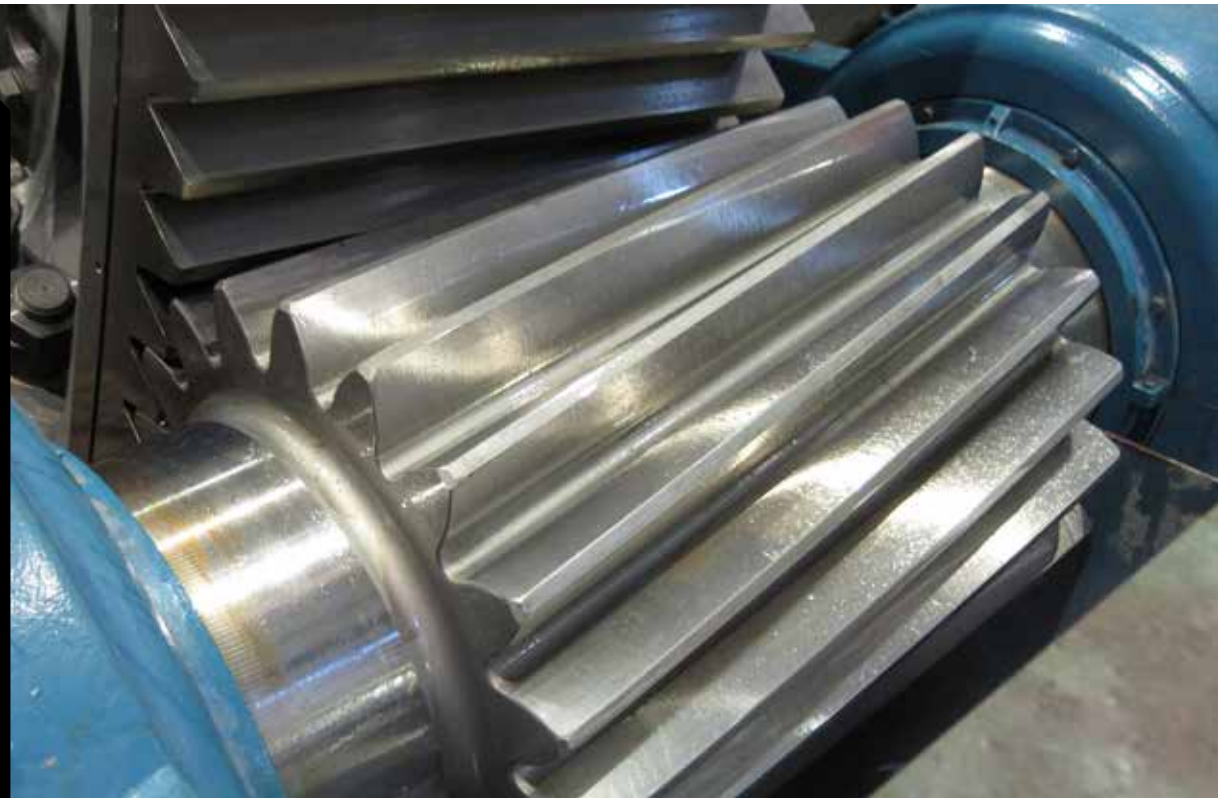


Metso:Outotec

Gears and pinions

A complete range of gear and pinion sets, inspections, design, installation and alignment services to drive your mill's performance



Introducing a new name

Metso Outotec is proud to announce the launch of our new rebranded offer: Metso Outotec Gears and Pinions. You can expect the same quality supported by decades of gearing and OEM expertise.

Read more at:
mogroup.com/grinding-mill-parts/

Your challenge

A recurring need for our customers is to continually meet demanding production requirements. To achieve these targets, uptime and reliability must be improved.

The Metso Outotec solution

Whether you want to restore or upgrade your mill, we have you covered. Replace worn or damaged parts to run as new or have our engineers redesign them for next-level performance. We also offer inspections, diagnostics, monitoring and component upgrades.

