioning also shares the same disadvantages and is additionally difficult to retrofit when out in the field.

Solution

Superbolt tensioners are designed as direct replacements for standard bolting. They can be threaded onto a new or existing bolt, stud, threaded rod or shaft. With Superbolt tensioners, bolting is fast, safe, easy and accurate - only hand tools are required.

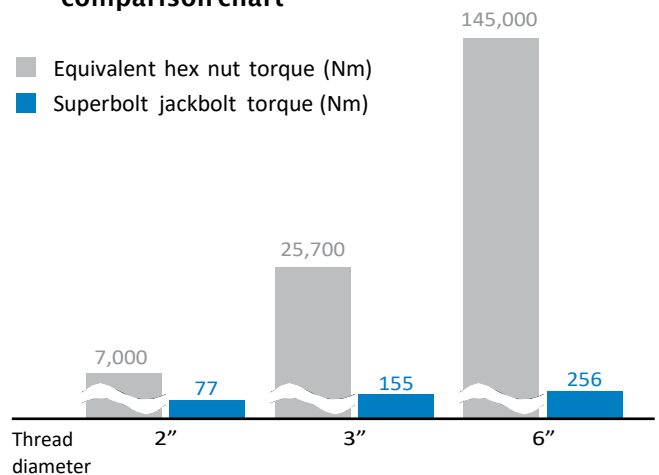
Superbolt vs. Hydraulic Wrench: With a hydraulic wrench one would need 18,925 lb•ft (22,500 Nm) of torque to stress a 3" stud to 428,400 lbs (1,950 kN) using a hex nut. With a 3" MTX Superbolt tensioner, only 114 lb•ft (154 Nm) on each of the jackbolts is needed to produce the same bolt load.



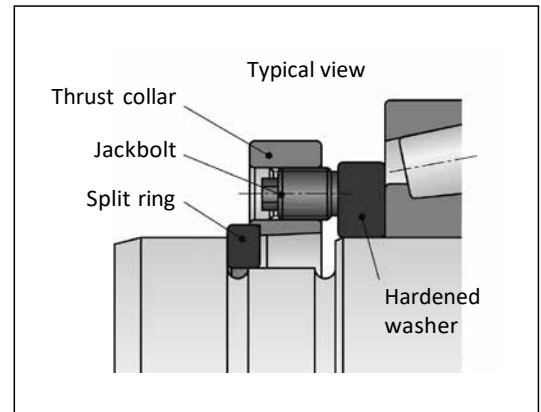
How it works

The hardened washer is installed first to protect the joint surface. The Superbolt tensioner is spun on hand tight, for positioning. Easy turn jackbolts "push" the nut body up, tightening the existing bolt or stud in pure tension.

Torque vs. preload comparison chart



Rolling Mill thrust collars



Example of Superbolt thrust collar: A modified thrust collar is retained in the chock, which requires only the manipulation of the split ring.

Superbolt thrust collars are primarily used in the steel industry on bearing back-up rolls and rolling mill work rolls. They replace the usual split thread and lock rings that are used to load the bearings. The entire thrust collar is carried in the roll chock and the only piece to be manipulated is a split ring that is inserted into a groove in the roll neck. The only tool required is a hand held impact wrench or torque wrench.

Advantages

Worker Safety: Eliminates injury from heavy lifting of existing nut or from using crane/cable tightening methods. Example: In one mill, five injuries in two years were reduced to zero.

Reduced Crane Time: Thrust collars are attached to the chock. After the chock is put on the roll, the split ring is inserted and

the jackbolts are tightened. The crane is then available for other lifts.

Cost Effective: More rolls can be built up with less manpower. "Overtime" has been eliminated or reduced in several roll shops.

Eliminates Standard Bearing Nuts: Due to the unthreaded design, stripping or cross threading of bearing nuts is eliminated. Down time to repair this condition is no longer required.

Ease of Build-Up: The quick change split ring makes it easier and faster to build up rolls.

Installation and Training Available: Installation of initial Thrust Collars and training of the roll change crew is provided.