Why Metso Outotec services

Our field experience and equipment knowledge allows us to understand the fundamental requirements of your operation. We can determine the most suitable changes to implement in order to reach your production goals.

Applications

- AG and SAG mills
- Ball and FGD mills
- Pebble and rod mills
- Multi-compartment mills
- Rotary kilns and dryers
- Mixers and other equipment

Benefits:

- OEM expertise designing to AGMA standards
- Use of detailed drawings for accurate manufacturing and inspection
- Certified Field Service personnel providing reliable inspections and installations
- Over 1,500 technicians globally to deliver timely service and results

Providing more than just gears and pinions

Complete integrated solutions

Aimed to optimize your availability and production with our extensive expertise



Complete inspection and evaluation

To avoid permanent damage to gears, pinion bearings and soleplates, we recommend a complete inspection and evaluation using our four step process; scope definition, thorough cleaning, OEM inspection and evaluation.



Gear set replacement

When selecting a replacement gear set, optimizing the design can result in cost savings, greater quality and quicker delivery. Using OEM expertise, Metso Outotec evaluates all available structure and material options as well as reviews gear tooth design.



Design upgrades for increased production

When greater production is required, there are many factors to consider. Metso Outotec can help improve performance of gears and pinions by redesigning for greater strength and resistance. Evaluations are also done to ensure other mill components can handle the new loads.



Installation and reversal

If components are not installed properly, misalignment and excessive vibration occur, which can shorten the life of your gear and pinion. Metso Outotec's field service and engineering experts ensure proper installation to OEM specifications. They are also capable of reversing the gear to extend its useful life.



Alignment services

Ensuring alignment for gears and pinions is critical, which can otherwise cause premature wear and cracking. Metso Outotec provides complete alignment services using modern tooling and best practices gained from thousands of field installations.



Temperature monitoring

Fluctuations in temperature can indicate serious issues with your pinions. Metso Outotec offers infrared temperature monitoring as well as expert interpretations so you can continuously track the health of your pinion and troubleshoot issues quickly and efficiently.



Lubrication systems

Proper lubrication is vital to the life and performance of your gears. Metso Outotec supplied gear spray systems are engineered to your specific gear set and lubricant. Gear guards are upgraded with new seal configurations to minimize contamination.

Clients have experienced over 60% reduction in mill downtime with our services.

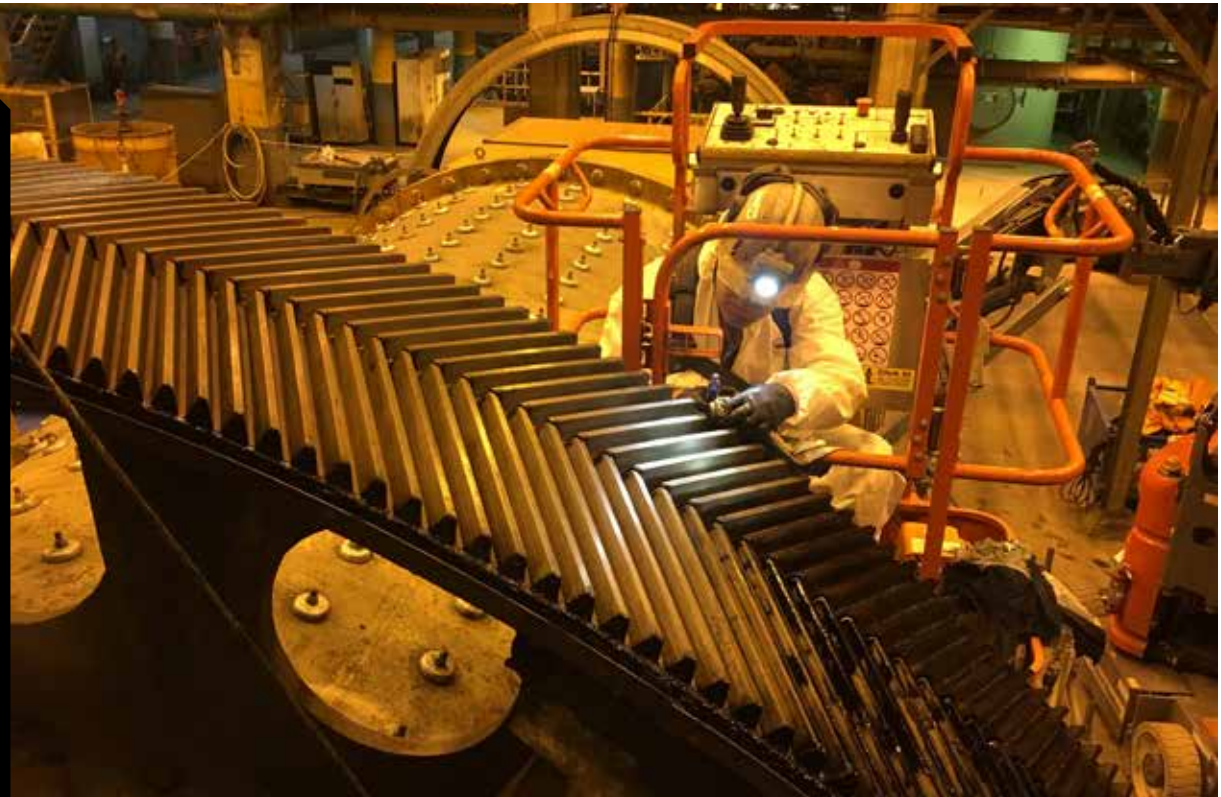
[Read more at mogroup.com/reduction-in-rod-mill-downtime](https://mogroup.com/reduction-in-rod-mill-downtime)

Metso:Outotec

Gears and pinions

Complete inspection and evaluation

Detect the undetected. Discover potential issues before they turn into real problems



Your challenge:

Issues with pinion teeth can be hard to spot. Even worse, when left uncorrected, they can cause permanent damage to gears, pinion bearings and soleplates.

Metso Outotec solution:

1. Define inspection scope with experts, to focus on key areas
2. Thorough cleaning during operation, to gain greater visibility
3. Detailed inspection by the OEM, uncovering potential damage
4. Full evaluation of results, providing insight for decision-making

Scoping process

- Metso Outotec will identify necessary inspection points, putting together a full inspection plan
- Experts consider history of operations as well as your specific equipment

Cleaning process during operation

- Gear and pinion sets are cleaned with specialized solvents, allowing the mills to run at full load during cleaning
- Metso Outotec Field Service technicians take care of all details and carry out cleaning

Inspection process

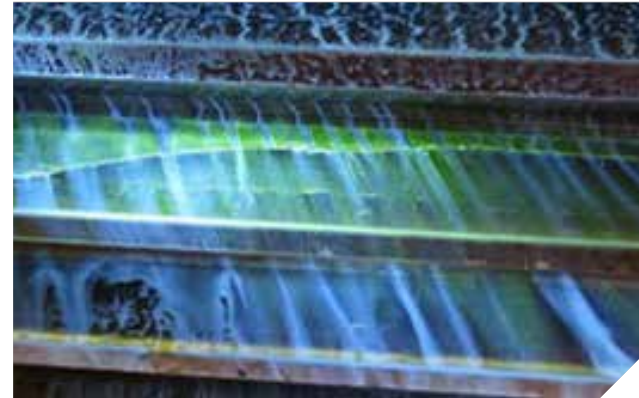
- State-of-the-art procedures including Magnetic Particle Inspection (MPI) and Eddy Current are used to find cracks as well as surface damage
- The process takes on average one to two 12-hour shifts, depending on the size and condition of the gear

Evaluation process

- Assessment and recommendations are made, determining if your gears and pinions are fit to run as-is or require repair, flipping or replacement
- If cracks are found, they are assessed, treated immediately and re-inspected
- The remaining safety in the gear is calculated and recommendations are made for replacement gear set procurement



Visual inspection after cleaning uncovered a crack on a gear tooth



A full inspection using MPI detected a deeper crack



Once detected, cracks are assessed and treated immediately by OEM experts

Why Metso Outotec services?