Cold mill roll neck - thrust collar



Thrust collars



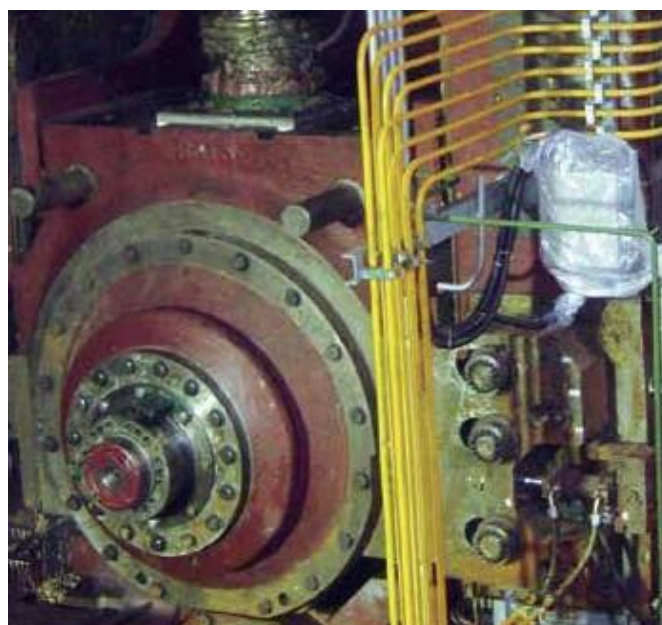
Challenge

On renewed installations some roll necks break. The heavy bearings of the work rolls are tightened with hydraulic nuts and cannot discharge the shocks. Cost intensive repairs, long down times of production and poor work pieces are the consequences.

Solution

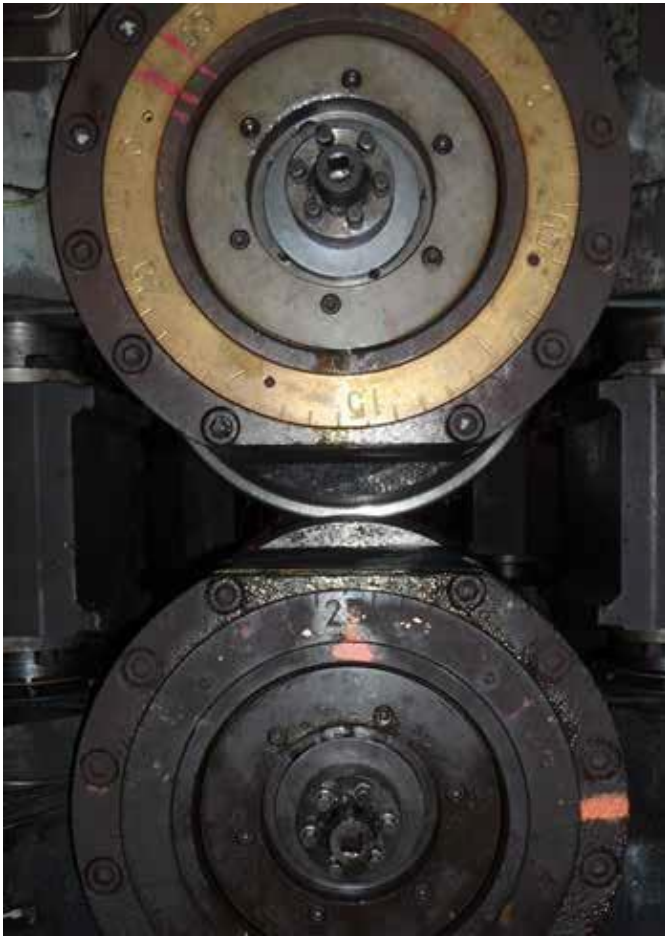
On one stand, Superbolt Thrust Collars are installed first. The Thrust Collars create higher preloads than the previous method and therefore even the heaviest peak loads can be absorbed. The roll necks are lasting and the production runs smoothly. Superbolt Thrust Collars have been used on temper mill stands, tandem mill stands, z-mill stands, and rougher stands

Hot strip mills - thrust collars



Multiple Superbolt Thrust Collars, as well as MT nut-style multi-jackbolt tensioners used on this hot strip mill.

Roll chock rolls



The use of Superbolt tensioners leads to improved ergonomics and greater workplace safety for this steel producer.

Every year Nucor produces over 21 million tons of steel, making it the biggest steel producer in North America and one of the biggest in the world. Since most of the steel comes from recycled scrap metal, which would otherwise be left to rust and decay, Nucor is also one of the world's largest recyclers.

In order to produce this much steel, Nucor's mini-mills are continuously in operation, melting down and recasting scrap metal. Despite the harsh conditions and extreme temperatures, everything needs to be in perfect working order. When dealing with a commodity as valuable as steel, any downtime is costly.