- Metso Outotec's extensive expertise ensures no damage to gears and pinions during the cleaning process
- Experts are able to provide full service immediately, from assesment to treatment

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Gear and pinion services

Gear set replacement

The perfect opportunity to improve your design.



Your challenge:

Evaluating gear designs and fabrications requires the right resources. While easier, a direct replacement may not provide the best option for cost savings, quality and delivery time.

Metso Outotec solution:

- **Review gear tooth design**, to ensure safe and extended operations with calculations done to AGMA standards
- **Structure and material selection**, to optimize design for quality and cost benefits as well as quicker deliver

The gear tooth design process

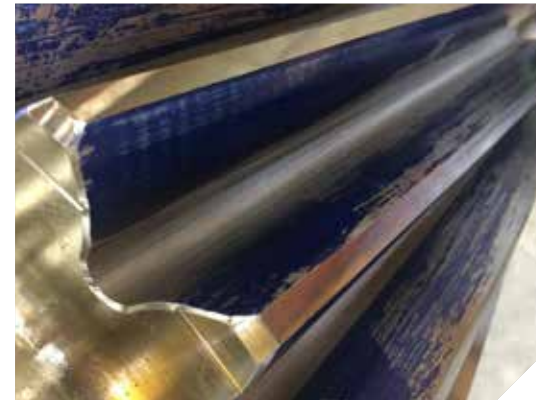
- Gear operations can be significantly improved with better design of gear teeth
- Metso Outotec experts perform teeth calculations to AGMA standards to determine safety factors in the teeth. Design is then optimized to suit new materials
- Pinion teeth can also be added to speed the mill for improved production



Replacing a previously cast gear with a new welded design

Selecting structure and materials

- Complete manufacturing drawings are created, with custom manufacturing and quality specifications requested for every gear set
- Metso Outotec engineers select the optimal gear section (T or Y) for your mill, as well as materials (iron/steel) and manufacturing methods (cast/welded)
- Gear guard seals are also upgraded to latest design



Performing a roll test to confirm optimal gear and pinion contact

Why Metso Outotec services?

- As the OEM, Metso Outotec has detailed drawings, design expertise, as well as an in-depth understanding of gear, pinions and the components they interact with
- Metso Outotec collaborates with multiple manufacturing facilities worldwide to optimize quality, cost and delivery



A new and optimized pinion certified for installation

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Gear and pinion services

Design upgrades for increased production

Make the most out of your new gears and pinions.



Your challenge:

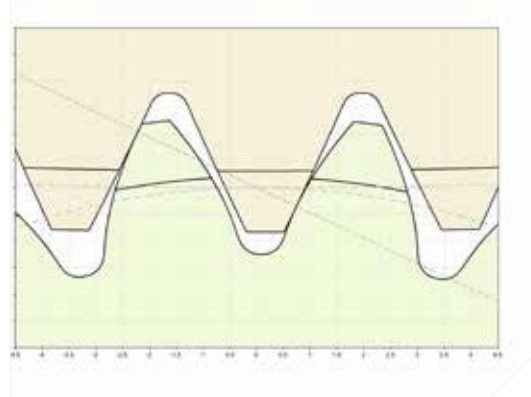
When greater production is required, there are many factors to consider. It can be a challenge to balance performance, longevity and cost for new components.

Metso Outotec solution:

- **New gear and pinion design**, to increase performance through improved strength and resistance
- **Compatibility evaluation**, to ensure other mill components operate properly at new production levels

The design process

- Metso Outotec engineers establish a new design to increase bending strength and pitting resistance with OEM specifications
- Service factors are verified to meet latest AGMA 6014-B15 or AGMA 321.05 standards
- Pinions can be upgraded from through hardened to carburized design



Applying the AGMA's in-depth gearing calculations

The compatibility evaluation

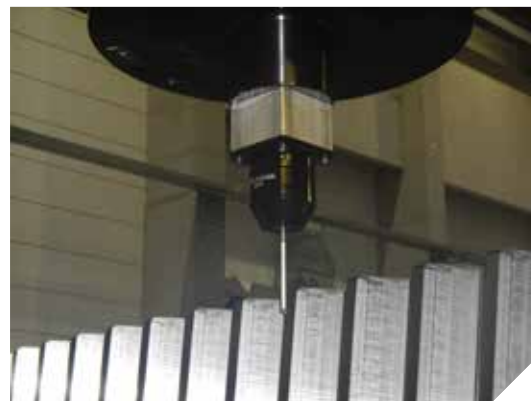
- To increase horsepower and meet higher production demands, older gear set tooth geometry is redesigned
- Higher tooth cutting accuracy is achieved while the gear set envelope remains unchanged without modifications to the mill
- Evaluation is made to ensure other mill components, such as the drivetrain, can handle increased production requirements



Measuring critical parameters of the pinion

Why Metso Outotec services?

- Metso Outotec gear design engineers have a complete understanding of the relationship between the mill and the drivetrain
- As the OEM, Metso Outotec has detailed drawings, design expertise and experience to help you achieve greater production output



Verifying the gear tooth profile with a CMM probe

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Gears and pinions

Installation and reversal

Ensure that your asset is able to live a full, healthy and long life



Your challenge:

When components are not installed properly, misalignment and excessive vibration occur. These seemingly small issues can have a big impact on the useful life of gears and pinions.

Metso Outotec solution:

1. **Installation by the OEM**, completed to exact specifications by those that know it best
2. **Gear reversal**, allowing you to give the component a second life when they appear worn out

Gear installation process

- All necessary procedures and plans are defined by dedicated Metso Outotec engineers
- Specialized tooling is used to ensure accurate and reliable installation
- Metso Outotec Field Service personnel manage millwrights for successful project execution

Gear reversal process

- Inspections are performed to ensure the component is an appropriate candidate for reversal
- It is ideal to use a new pinion with an unworn gear flank in order to avoid transmitting tooth profile damage
- The gear is flipped, restoring it to proper operating conditions
- Prolonging the asset's life results in significant capital cost savings



A 40,000 lbs gear segment being prepared for reversal



Pinion being aligned to the reversed gear



Gear being replaced on an 11,000 HP Sag Mill

Why Metso Outotec services?

- As the OEM, Metso Outotec has detailed drawings, design expertise and field services personnel
- This allows for accurate, timely and reliable installations

Read more at mogroup.com/grinding-mill-parts/

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mogroup.com

Partner for positive change

Metso:Outotec

Gear and pinion services

Alignment services

Ensuring alignment is as critical as the component itself



Your challenge:

Uneven temperatures and excessive vibration are often signs of misalignment. If not treated, premature wear and cracking can occur.

Metso Outotec solution:

- **Dynamic pinion and gear alignment**, evening out load distribution for each pinion
- **Drivetrain alignment**, ensuring all components are lined up properly and operating together within tight tolerances

The importance of alignment

- Installation and maintenance are as critical as the manufacturing and design.
- Alignment to strict tolerances must be achieved to ensure even load distribution. It is also key to control operating temperatures and reduce vibration.