Currently, Nucor uses Superbolt multi-jackbolt tensioners in two applications on its steel mills, resulting in improved safety and reliability, as well as contributing to a more ergonomic working environment for its workers.

Firstly, Superbolt MJTs are used to secure the rolls to the roll chocks. Compared to torque tightened nuts, applying the necessary torque is significantly easier as it can be achieved using standard hand tools, thus eliminating the strain when assembling and disassembling equipment.

Secondly, the tensioners also secure the mill's stand to the transport cart used in the production process. Originally, this was secured using hydraulic nuts, which were cumbersome, unreliable and thus a safety hazard for employees. However, since switching to Superbolt MJTs, the connection to the cart is now safe and reliable.

Press columns

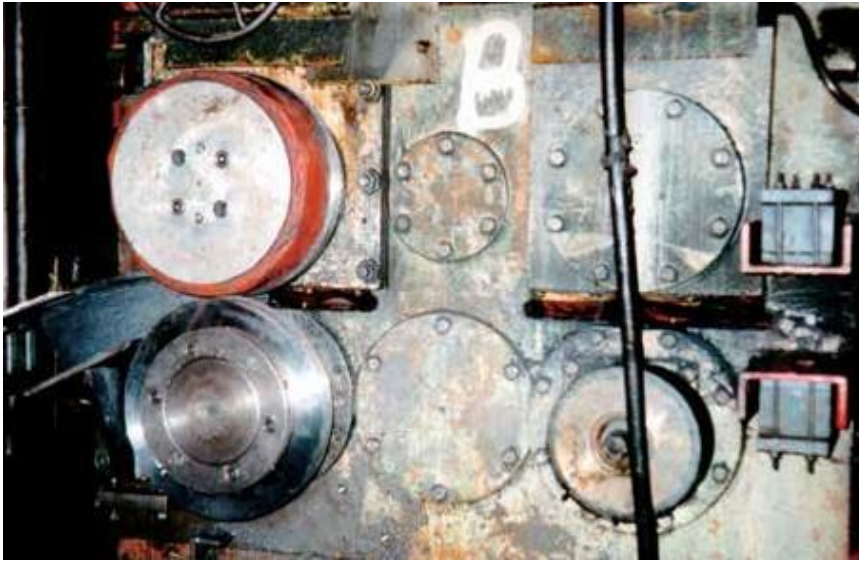


5,000 ton forging press.



3,250 ton slab shear press.

Side trimmer nuts



Superbolt side trimmer nuts replace standard nuts driven on by a spanner wrench and heavy sledge hammer. The Superbolt side trimmer nut can be tightened directly against the hardened knife body.

After hand spinning the nut onto the thread, a 1/2" impact or hand held torque wrench is used to tighten the jackbolts. This make bolting much safer for workers.

EAF electrode arm assembly



Additional steel mill applications

Hot & Cold Strip Mill:

- Pinion stand anchor bolting - MT series.
- Coupling bolts on reversing mill - MT series.
- Coilers - Hydraulic cylinder mounting bolts - SB8 series.
- Crop shear tie rod nuts - MT series.
- Line shaft anchor bolting - MT series.
- Furnace Bumper anchor bolting - MT series.
- Mill Motor nuts on crane brake wheels - SMX series.

Caster:

- Segment bolting - mainly stainless steel nuts bolting segments to rail or base.
- Mill Motor nuts - SMX series.

Melt Shop:

- Electrode Arms on Electric Arc Furnaces - Stainless high temp nut and stud.
- Mill Motor nuts - SMX series.
- Crane gantry gearbox anchor bolting - MT or SB8 series.

When **safety** really matters



Joining parts together is one of the most critical steps when delivering a product or system. The Nord-Lock Group is focused on solving the toughest bolting challenges. We offer a unique combination of bolting expertise and a wide product range, including wedge-locking technology and Superbolt™ tensioners — all designed and developed in-house.

Nord-Lock holds decades of documented success in every major industry, including oil and gas, energy, transportation and mining. Our Production System includes rigorous internal testing and full traceability, and our products hold several certificates from independent institutes including AbP, ABS, DIBt, DNV and TÜV.

The tools available through Nord-Lock Performance Services add value throughout a project and ensure that your bolting application pays back multiple times. We can also assist you in the design phase with joint simulation and testing. Additionally, we help you ensure successful operations over time with our onsite support and remote product training.

Our mission is to safeguard human lives and customer investments by securing the world's most demanding applications. The Nord-Lock Group looks forward to being your partner in bolting solutions.

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Bolt securing systems