The alignment process

- Static alignment of all components is performed using laser technology. Dial indicators with Bluetooth technology is also used.
- Specialists confirm that all bolts are pre-loaded to engineering specifications
- Anti-friction roller/babbitted bearing alignment is controlled and recorded
- The motor, gear box reducer, clutch and coupling conditions are checked.
- After mill starts-up, dynamic pinion alignment is performed to ensure longevity of the components
- Vibrations and operating temperatures of vital components are verified to confirm successful installation



Field personnel align the synchronous motor to the



Adjustments to the gear – axial and radial



An inching drive through a reducer gear box

Why Metso Outotec services?

- Metso Outotec have extensive field experience with many drivetrain arrangements
- Trained professionals ensure alignment is always performed to OEM specifications

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Gear and pinion services

Temperature monitoring

Keeping an eye on temperature can help correct issues before they really heat up.



Your challenge:

Fluctuations in temperature signify serious misalignment issues. This can be a potential threat to your overall operation.

Metso Outotec solution:

- **Infrared temperature monitoring**, continuously tracking the health of your pinion
- **Expert interpretation**, quickly troubleshooting irregular pinion temperature profiles

The monitoring process

- The pinion temperature monitoring system uses differential temperature checks across the pinion face to ensure proper pinion alignment
- Automatic sensing and continuous condition monitoring is accomplished through infrared sensor technology
- The system uses low-maintenance parts for operational efficiency and is customizable to fit most gear guards



Temperature readings are taken by non-contact infrared

The interpretation process

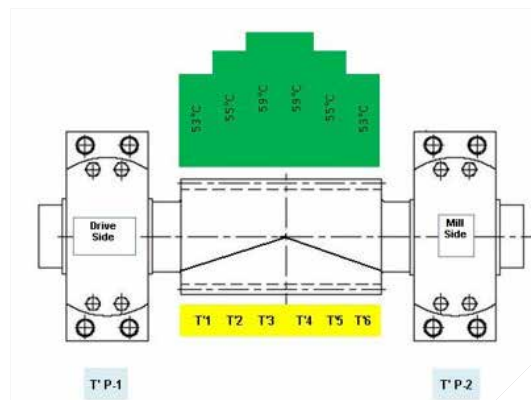
- Collected data is extremely valuable and can be used to prevent future issues
- Metso Outotec personnel are available to interpret any irregularities
- Additionally, they can provide an action plan, correct any misalignment, as well as properly control lubrication and contamination



An infrared thermography system tracks the readings continuously

Why Metso Outotec services?

- As the OEM, Metso Outotec has an in-depth understanding of gearing technology and other interacting components
- Coupling this with detailed drawings, design expertise and field services personnel, Metso Outotec is uniquely positioned to provide you with more accurate and



The pinion temperature profile is then shown on an HMI display

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Gear and pinion services

Lubrication systems

Not to be overlooked, lubrication is a vital factor for gear life and performance.



Your challenge:

When gears are not being properly lubricated, it can be detrimental as excessive wear occurs. Contaminants can be an issue too, leading to system failure.

Metso Outotec solution:

- **Gear spray systems**, allowing lubrication quantities and spray frequencies to be maintained automatically
- **Gear guards**, maximize mill uptime by keeping contaminants out of your lube system and gear set

Gear spray lubrication systems

- Systems are custom engineered for your individual gear set and lubricant
- Programmable Logic Controller (PLC) system is fail safe and interlocked with your mill
- Minimizes waste and cost by ensuring that the exact lubrication quantity needed is metered, dispensed and continuously monitored
- Externally mounted nozzles reduce cleaning and maintenance time required



Metered lubrication is precisely applied to the teeth

Gear guard upgrades

- Contaminants in the gear mesh can cause wear and decrease useful life
- Gear guards with new seal configuration minimize potential contamination
- Pressurized filtered air can be used to keep unwanted particles out



Mounted PLC control panel monitors the gear spray activity

Why Metso Outotec services?

- As the OEM of your gear, Metso Outotec has the expert knowledge to maximize its life
- With detailed drawings, design expertise and field service personnel, Metso Outotec's services are reliable, accurate and timely



Protecting the gear with a pressurized guard